



FESIA A. DAVENPORT
Chief Executive Officer

County of Los Angeles CHIEF EXECUTIVE OFFICE OPERATIONS CLUSTER

DATE: January 27, 2021
TIME: 2:00 p.m. – 4:00 p.m.
LOCATION: **TELECONFERENCE CALL-IN NUMBER: 1(323)776-6996**
TELECONFERENCE ID: 605696861#

To join via phone, dial 1(323)776-6996, then press 605696861#.

YOU CAN ALSO JOIN THIS MEETING BY CLICKING ON THE FOLLOWING LINK:

[Click here to join the meeting](#)

**DUE TO THE CLOSURE OF ALL COUNTY BUILDINGS, MEMBERS OF THE PUBLIC
WILL NEED TO CALL IN TO PARTICIPATE IN THE MEETING.**

AGENDA

Members of the Public may address the Operations Cluster on any agenda
item after all Informational Items are presented.
Two (2) minutes are allowed for each item.

1. **Call to order – Tamela Omoto-Frias/Anthony Baker**
2. **INFORMATIONAL ITEM(S):**
(5 minutes)
 - A) Board Letter:
TRANSPORTATION CORE SERVICE AREA AWARD SERVICES
CONTRACT FOR LACO-4E TRAFFIC SIGNAL CONTROLLER
FIRMWARE DEVELOPMENT AND SUPPORT
DPW – Jesse Juarros, Chief Information Officer and
Ron Matsuoka, Civil Engineer

CONTINUED ON PAGE 2

B) Board Letter:

AUTHORIZATION TO ACCEPT (IF AWARDED), AND EXECUTE CONTRACTUAL DOCUMENTS ON BEHALF OF THE COUNTY IN SUPPORT OF ANTELOPE VALLEY AIR QUALITY MANAGEMENT DISTRICT'S ELECTRIC VEHICLE CHARGING STATIONS PROGRAM GRANTS

ISD – Minh Le, General Manager and
Laura Iannaccone, Administrative Manager X

3. **PRESENTATION/DISCUSSION ITEMS:**

A) DIGITAL DIVIDE STRATEGIC PLAN

CEO/CIO – William Kehoe, Chief Information Officer and
Jagjit Dhaliwal, Deputy Chief Information Officer

4. **Public Comment**

(2 minutes each speaker)

5. **Adjournment**

FUTURE AGENDA TOPICS

CALENDAR LOOKAHEAD:

LASD – APPROVE SOLE SOURCE AMENDMENT NUMBER SIX TO EXTEND AGREEMENT NUMBER 78034 WITH SENTINEL OFFENDER SERVICES, LLC FOR CONTINUED LOS ANGELES COUNTY OFFENDER MONITORING SYSTEM SERVICES

RR/CC – NOTIFICATION OF INTENT TO ENTER INTO SOLE SOURCE NEGOTIATIONS WITH DIGITAL FOUNDRY FOR CONTINUED PRODUCTION SOFTWARE DEVELOPMENT OF THE TALLY SYSTEM AND BALLOT LAYOUT APPLICATION UNDER VOTING SOLUTIONS FOR ALL PEOPLE (VSAP)

BOARD LETTER/MEMO – FACT SHEET OPERATIONS CLUSTER

☒ Board Letter

☐ Board Memo

☐ Other

OPS CLUSTER AGENDA REVIEW DATE	1/27/2021			
BOARD MEETING	2/16/2021			
DELEGATED AUTHORITY BOARD LETTER	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			
SUPERVISORIAL DISTRICT AFFECTED	All Supervisorial Districts			
DEPARTMENT	Public Works			
SUBJECT	AWARD SERVICES CONTRACT FOR LACO- 4E TRAFFIC SIGNAL CONTROLLER FIRMWARE DEVELOPMENT AND SUPPORT			
PROGRAM				
SOLE SOURCE CONTRACT	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, please explain why:			
DEADLINES/ TIME CONSTRAINTS	The existing contract for LACO-4E Traffic Signal Controller Firmware Development and Support ends on March 3, 2021 and this agreement prevents a lapse in support.			
COST & FUNDING	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Total cost: \$440,000</td> <td style="width: 50%;">Funding source: LA County Metro Grant funds, Prop C (75%, \$330,000) County matching funds, Local Return (25%, \$110,000)</td> </tr> </table> TERMS (if applicable): Maximum contract term is 6 years with a month-to-month extension up to 6 months for a maximum potential contract term of 78 months. Explanation: The 6-year term includes 2 years of initial service plus two 2-year extensions with a month-to-month extension up to 6 months for a maximum potential contract term of 78 months.		Total cost: \$440,000	Funding source: LA County Metro Grant funds, Prop C (75%, \$330,000) County matching funds, Local Return (25%, \$110,000)
Total cost: \$440,000	Funding source: LA County Metro Grant funds, Prop C (75%, \$330,000) County matching funds, Local Return (25%, \$110,000)			
PURPOSE OF REQUEST	Provides support for troubleshooting, upgrading, maintaining, and enhancing our existing County-owned traffic signal controller firmware that supports 170-type traffic signal controllers. The continued operation of the LACO-4E firmware is required to support two regionally significant transportation systems			
BACKGROUND (include internal/external issues that may exist)	The LACO-4E program is used in conjunction with the County's traffic signal control system, KITS, which connects more than 800 intersections to the TMC. In addition to working with the County's traffic signal control system, the software is also being utilized for the County of Los Angeles' Metropolitan Transportation Authority's Bus Signal Priority Program. The LACO-4E program is being used Countywide in support of numerous city traffic signal control systems. Since Public Works does not have in-house staff with the expertise to complete this type of work, we are seeking the services of a contractor to investigate and repair current and future software bugs discovered in the firmware program.			
DEPARTMENTAL AND OTHER CONTACTS	Name, Title, Phone # & Email: Jesse Juarros, Chief Information Officer: (626) 458-4117/ jjuarros@dpw.lacounty.gov Ron Matsuoka, Civil Engineer (626) 300-4822/ rmatsuoka@dpw.lacounty.gov			

February 16, 2021

The Honorable Board of Supervisors
County of Los Angeles
383 Kenneth Hahn Hall of Administration
500 West Temple Street
Los Angeles, CA 90012

Dear Supervisors:

**SERVICES CONTRACT
TRANSPORTATION CORE SERVICE AREA
AWARD SERVICES CONTRACT FOR
LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE
DEVELOPMENT AND SUPPORT
(ALL SUPERVISORIAL DISTRICTS)
(3 VOTES)**

CIO RECOMMENDATION: APPROVE (X)

SUBJECT

Public Works is seeking Board approval to award a services contract to Parsons Transportation Group Inc., for software enhancements, repairs, and support of the LACO-4E traffic signal controller firmware throughout the County of Los Angeles.

IT IS RECOMMENDED THAT THE BOARD:

1. Find that the contract project is exempt from the provisions of the California Environmental Quality Act for the reasons stated in this Board Letter and in the record of the project.
2. Award the contract for the LACO-4E traffic signal controller firmware development and support to Parsons Transportation Group, Inc. This contract will be for a term of 2 years with two 2-year renewal options and a month-to-month extension up to 6 months for a maximum potential contract term of 78 months with a maximum potential contract sum of \$440,000.
3. Delegate authority to the Director of Public Works or his designee to execute the contract; to renew the contract for each additional renewal option and extension period if, in the opinion of the Director of Public Works or his designee, Parsons Transportation Group, Inc., has successfully performed during the previous contract period, and the services are still required; to approve and execute amendments to incorporate necessary changes

within the scope of work; and to suspend work if it is in the best interest of the County to do so.

4. Delegate authority to the Director of Public Works or his designee to increase the contract amount up to an additional 10 percent of the contract sum for unforeseen additional work within the scope of the contract if required.

PURPOSE/JUSTIFICATION OF RECOMMENDED ACTION

Approval of the recommended action will find the project exempt from the California Environmental Quality Act and award the services contract to Parsons Transportation Group, Inc., to provide on-call and intermittent software enhancements, repairs, and support of the LACO-4E traffic signal controller firmware. In addition to troubleshooting, the contractor may also be required to develop future enhancements to the LACO-4E program as requested by the County.

This services contract will entail support for troubleshooting, upgrading, maintaining, and enhancing our existing County owned traffic signal controller firmware to support our 170-type traffic signal controllers. These services are necessary to continue the facilitation of connections between the County's traffic signals and the Kimley-Horn Integrated Transportation System, which connects more than 800 intersections with 170-type traffic signals controllers to our Traffic Management Center. If this contract was not awarded, the County would not have the expertise to continue supporting the LACO-4E firmware in our traffic signal controllers.

The current contract will expire on March 3, 2021. The award of this contract will result in the continuation of services by the recommended contractor.

Implementation of Strategic Plan Goals

These recommendations support the County Strategic Plan: II.3, Make Environmental Sustainability our Daily Reality, and Objective III.2.3, Prioritize and Implement Technology Initiatives that Enhance Service Delivery and Increase Efficiency. The recommended actions support a clean, flexible, and integrated Multi-Modal Transportation System that improves mobility and implements technologies that increase efficiency.

FISCAL IMPACT/FINANCING

There will be no impact to the County General Fund.

The service contract amount is \$400,000 plus 10 percent of the contract sum for unforeseen additional work and cost-of-living adjustment in accordance with the contract, including the two 2-year renewal options and a month-to-month extension up to 6 months for a maximum potential contract term of 78 months with an estimated maximum potential contract sum of \$440,000. This amount is based on the hourly rates quoted by the contractor and our estimated annual utilization of the contractor's services.

This services contract will be funded with \$330,000 in Los Angeles County Metropolitan Transportation Authority Call for Projects, Proposition C Discretionary Grant funds in the 2007 Call for Projects Information Exchange Network Phase II, and \$110,000 in County Proposition C Local Return funds.

Funding for this contract is included in the Proposition C Local Return Fund Fiscal Year 2020-21 Budget.

FACTS AND PROVISIONS/LEGAL REQUIREMENTS

The recommended contractor is Parsons Transportation Group, Inc., located in La Palma, California. This contract will commence on March 1, 2021, or upon the Board's approval and execution by both parties, whichever occurs last, for a period of 2 years. With the Board's delegated authority, Public Works may renew the contract for two 2-year renewal options and a month-to-month extension up to 6 months for a maximum potential total contract term of 78 months.

County Counsel has reviewed the contract as to form (Enclosure A). The recommended contract with Parsons Transportation Group, Inc., was solicited on an open-competitive basis and is in accordance with applicable Federal, State, and County requirements.

A standard service contract has been used that contains terms and conditions in compliance with the Board's ordinances, policies, and programs. Enclosure B reflects the proposer's utilization participation and community business enterprise program information. Data regarding the proposer's minority participation is on file with Public Works. The contractor was selected upon final analysis and consideration without regard to race, creed, gender, or color.

Public Works has evaluated and determined that the contracted services are required on an on-call and intermittent basis; therefore, Proposition A (County Code Chapter 2.121) and the Living Wage Program (County Code Chapter 2.201) do not apply to this contract.

The contract includes a cost-of-living adjustment provision, which is in accordance with the Board's Policy 5.070, Multi-Year Services Contract Cost-of-Living Adjustments. The cost-of-living adjustment will not increase the maximum potential contract sum.

The Chief Information Officer (CIO) has reviewed this request and recommends approval. The CIO Analysis is attached as Enclosure C.

ENVIRONMENTAL DOCUMENTATION

The proposed project is exempt from the provisions of the California Environmental Quality Act. The modification of existing traffic signal systems, installation of new traffic signal systems, and maintenance of existing roadway LACO-4E traffic signal controller firmware, with no expansion in use, is within the class of projects that have been determined not to have a significant effect on the environment, which meets the criteria set forth in Section 15301 of the State California Environmental Quality Act Guidelines and Class 1(x) 4, 5, and 22 of the County's Environmental Document Reporting Procedures and Guidelines, Appendix G.

In addition, based on the proposed project records, it will comply with all applicable regulations, and there are no cumulative impacts, unusual circumstances, damage to scenic highways, listing on hazardous waste site lists compiled pursuant to Government Code Section 65962.5, or indications that it may cause a substantial adverse change in the significance of a historical resource that would make the exemption inapplicable.

CONTRACTING PROCESS

On April 20, 2020, a notice of the Request for Proposals was placed on the "Doing Business with the County" website (Enclosure D); "Do Business with Public Works" website; Twitter; and advertisements were placed in the *Antelope Valley Press*, *Los Angeles Daily Journal*, *Los Angeles Sentinel*, and *La Opinión*. Also, Public Works informed 1,483 Local Small Business Enterprises; 172 Disabled Veteran Business Enterprises; 160 Social Enterprises; 867 Community Business Enterprises; and 82 independent contractors, various business development centers, and municipalities about this business opportunity.

On May 18, 2020, one proposal was received. The proposal was evaluated by an evaluation committee consisting of Public Works staff. The evaluation was based on criteria described in the Request for Proposals, which included the price, experience, work plan, and performance history/references, utilizing the informed averaging methodology for applicable criteria. Based on these evaluations, it is recommended that this contract be awarded to the apparent responsive and responsible proposer, Parsons Transportation Group Inc., located in La Palma, California.

IMPACT ON CURRENT SERVICES (OR PROJECTS)

The award of this contract will continue the services without disruption to the public and will not result in the displacement of any County employees as these services are presently contracted with the private sector.

CONCLUSION

Please return one adopted copy of this Board letter to Public Works, Business Relations and Contracts Division.

Respectfully submitted,

Reviewed by:

MARK PESTRELLA
Director of Public Works

WILLIAM S. KEHOE
Chief Information Officer

MP:JQ:ep

Enclosures

c: Chief Executive Office (Chia-Ann Yen)
Chief Information Office
County Counsel
Executive Office

Agreement



BY AND BETWEEN
LOS ANGELES COUNTY
PUBLIC WORKS

AND

PARSONS TRANSPORTATION GROUP, INC.

FOR

LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE
DEVELOPMENT AND SUPPORT
(LACO-4E DEVELOPMENT)
(BRC0000120)

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EXHIBITS

Exhibit A- Statement of Work

Attachment A.1 – LACO-4E User's Manual

Attachment A.2 – Acceptance Certificate

Exhibit B- Payment Schedule

Exhibit C- Schedule of Prices

Exhibit D- Contractor's EEO Certification

Exhibit E- Administration of Agreement

Exhibit F- Performance Requirement Summary

Exhibit G- Confidentiality and Assignment Agreement

Exhibit H- Jury Service Ordinance

Exhibit I- Safely Surrendered Baby Law

Exhibit J- Defaulted Property Tax Reduction Program Ordinance

Exhibit K- County of Los Angeles Policy on Doing Business With Small Business

Exhibit L- Listing of Contractors Debarred in Los Angeles County

Exhibit M- County of Los Angeles Lobbyist Ordinance

Exhibit N- IRS Notice 1015

THIS AGREEMENT is entered into this ____ day of _____, 2020, by and between the County of Los Angeles, a subdivision of the State of California, (hereinafter referred to as "County"), and Parsons Transportation Group, Inc., a Illinois Corporation (hereinafter referred to as "Contractor") (hereinafter collectively also the "parties").

RECITALS

WHEREAS, County may contract with private businesses for information technology services (hereinafter also "Services") relating to LACO-4E Traffic Signal Controller Firmware Development and Support (LACO 4E Development) when certain requirements are met; and

WHEREAS, Contractor possesses the necessary skills, qualifications, competence, license and expertise and, therefore, is qualified to perform such Services; and

WHEREAS, County does not have the requisite technical staff with the specific skills and expertise necessary to perform the Services; and

WHEREAS, County is authorized by the California Government Code, Section 31000 to contract for special services, including the Services described herein; and

WHEREAS, based upon an open competitive selection process, the Department has recommended to County's Board of Supervisors the selected Contractor that is prepared and desires to provide to County the Services as described herein.

NOW THEREFORE, in consideration of the mutual promises, covenants and conditions set forth herein and for good and valuable consideration, County and Contractor agree as follows:

1. APPLICABLE DOCUMENTS

1.1 INTERPRETATION

The provisions of this document (hereinafter "Base Agreement"), along with Exhibits A, B, C, D, E, F, G, H, I, J, K, L, M, and N including all Attachments and Schedules thereto, whether attached hereto, and described in this Paragraph 1.1 below and incorporated herein by reference, collectively form and throughout and hereinafter are referred to as the "Agreement". In the event of any conflict or inconsistency in the definition or interpretation of any word, responsibility, schedule or the contents or description of any task, subtask, deliverable, service or other work, or otherwise, between this Base Agreement and the Exhibits, Attachments and Schedules or between the Exhibits, Attachments and Schedules, such conflict or inconsistency shall be resolved by giving precedence first to the Base Agreement, and then to the Exhibits, Attachments and Schedules according to the following descending priority:

Exhibit A – Statement of Work

Attachment A.1 – LACO-4E User's Manual

Attachment A.2 – Acceptance Certificate

Exhibit B – Payment Schedule

- Exhibit C – Schedule of Prices
- Exhibit D – Contractor's EEO Certification
- Exhibit E – Administration of Agreement
- Exhibit F – Performance Requirement Summary
- Exhibit G – Confidentiality and Assignment Agreement
- Exhibit H – Jury Service Ordinance
- Exhibit I – Safely Surrendered Baby Law
- Exhibit J – Defaulted Property Tax Reduction Program Ordinance
- Exhibit K – County of Los Angeles Policy on Doing Business With Small Business
- Exhibit L – Listing of Contractors Debarred in Los Angeles County
- Exhibit M – County of Los Angeles Lobbyist Ordinance
- Exhibit N – IRS Notice 1015

1.2 ENTIRE AGREEMENT

This Agreement constitutes the complete and exclusive statement of understanding between the parties and supersedes all previous and contemporaneous agreements, whether written or oral, and any and all communications and negotiations between the parties relating to the subject matter of this Agreement.

1.3 DEFINITIONS

The terms and phrases in this Paragraph 1.3 in quotes and with initial letter capitalized, where applicable, whether singular or plural, shall have the particular meanings set forth below whenever such terms are used in this Agreement.

1.3.1 ACCEPTANCE

The term "Acceptance" shall mean County's written approval of any tasks, subtasks, deliverables, services or other Work, including Acceptance Tests, provided by Contractor to County pursuant to this Agreement.

1.3.2 ACCEPTANCE TEST

The term "Acceptance Test" shall mean any of the Software acceptance tests conducted by County or Contractor, as applicable, under Exhibit A (Statement of Work).

1.3.3 ADDITIONAL PRODUCTS

The term "Additional Product(s)" shall mean any item of software or hardware, and related Documentation, that Contractor may provide as part of Additional Work upon County's request and approval.

1.3.4 ADDITIONAL WORK

The term "Additional Work" shall mean Software Modifications, Professional Services, and/or Additional Products that may be provided by Contractor to County upon County's request and approval.

1.3.5 AGREEMENT

The term "Agreement" shall have the meaning specified in Paragraph 1.1 (Interpretation).

1.3.6 AMENDMENT

The term "Amendment" shall have the meaning specified in Paragraph 4 (Changes Notices and Amendments).

1.3.7 BASE AGREEMENT

The term "Base Agreement" shall have the meaning specified in Paragraph 1.1 (Interpretation) above.

1.3.8 BOARD OF SUPERVISORS; BOARD

The terms "Board of Supervisors" and "Board" shall mean County's Board of Supervisors, which is the governing body of County.

1.3.9 BUSINESS DAY

The term "Business Day" shall mean any day of eight working hours from 7 a.m. to 6 p.m. Pacific Time (PT), Monday through Friday, excluding County observed holidays.

1.3.10 BUSINESS HOURS

The term "Business Hours" shall mean from 7 a.m. to 6 p.m. Pacific Time (PT)

1.3.11 CHANGE NOTICE

The term "Change Notice" shall have the meaning specified in Paragraph 4.2 (Change Notices).

1.3.12 CHANGE ORDER

The term "Change Order" shall mean the Change Notice executed by the parties for acquisition of Additional Work under the Change Notice.

1.3.13 COST-OF-LIVING ADJUSTMENT

The terms "COLA" and "Cost-of-Living Adjustment" shall have the meaning specified in Paragraph 8.6 (Cost of Living Adjustment).

1.3.14 CONFIDENTIAL INFORMATION

The term "Confidential Information" shall mean any data or information, in any format, and includes sensitive financial information, any County data and any other information otherwise deemed confidential by County or by Contractor or by applicable Federal, State or local law, as further specified in Paragraph 18 (Confidentiality and Security).

1.3.15 CONTRACT SUM

The term "Contract Sum" shall mean the total monetary amount payable by County to Contractor hereunder, as set forth in Paragraph 8.1 (Maximum Contract Sum). The Contract Sum shall not be adjusted for any costs or expenses whatsoever of Contractor.

1.3.16 CONTRACTOR

The term "Contractor" shall have the meaning specified in the Recitals to the Agreement.

1.3.17 CONTRACTOR KEY PERSONNEL

The term "Contractor Key Personnel" shall have the meaning specified in Paragraph 3.1 (Contractor Administration).

1.3.18 CONTRACTOR KEY STAFF

The term "Contractor Key Staff" shall have the meaning specified in Paragraph 3.3 (Approval of Contractor's Staff).

1.3.19 CONTRACTOR'S PROJECT DIRECTOR; CONTRACTOR'S PD

The terms "Contractor's Project Director" and "Contractor's PD" shall have the meaning specified in Paragraph 3.2.1 (Contractor's Project Director).

1.3.20 CONTRACTOR'S PROJECT EXECUTIVE

The term "Contractor's Project Executive" shall be the person designated as such in Section 2 (Contractor Key Personnel) of Exhibit E (Administration of Agreement).

1.3.21 CONTRACTOR'S PROJECT MANAGER; CONTRACTOR'S PM

The terms "Contractor's Project Manager" and "Contractor's PM" shall have the meaning specified in Paragraph 3.2.2 (Contractor's Project Manager).

1.3.22 COUNTY

The term "County" shall mean the County of Los Angeles, California, including its Department of Public Works.

1.3.23 COUNTY KEY PERSONNEL

The term "County Key Personnel" shall have the meaning specified in Paragraph 2.1 (County Administration).

1.3.24 COUNTY MATERIALS

The term "County Materials" shall have the meaning specified in Paragraph 16.1 (County Materials).

1.3.25 COUNTY SOFTWARE

The term "County Software" shall mean any County software installed and utilized by County in its working environment.

1.3.26 COUNTY'S PROJECT DIRECTOR

The term "County's Project Director" shall have the meaning specified in Paragraph 2.2.1 (County's Project Director).

1.3.27 COUNTY'S PROJECT MANAGER

The term "County's Project Manager" shall have the meaning specified in Paragraph 2.2.2 (County's Project Manager).

1.3.28 DAY

The term "Day" shall mean calendar day and not Business Day.

1.3.29 DEFICIENCY; DEFICIENCIES

The terms "Deficiency" and "Deficiencies", whether singular or plural, shall mean any of the following: any malfunction, error or defect in the design, development, implementation, materials, and/or workmanship; any failure to meet or comply with County approved Deliverables, any published and/or mutually agreed upon standards or any other representations or warranties by Contractor under the Agreement regarding the Software; and/or any other problem which results in the Software not performing in compliance with the provisions of this Agreement.

1.3.30 DELIVERABLE; DELIVERABLE

The terms "Deliverable" and "deliverable" shall mean items and/or services provided or to be provided by Contractor under this Agreement, including numbered Deliverable(s) in Exhibit A (Statement of Work).

1.3.31 DEPARTMENT/ DPW/ PUBLIC WORKS

The terms "Department", "DPW" and "Public Works" shall mean and refer to County's Department of Public Works.

1.3.32 DIRECTOR

The term "Director" shall mean the Director of Public Works or designee.

1.3.33 DISPUTE RESOLUTION PROCEDURE

The term "Dispute Resolution Procedure" shall mean and refer to the provisions of Paragraph 53 (Dispute Resolution Procedure) describing the procedure for resolving the disputes arising under or with respect to this Agreement.

1.3.34 DOCUMENTATION

The term "Documentation" shall mean any and all written and electronic materials provided or made available by Contractor under this Agreement, including, but not limited to, documentation relating to software specifications and functions, technical manuals, technical information, reference materials, user manuals, operating manuals, and all other instructions and reference materials relating to the capabilities, operation, installation and use of the Software.

1.3.35 DUE DATE

The term "Due Date" shall mean the due date for the completion of any Task.

1.3.36 EFFECTIVE DATE

The term "Effective Date" shall mean the date of execution of this Agreement by County and the authorized representative(s) of Contractor.

1.3.37 EXTENDED TERM

As used herein, the term "Extended Term" shall have the meaning specified in Paragraph 7.2 (Extended Term).

1.3.38 FINAL ACCEPTANCE

The term "Final Acceptance" shall mean County's written approval of Software Modifications in accordance with the terms of this Agreement.

1.3.39 FINAL ACCEPTANCE DATE

The term "Final Acceptance Date" shall mean the date of Final Acceptance of each Task.

1.3.40 HOURLY LABOR RATES

The term "Hourly Labor Rates" means a fully burdened hourly rate, which includes a blended and allocated average of direct and indirect costs, overhead, administrative expenses and any and all other incidental expenses attributable to each personnel hour worked.

1.3.41 INITIAL TERM

The term "Initial Term" shall have the meaning specified in Paragraph 7.1 (Initial Term).

1.3.42 INTERFACES

The term "Interface(s)" shall mean the set of software mechanisms, which may be provided by Contractor under this Agreement as part of Software Modifications, which allow the transfer of electronic data and/or software commands between computer systems, networks, applications or modules, and related Documentation.

1.3.43 MAXIMUM FIXED PRICE

The term "Maximum Fixed Price" shall mean the maximum amount to be paid by County to Contractor for identified Deliverables listed under Exhibit A (Statement of Work) in accordance with the prices, rates, and other fees listed in Exhibit B (Payment Schedule) or any Additional Work approved by County to be provided by Contractor in accordance with Paragraph 5.1 (Additional Work) and Paragraph 8.3 (Additional Work) of the Base Agreement.

1.3.44 POOL DOLLARS

The term "Pool Dollars" shall mean the amount allocated under this Agreement for the provision by Contractor of Additional Work, including Professional Services and Additional

Products, approved by County in accordance with the terms of this Agreement Production Use.

The term "Production Use" shall mean the actual use of the Software in the working environment for the performance of County's operations.

1.3.45 PROFESSIONAL SERVICES

The term "Professional Service(s)" shall mean consulting services and/or training that Contractor may provide upon County's request and approval in the form of Additional Work in accordance with Paragraph 5.1 (Additional Work) and 8.3 (Additional Work).

1.3.46 SCOPE OF ADDITIONAL WORK

The term "Scope of Additional Work" shall mean the Additional Work agreed by the parties to be provided by Contractor as Additional Work.

1.3.47 SERVICES

The term "Services" shall mean any services that are part of Work or Additional Work, and any other services provided by Contractor under this Agreement.

1.3.48 SOFTWARE

The term "Software" shall mean the County Software including LACO-4E core software, and related Documentation, provided by County in accordance with the terms of this Agreement.

1.3.49 SOFTWARE MODIFICATIONS

The term "Software Modification(s)" shall mean any and all Software updates, modifications, repairs, enhancements, and related Documentation, which may be provided by Contractor under the Agreement. Once accepted and approved by County, Software Modifications shall become part of, and be deemed, Software for the purpose of this Agreement.

1.3.50 SOURCE CODE

The term "Source Code" shall mean the source code for Software, to the extent available, developed by Contractor to County under this Agreement, including Software Modifications, together with all Documentation and other proprietary information related to such source code.

1.3.51 STATE

The term "State" means the State of California.

1.3.52 STATEMENT OF WORK; SOW

The terms "Statement of Work" and "SOW" shall mean the Work to be provided by Contractor pursuant to this Agreement identified in terms of Tasks, Subtasks, and Deliverables in Exhibit A (Statement of Work).

1.3.53 TASK; TASK; SUBTASK; SUBTASK

The terms "Task", "task", "Subtask" and "subtask" shall mean one of the areas of work to be performed under this Agreement, including those identified as numbered Tasks and Subtasks in Exhibit A (Statement of Work).

1.3.54 TASK SCHEDULE

The term "Task Schedule" shall mean the agreed upon timeline for the Tasks, Subtasks and Deliverables specified in Exhibit A (Statement of Work) and Exhibit B (Payment Schedule).

1.3.55 THIRD PARTY SOFTWARE

The term "Third Party Software" shall mean any software of third parties provided by County, as applicable, under this Agreement.

1.3.56 WORK

The term "Work" shall mean any and all tasks, subtasks, deliverables, services and other work provided, or to be provided, by or on behalf of Contractor pursuant to this Agreement and as explained in the Statement of Work, including Software Modifications.

1.3.57 WORK DAY

The term "Work Day" shall mean any day of eight working hours from 7 a.m. to 6 p.m. Pacific Time (PT), Monday through Thursday, excluding County observed holidays.

1.4 AMBIGUITIES OR DISCREPANCIES

Both parties have either consulted or had the opportunity to consult with counsel regarding the terms of this Agreement and are fully cognizant of all terms and conditions. Should there be any uncertainty, ambiguity, or discrepancy in the terms or provisions hereof, or should any misunderstanding arise as to the interpretation to be placed upon any position hereof or the applicability of the provisions hereunder, neither party shall be deemed as the drafter of this Agreement and the uncertainty, ambiguity, or discrepancy shall not be construed against either party.

2. ADMINISTRATION OF AGREEMENT – COUNTY

2.1 COUNTY ADMINISTRATION

All persons administering this Agreement on behalf of County and identified in this Paragraph 2 below (hereinafter "County Key Personnel") are listed in Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement). Unless otherwise specified, reference to each of the persons listed in such Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement) shall also include his/her designee. County will notify Contractor in writing of any change in the names and/or addresses of County Key Personnel.

No member of County Key Personnel is authorized to make any changes in any of the terms and conditions of this Agreement other than those specifically authorized under Paragraph 4 (Changes Notices and Amendments).

2.2 COUNTY KEY PERSONNEL

2.2.1 COUNTY'S PROJECT DIRECTOR

County's Project Director will be responsible for ensuring that the objectives of this Agreement are met. County's Project Director will have the right at all times to inspect any and all Work provided by or on behalf of Contractor.

2.2.2 COUNTY'S PROJECT MANAGER

County's Project Manager will be responsible for ensuring that the technical, business and operational standards and requirements of this Agreement are met. County's Project Manager will interface with Contractor's Project Manager on a regular basis. County's Project Manager will report to County's Project Director regarding Contractor's performance with respect to technical standards and functional performance. Unless specified otherwise, County's Project Manager shall be the designee of County's Project Director.

2.3 COUNTY PERSONNEL

All County personnel assigned to this Agreement shall be under the exclusive supervision of County. Contractor understands and agrees that all such County personnel are assigned only for the convenience of County. Contractor hereby represents that its price, Task Schedule and performance hereunder are based solely on the work of Contractor's personnel, except as otherwise expressly provided in this Agreement.

2.4 APPROVAL OF WORK

All Tasks, Subtasks, Deliverables, and other Work provided by Contractor under this Agreement must have the written approval of County's Project Manager as described in this Paragraph 2.4. In no event, shall County be liable or responsible for any payment prior to such written approval. Furthermore, County reserves the right to reject any Work not approved by County.

3. ADMINISTRATION OF AGREEMENT - CONTRACTOR

3.1 CONTRACTOR ADMINISTRATION

All persons administering this Agreement on behalf of Contractor and identified in this Paragraph 3 below (hereinafter "Contractor Key Personnel") are listed in Section 2 (Contractor Key Personnel) of Exhibit E (Administration of Agreement). All staff employed by and/or on behalf of Contractor, including the persons listed in such Section 2 (Contractor Key Personnel) of Exhibit E (Administration of Agreement), shall be adults who are fully fluent in both spoken and written English. Contractor shall notify County in writing of any change in the names and/or addresses of Contractor Key Personnel.

3.2 CONTRACTOR KEY PERSONNEL

3.2.1 CONTRACTOR'S PROJECT DIRECTOR

Contractor's Project Director shall be responsible for Contractor's performance of all its tasks, subtasks and other Work and ensuring Contractor's compliance with this

Agreement. Contractor's Project Director shall meet and confer with County's Project Director as required by County. Such meetings shall be conducted via teleconference or at a time and place agreed to by County's Project Director and Contractor's Project Director.

3.2.2 CONTRACTOR'S PROJECT MANAGER

Contractor's Project Manager shall be responsible for Contractor's day-to-day activities as related to this Agreement and for reporting to County in the manner set forth in Paragraph 3.5 (Status Reports by Contractor). Contractor's Project Manager shall interface with County's Project Manager on a regular basis to review project progress and discuss project coordination. Such meetings shall be conducted via teleconference or at a time and place agreed to by County's Project Director and Contractor's Project Director.

3.3 APPROVAL OF CONTRACTOR'S STAFF

- 3.3.1 In fulfillment of its responsibilities under this Agreement, Contractor shall utilize, and permit utilization of, only staff fully trained and experienced, and as appropriate, licensed or certified in the technology, trades, tasks, and subtasks required by this Agreement. Contractor shall supply sufficient staff to discharge its responsibilities hereunder in a timely and efficient manner.
- 3.3.2 County shall have the right to approve or disapprove each member, or proposed member, of Contractor's Project Director, Contractor's Project Manager and any staff providing Training or on-site Work to County under this Agreement or with access to any of County's sensitive information (hereinafter "Contractor Key Staff") prior to and during their performance of any Work hereunder, as well as so approving or disapproving any proposed deletions from or other changes in such Contractor Key Staff. County's Project Manager, in his/her reasonable discretion, may require replacement of any member of the Contractor Key Staff performing, or offering to perform, Work hereunder. Contractor shall provide County with a resume of each such proposed initial Contractor Key Staff member and a proposed substitute and an opportunity to interview such person prior to his/her performance of any Work hereunder.
- 3.3.3 In addition, Contractor shall provide to County's Project Director an executed Confidentiality and Assignment Agreement (Exhibit G) for each member of the Contractor Key Staff performing Work under this Agreement on or immediately after the Effective Date, but in no event later than the date such member of the Contractor Key Staff first performs Work under this Agreement.
- 3.3.4 Contractor shall, to the maximum extent possible, take all necessary steps to ensure continuity over time of the membership of the group constituting the Contractor Key Staff. Contractor shall promptly fill any Contractor Key Staff vacancy with personnel having qualifications at least equivalent to those of the Contractor Key Staff member(s) being replaced.
- 3.3.5 In the event Contractor should ever need to remove any member of the Contractor Key Staff from performing Work under this Agreement, Contractor shall provide County with notice at least fifteen (15) days in advance, except in circumstances in which such notice

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is not possible, and shall work with County on a mutually agreeable transition plan so as to provide an acceptable replacement and ensure project continuity. Should County be dissatisfied with any member of the Contractor Key Staff during the term of the Agreement, Contractor shall replace such person with another to County's satisfaction.

- 3.3.6 Contractor shall supply sufficient staff to discharge its responsibilities hereunder in a timely and efficient manner.
- 3.3.7 All staff employed by and on behalf of the Contractor shall be adults who are legally eligible to work under the laws of the United States of America and the state of California. All Contractor Key Personnel and all other members of the Contractor's staff who have direct contact with County (either by telephone, electronic or written correspondence, or in person) shall be fully fluent in both spoken and written English.

3.4 BACKGROUND AND SECURITY INVESTIGATIONS

- 3.4.1 Each of Contractor's staff performing Work under this Agreement, who is in a designated sensitive position, as determined by County in County's sole discretion, shall undergo and pass a background investigation to the satisfaction of County as a condition of beginning and continuing to perform Work under this Agreement. Such background investigation must be obtained through fingerprints submitted to the California Department of Justice to include State, local, and federal-level review, which may include, but shall not be limited to, criminal conviction information. The fees associated with the background investigation shall be at the expense of Contractor, regardless of whether the member of Contractor's staff passes or fails the background investigation.

If a member of Contractor's staff does not pass the background investigation, County may request that the member of Contractor's staff be removed immediately from performing Work under the Agreement. Contractor shall comply with County's request at any time during the term of the Agreement. County will not provide to Contractor or to Contractor's staff any information obtained through the County's background investigation.

- 3.4.2 County may immediately, in its sole discretion, deny or terminate facility access to any of Contractor's staff, including subcontractor's staff, who do not pass such background investigation(s) to the satisfaction of County and/or whose background or conduct is incompatible with County's facility access.
- 3.4.3 Disqualification, if any, of Contractor's staff, including subcontractor's staff, pursuant to this Paragraph 3.4 shall not relieve Contractor of its obligation to complete all Work in accordance with the terms and conditions of this Agreement.

3.5 STATUS REPORTS BY CONTRACTOR

In addition to any reports required elsewhere pursuant to this Agreement including the Statement of Work, in order to control expenditures and to ensure the reporting of all Work provided by Contractor, Contractor shall provide to County's Project Manager, as frequently as requested by County's Project Manager, but in no event more frequently than monthly, written reports which shall include, at a minimum, the following information:

- (1) Tasks accomplished since the last meeting.

- (2) A review of any incomplete Tasks and the reasons why they are not completed.
- (3) An outline of the Tasks anticipated to be accomplished in the next monthly period.
- (4) A list and status of outstanding issues, Deliverables, and Invoices as required by this Agreement.
- (5) Any Project risks or problems identified as part of the implementation process.
- (6) Tracking of all issues and their resolution.

3.6 RULES AND REGULATIONS

- 3.6.1 During the time when Contractor's employees, subcontractors or agents are at County facilities, such persons shall be subject to the applicable rules and regulations of County facilities. It is the responsibility of Contractor to acquaint such persons, who are to provide Work, with such rules and regulations. In the event that County determines that an employee, subcontractor or agent of Contractor has violated any applicable rule or regulation, County shall notify Contractor, and Contractor shall undertake such remedial or disciplinary measures as Contractor determines appropriate. If the reported violation is not thereby corrected, then Contractor shall permanently withdraw its employee, subcontractor or agent from the provision of Work upon receipt of written notice from County that: (i) such employee, subcontractor or agent has violated such rules or regulations; or (ii) such employee's, subcontractor's or agent's actions, while on County premises, indicate that the employee, subcontractor or agent may adversely affect the provision of Work. Upon removal of any employee, subcontractor or agent, Contractor shall immediately replace the employee, subcontractor or agent and continue uninterrupted Work hereunder.

3.7 CONTRACTOR'S STAFF IDENTIFICATION

- 3.7.1 Contractors shall provide each member of the staff assigned to this Agreement staff a visible photo identification badge. While on duty or when entering a County facility or its grounds, shall prominently display the photo identification badge on the upper part of the body. The format and content of the badge is subject to County's approval prior to Contractor implementing the use of the badge.
- 3.7.2 Contractor shall notify County within one (1) Business Day when staff is terminated from work under this Agreement. Contractor is responsible to retrieve and immediately destroy the staff's County-specified photo identification badge at the time of removal from Work under this Agreement.

If County requests the removal of Contractor's staff, Contractor shall be responsible to retrieve and immediately destroy Contractor staff's County photo identification badge at the time of removal from work under this Agreement.

4. CHANGES NOTICES AND AMENDMENTS

4.1 GENERAL

No representative of either County or Contractor, including those named in this Agreement, is authorized to make any changes in any of the terms, obligations or conditions of this Agreement, except through the procedures set forth in this Paragraph 4. County reserves the right to change any portion of the Work required under this Agreement or to amend such other terms or conditions as may become necessary. All such changes shall be accomplished only as provided in this Paragraph 4.

4.2 CHANGE NOTICES

Except as otherwise provided in this Agreement, for any change requested by County, which does not materially affect the Work or term, payments or any term or condition included in this Agreement, a negotiated written notice of such change (hereinafter "Change Notice") shall be prepared and executed by County's Project Director and Contractor's Project Director or Contractor's authorized representative(s). Consistent with the foregoing, the parties shall execute a Change Notice in the form of a Change Order for any acquisition of Additional Work under the Agreement or other changes to the Statement of Work allowable under the Agreement by Change Notice.

4.3 AMENDMENTS

For any change which affects the Scope of Work, Contract Sum, payments, or any term or condition included in this Agreement, an amendment shall be prepared and executed by Contractor and the Board or if delegated by the Board, the Director, and Contractor.

The Board or County's Chief Executive Officer or designee may require the addition and/or change of certain terms and conditions in this Agreement during the term. County reserves the right to add and/or change such provisions as required by the Board or the Chief Executive Officer. To implement such changes, an amendment or a change order to this Agreement shall be prepared by Public Works and signed by the Contractor.

County may, at its sole discretion, authorize extensions of time to this Contract's term. Contractor agrees that such extensions of time shall not change any other term or condition of this Agreement during the period of such extensions. To implement an extension of time, an amendment to this Agreement shall be prepared and executed by Contractor and the Board or if delegated by the Board, the Director, and Contractor. To the extent that extensions of time for Contractor performance do not impact either scope or amount of this Contract, Public Works may, at its sole discretion, grant Contractor extensions of time, provided the aggregate of all such extensions during the life of this Agreement shall not exceed 270 days.

For any change which does not materially affect the Scope of Work or any other term or condition included under this Contract, a change order shall be prepared by Public Works and signed by the Contractor. If the change order is prepared by the Contractor, it shall be approved by Public Works and signed by the Contractor and the County.

4.4 TASK SCHEDULE

Changes to the Task Schedule shall be made upon mutual agreement, in writing, by County's Project Director and Contractor's Project Director by Change Notice or otherwise, provided that County's Project Director's and Contractor's Project Director's agreement to alter the Task Schedule shall not prejudice either party's right to claim that such alterations constitute an Amendment to this Agreement that shall be governed by the terms of Paragraph 4.3 (Amendments) above.

4.5 BOARD ORDERS

Notwithstanding any other provision of this Paragraph 4 or Paragraph 21 (Termination/Suspension for Convenience), Director shall take all appropriate actions to carry out any orders of County's Board of Supervisors relating to this Agreement, which directly impact the Software or the budget allocated for the Software or the Agreement, and, for this purpose, Director is authorized: (i) to issue written notice(s) of partial or total termination of this Agreement pursuant to Paragraph 21 (Termination/Suspension for Convenience) without further action by County's Board of Supervisors and/or (ii) to prepare and execute Amendment(s) to this Agreement, which shall reduce the Work and the Contract Sum without further action by County's Board of Supervisors.

4.5.1 Such notices of partial or total termination shall be authorized under the following conditions:

- (1) Notices shall be in compliance with all applicable Federal, State, and County laws, rules, regulations and ordinances, and publicly known guidelines and directives.
- (2) Director shall obtain the approval of County Counsel for any notice.
- (3) Director shall file a copy of all notices with the Executive Office of County's Board of Supervisors and County's Chief Executive Office within thirty (30) days after execution of each notice.

4.5.2 Such Amendments shall be authorized under the following conditions:

- (1) Amendments shall be in compliance with all applicable Federal, State, and County laws, rules, regulations and ordinances, and publicly known guidelines and directives.
- (2) County's Board of Supervisors has appropriated sufficient funds for purposes of such Amendments and this Agreement.
- (3) Director shall obtain the approval of County Counsel for any Amendment.
- (4) Director shall file a copy of all Amendments with the Executive Office of County's Board of Supervisors and County's Chief Executive Office within 30 days after execution of each Amendment.

4.6 CHANGE ORDERS

Change Orders proposed or executed by the parties for acquisition of Additional Work or other changes to the Statement of Work allowable under the Agreement by Change Notice shall include, unless waived in writing by County's Project Director:

- (1) A quotation of a "not to exceed" Maximum Fixed Price for completion and delivery of the requested Work, including a proposed Task and Deliverable completion schedule and a monthly budget of anticipated expenditures (including labor expenses calculated using the Hourly Labor Rates for personnel time);
- (2) Staff level recommended for completion of the applicable Work;
- (3) Estimated personnel hours for completion of the requested Work;
- (4) To the extent Software Modifications are requested, functional Software specifications;
- (5) Final delivery date for completed Work, including any post-delivery acceptance period as may be applicable;
- (6) If applicable, a revised Task and Deliverable completion schedule under the SOW for the remaining Work (i.e., other than the Work requested under the Change Order);
- (7) A description and Contractor's cost of any applicable hardware, third party software, or other materials required to complete the requested Work.

4.6.1 DURATION OF CHANGE ORDER PRICE QUOTATION

Contractor's quotations under the proposed Change Order, including the "not to exceed price" under Paragraph 4.6, shall be valid for ninety (90) days from the date of its submission.

4.6.2 CHANGE ORDER DISPUTE RESOLUTION

In the event the parties fail to agree on the amount to be paid by County for the Work requested pursuant to a Change Order, County may, upon notice to Contractor, elect to direct Contractor to commence performing such Work (and Contractor agrees to commence performing such Work) and resolve the dispute over amounts owed to Contractor in accordance with the Dispute Resolution Procedure. To give effect to the preceding sentence, however, County agrees to pay and will pay the undisputed portion of such fees in accordance with the procedures set forth in Paragraph 4.1 (General) and Paragraph 9 (Invoices and Payments).

4.6.3 CHANGE ORDER AUDIT

County is entitled to audit, in accordance with Paragraph 30 (Records and Audits), Contractor's compliance with Paragraph 4.6 (Change Order) with respect to the Work performed pursuant to any Change Order.

4.7 FACSIMILE/ELECTRONIC MAIL TRANSMISSION/COUNTERPART SIGNATURES

This Agreement may be signed by the parties hereto in separate counterparts. Each executed counterpart shall be deemed an original. All counterparts, taken together, constitute the executed Agreement.

Except for the parties' initial signatures to this Agreement, which must be provided in "original" form and not by facsimile, County and Contractor hereby acknowledge and agree

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that electronic records and electronic signatures, as well as facsimile signatures or signatures transmitted by electronic mail in so-called pdf format shall be legal and binding and shall have the same full force and effect as if a paper original had been delivered had been signed using a handwritten signature for Amendments, Change Orders, and Change Notices pursuant to Paragraph 4 when received via a party's communication facilities. Contractor and County (i) agree that an electronic signature, whether digital or encrypted, of a party to this Agreement is intended to authenticate this writing and to have the same force and effect as a manual signature, (ii) intend to be bound by the signatures (whether original, faxed or electronic) on any document sent or delivered by facsimile or, electronic mail, or other electronic means, (iii) are aware that the other party will rely on such signatures, and (iv) hereby waive any defenses to the enforcement of the terms of this Agreement based on the foregoing forms of signature. If this Agreement has been executed by electronic signature, all parties executing this document are expressly consenting under the United States Federal Electronic Signatures in Global and National Commerce Act of 2000 ("E-SIGN") and California Uniform Electronic Transactions Act ("UETA")(Cal. Civ. Code § 1633.1, et seq.), that a signature by fax, email or other electronic means shall constitute an Electronic Signature to an Electronic Record under both E-SIGN and UETA with respect to this specific transaction.

5. SCOPE OF WORK

In exchange for County's payment to Contractor of the applicable fees arising under the Agreement and invoiced by Contractor, Contractor shall (a) on a timely basis provide, complete, deliver and implement all Work set forth in this Agreement, including Exhibit A (Statement of Work), Contractor shall perform all such tasks, subtasks, deliverables, services and other Work in accordance with Exhibit A (Statement of Work) with all Attachments thereto with all Schedules thereto at the applicable rates and prices specified in Exhibit B (Payment Schedule) with all Schedules thereto.

5.1 ADDITIONAL WORK

Upon the written request of County's Project Director or designee and mutual agreement, Contractor shall provide to County Additional Work using Pool Dollars, including Software Modifications, Professional Services and/or Additional Products, in accordance with Paragraph 8.3 (Additional Work) at the applicable pricing terms set forth in Exhibit C (Schedule of Prices). Software Modifications shall only include those products and services relating to the Software not existing on the Effective Date, as determined by County's Project Director or designee.

Upon County's request and Contractor's agreement to provide the Additional Work, Contractor shall provide to County within ten (10) Business Days of such request, or such longer period as agreed to by the parties, a proposed Scope of Additional Work and a quote for a Maximum Fixed Price calculated in accordance with the applicable pricing terms set forth in Exhibit C (Schedule of Prices). Following agreement by the parties with respect to such Scope of Additional Work and the Maximum Fixed Price, the parties shall

execute a Change Order for such Additional Work in accordance with Paragraph 4.6 (Change Orders).

5.2 STANDARD OF SERVICES

Contractor's services and other Work required by this Agreement shall during the term of the Agreement conform to reasonable commercial standards as they exist in Contractor's profession or field of practice. If Contractor's services or other work provided under this Agreement fail to conform to such standards, upon notice from County specifying the failure of performance, Contractor shall, at Contractor's sole expense, provide the applicable remedy as specified in this Agreement, including Exhibit A (Statement of Work). Contractor shall, at its own expense, correct any data in which (and to the extent that) errors have been caused by Contractor or malfunctions of the Software or by any other tools introduced by Contractor into the Software for the purpose of performing services or other Work under this Agreement or otherwise.

5.3 TESTING OF WORK

Contractor shall conduct all appropriate testing of the Software before providing any Work hereunder, including Additional Work, to ensure the Software's continued functionality, that the Software is free of any Deficiencies and that the Additional Work meets the requirements of the applicable Scope of Additional Work. Such Software tests shall test, among others, the Software's functionality, integration and interfacing, volume endurance and user acceptance.

5.4 INTEGRATION/INTERFACING

From time to time, Contractor may be responsible for developing, and incorporating into the Software, Software Modifications, including Software Modifications and Additional Products, in the form of Additional Work. If such Software Modifications are to be integrated or interfaced with other software, equipment and/or systems provided by Contractor or at the direction of Contractor, the Software Modifications shall not be deemed Accepted by County until the Software Modifications and such other systems have been successfully integrated or interfaced and accepted by County in accordance with the terms of this Agreement. Contractor shall not obtain any ownership interest in any other systems merely because they were interfaced, integrated or used with the Software.

5.5 UNAPPROVED WORK

If Contractor provides any tasks, subtasks, deliverables, services or other work to County other than those specified in this Agreement, or if Contractor provides such items requiring County's prior written approval without first having obtained such written approval, the same shall be deemed to be a gratuitous effort on the part of Contractor, and Contractor shall have no claim whatsoever against County therefor.

6. TASK SCHEDULE

6.1 PROJECT PLAN

Contractor shall implement the Software in accordance with the Task Schedule, set forth in Exhibit B (Payment Schedule).

7. TERM

7.1 INITIAL TERM

The effective date of this Agreement for the initial term shall commence on March 1, 2021, or upon Board approval and execution between both parties, whichever occurs last, and shall expire 2 years following the Notice to Proceed by County, unless sooner terminated or extended, in whole or in part, as provided in this Agreement (hereinafter "Initial Term").

7.2 EXTENDED TERM

At the end of the Initial Term, County may, at its sole option, extend this Agreement for two additional 2- year period and a six month-to-month extension (hereinafter "Extended Term"), subject to, among others, County's right to terminate earlier for convenience, non-appropriation of funds, default of Contractor, substandard performance of Contractor, non-responsibility of Contractor and any other term or condition of the Agreement providing for early termination of the Agreement by County. If County elects not to exercise its option to extend at the end of the Initial Term, the term of the Agreement shall expire. The extension options shall be exercised by County at its sole discretion. County shall be deemed to have exercised any of its extension options automatically, without further act, unless the Director or designee provides a written notice of nonrenewal at least ten (10) days prior to the expiration of the Initial Term, in which case this Agreement shall expire as of midnight on the last day of that term pursuant to this Paragraph 7.

County maintains databases that track/monitor Contractor performance history. Information entered into such databases may be used for a variety of purposes, including determining whether County will exercise an Agreement term extension option.

7.3 DEFINITION OF TERM

As used throughout this Agreement, the word "term" when referring to the term of the Agreement shall include the Initial Term and the Extended Term, to the extent County exercises any of its extension option pursuant to Paragraph 7.2 (Extended Term).

7.4 NOTICE OF EXPIRATION

Contractor shall notify County when this Agreement is within 6 months from the expiration of the term. Upon occurrence of this event, Contractor shall send written notification to County's Project Director at the address set forth in Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement).

8. CONTRACT SUM**8.1 MAXIMUM CONTRACT SUM**

The Contract Sum under this Agreement shall be the total monetary amount payable by County to Contractor for supplying all the tasks, subtasks, deliverables, services and other Work required or requested by County under this Agreement. All Work completed by Contractor must be approved in writing by County in accordance with Paragraph 2.4 (Approval of Work). If County does not approve work in writing, no payment shall be due Contractor for that Work. The Contract Sum, including all applicable taxes, authorized by County hereunder shall not exceed \$400,000, as further detailed in Exhibit C (Schedule of Prices), unless the Contract Sum is modified pursuant to a duly approved Amendment to this Agreement by County's and Contractor's authorized representative(s) pursuant to Paragraph 4 (Changes Notices and Amendments). The Contract Sum under this Agreement shall cover authorized payments for any and all Work provided by Contractor under the Agreement, including all Software, Services and any Additional Work. Contractor acknowledges and agrees that the Maximum Contract Sum is an all-inclusive, not-to-exceed price, that is an agreed upon assessment of the amount to be paid by County to Contractor in exchange for Contractor to deliver to County, and County accepting, within the required delivery schedule. Notwithstanding any provision of this Agreement to the contrary, Contractor is not obligated to perform Work under Change Orders if Pool Dollars are not available to pay for such Work.

Contractor shall maintain a system of record keeping that will allow Contractor to determine when it has incurred seventy-five percent (75) of the Contract Sum, including the Pool Dollars expenditures, authorized for this Agreement. Contractor also shall maintain a system of record keeping that will allow Contractor to determine when it has incurred 75 percent of the expenditures for each individual Task Order, authorized under this Agreement. Upon occurrence of these events, Contractor shall provide written notification to County's Project Director at the address set forth in Section 1 (County Key Personnel) in Exhibit E (Administration of Agreement). Notwithstanding the foregoing, Contractor's failure to provide such notification shall not constitute a material breach of this Agreement.

8.2 SOFTWARE IMPLEMENTATION**8.2.1 SOFTWARE MODIFICATION COST**

County will reimburse Contractor for Software Modifications by payment of the applicable Cost for providing Software installation, data migration and/or conversion (if any), Acceptance Tests, and any other Work to be provided by Contractor as part of Software Modifications pursuant to Exhibit A (Statement of Work). Cost of Software Modifications will be paid by County to Contractor following Contractor's completion and County's approval of the Statement of Work Deliverables as set forth in Exhibit B (Payment Schedule).

8.2.2 CREDITS TO COUNTY

In an increasingly mobile society, it is critical to improve traffic flow through multiple jurisdictions within the County of Los Angeles in an effort to enhance mobility, relieve traffic congestion and increase air quality. To meet these goals, County continues to work with cities Countywide to improve mobility and provide transit signal priority capabilities through multiple jurisdictions. Any delay in the completion and delivery of the Tasks associated with this Agreement decreases the efficiency and value of the Software. County and Contractor have identified the Task Schedule specified in Exhibit B (Payment Schedule), Contractor's timely completion and delivery of which will ensure County receives, and is able to implement, the Software Modifications in a timely fashion, and therefore improve mobility, relieve traffic congestion and enhance air quality in the County of Los Angeles. If Contractor fails to complete and deliver such Deliverables by the dates set forth in each Task, it is mutually agreed that such delay increases the likelihood that Contractor will not complete and deliver the Software Modifications in a timely manner, and, therefore, decreases County's ability to use the Software to achieve its goals.

Contractor, therefore, agrees that delayed performance by Contractor will cause damages to County, which are uncertain and would be impracticable or extremely difficult to ascertain in advance. Contractor further agrees that, in conformity with California Civil Code Section 1671, Contractor shall be liable to County for liquidated damages in the form of credits, as specified in Paragraph 8.2.2 below, as a fair and reasonable estimate of such damages. Any amount of such damages is not and shall not be construed as penalties and, when assessed, will be deducted from County's payment that is due.

For each and every occasion upon which a Deliverable has not been completed by Contractor within 30 days after the date scheduled for completion of each Tasks set forth in such Task Schedule, other than as a result of delays caused by acts or omissions of County, and unless otherwise approved in writing by County's Project Manager or designee in his/her discretion, County shall be entitled to receive credit against any or all amounts due to Contractor under this Agreement or otherwise. Determination whether County shall assess credits due to it pursuant to this Paragraph 8.2.2 shall be made by County's Project Manager in his/her reasonable discretion.

Such credits will be calculated according to the following rules:

- (i) Deliverables not properly completed within 30 working days of the Deliverable due date, as specified in Exhibit B (Payment Schedule), shall entitle County to a credit of Five Hundred Dollars (\$500) for each day of the actual cost of such Deliverable, as set forth in Exhibit B (Payment Schedule).
- (ii) The credits shall be increased by Five Hundred Dollars (\$500) for each day of such cost each Working Day the Deliverable is late beyond the 30 working days.

A Deliverable shall be deemed completed for purposes of this Paragraph 8.2.2 and Paragraph 8.2.3 (Termination/Suspension) on the earliest date that all of the tasks, subtasks, deliverables, services and other Work required for the completion of such Deliverable are completed and delivered to County, provided that all of such tasks,

subtasks, deliverables, services and other Work required for the completion of such Deliverable are thereafter approved in writing by County pursuant to Paragraph 2.4 (Approval of Work) without prior rejection by County or significant delay in County's approval thereof, which delay is the result of Contractor's failure to deliver such tasks, subtasks, deliverables, services and other Work in accordance with the terms hereof. For purposes of this Paragraph 8.2.2 and Paragraph 8.2.3 (Termination/Suspension), the determination of whether a Deliverable has been so completed and is so approved, and of the date upon which such Deliverable was completed, shall be made by County's Project Director as soon as practicable after County is informed by Contractor that such Deliverable has been completed and is given all the necessary information, data and documentation to verify such completion.

8.2.3 TERMINATION/SUSPENSION

In addition to the foregoing provisions of Paragraph 8.2.2 (Credits to County), if any Deliverable is not completed within 90 days after the applicable Due Date, and thereafter approved in writing by County pursuant to Paragraph 2.4 (Approval of Work), other than as a result of delays caused by acts or omissions of County as determined by Director in his/her reasonable judgment, and unless County's Project Director and Contractor's Project Director have otherwise agreed in writing prior to such date scheduled for completion, then County may, upon notice to Contractor, terminate/suspend this Agreement for default in accordance with Paragraph 20 (Termination/Suspension for Default) or for convenience in accordance with Paragraph 21 (Termination/Suspension for Convenience), as determined in the sole discretion of County, subject to the cure provisions set forth in Paragraph 20 (Termination/Suspension for Default).

8.3 ADDITIONAL WORK

Upon County's request for Additional Work and mutual agreement, Contractor shall provide to County Additional Work using Pool Dollars in accordance with the agreed upon Maximum Fixed Priced and the Scope of Additional Work, as specified in Paragraph 5.1 (Additional Work). Contractor's rates for Additional Work shall be subject to the applicable pricing terms set forth in Exhibit B (Payment Schedule) and/or Exhibit C (Schedule of Prices) for the term of this Agreement. Any Additional Work provided by Contractor shall not cause an increase in the Service Fees under this Agreement with the exception of any Additional Software procured as part of Additional Products that may require an increase. Absent an Amendment in accordance with Paragraph 4 (Changes Notices and Amendments), the Pool Dollars are the aggregate amount available during the term of this Agreement for Additional Work requested.

8.4 NON-APPROPRIATION OF FUNDS

County's obligation may be limited if it is payable only and solely from funds appropriated for the purpose of this Agreement. Notwithstanding any other provision of this Agreement, County shall not be obligated for Contractor's performance hereunder or by any provision of this Agreement during any of County's future fiscal years unless and until County's Board of Supervisors appropriates funds for this Agreement in County's budget for each

such future fiscal year. In the event that funds are not appropriated for this Agreement, then County shall, at its sole discretion, either (i) terminate this Agreement as of June 30 of the last fiscal year for which funds were appropriated or (ii) reduce the work provided hereunder in accordance with the funds appropriated, as mutually agreed to by the parties. County will notify Contractor in writing of any such non-appropriation of funds at its election at the earliest possible date.

8.5 COUNTY'S OBLIGATION FOR FUTURE FISCAL YEARS

In the event that County's Board of Supervisors adopts, in any fiscal year, a County Budget which provides for the reductions in the salaries and benefits paid to the majority of County employees and imposes similar reductions with respect to County contracts, County reserves the right to reduce its payment obligation under this Agreement correspondingly for that fiscal year and any subsequent fiscal year during the term of this Agreement (including any extensions), and the services to be provided by Contractor under this Agreement shall also be reduced correspondingly. County's notice to the Contractor regarding said reduction in payment obligations shall be provided within 30 calendar days of the Board of Supervisors' approval of such actions. Except as set forth in the preceding sentence, Contractor shall continue to provide all of the services set forth in this Agreement.

8.6 COST-OF-LIVING ADJUSTMENT

If requested by the Contractor, the contract (hourly, daily, monthly, etc.) amount may, at the sole discretion of the County, be increased at the time of contract renewal, if exercised by the County, based on the most recently published percentage change in the U.S. Department of Labor, Bureau of Labor Statistics' Consumer Price Index (CPI) for the Los Angeles-Long Beach-Anaheim area for the 12-month period preceding the renewal date, which shall be the effective date for any Cost-of-Living Adjustments (COLAs). However, any increase shall not exceed the general salary movement granted to County employees as determined by the Chief Executive Officer as of each July 1 for the prior 12 month period. Furthermore, should fiscal circumstances ultimately prevent the Board from approving any increase in County employee salaries, no COLAs will be granted. Upon approval of COLAs, a notification will be sent to the Contractor.

9. INVOICES AND PAYMENTS

9.1 INVOICES

Contractor shall invoice County in accordance with Exhibit B (Payment Schedule), for (i) Services, based on the Deliverable amounts due upon Contractor's completion and County's written approval of billable Deliverables and (ii) all Additional Work, on a per Change Notice basis, by payment of the actual price expended by Contractor for the provision of any such Additional Work, which shall not exceed the Maximum Fixed Price quoted for such Additional Work following Contractor's completion and County's written approval of the Additional Work.

9.1.1 SUBMISSION OF INVOICES

Contractor's invoice shall include the charges owed to Contractor by County under the terms of this Agreement as provided in Exhibit B (Payment Schedule). All invoices and supporting documents under this Agreement shall itemize the Work completed or invoiced and shall be submitted in triplicate (original and two copies) to the person(s) and address specified in Exhibit E (Administration of Agreement).

9.1.2 INVOICE DETAILS

Each invoice submitted by Contractor shall indicate, at a minimum:

- (1) Agreement Name and Number;
- (2) The tasks, subtasks, deliverables, services, other Work, any Change Orders or Amendments, as applicable, for which payment is claimed, including Services, Deliverable(s) and Additional Work;
- (3) The price of such tasks, subtasks, deliverables, services or other Work calculated based on the pricing terms set forth in Exhibit B (Payment Schedule) or any Change Notice and Amendments, as applicable.
- (4) If the invoice is for Additional Work or any other Work for which Pool Dollars will be utilized, a copy of the applicable Change Order or Amendment, executed by the applicable representative of County, a copy of the Acceptance Certificate evidencing County's approval of such Work, and any additional supporting documentation reasonably requested by County. The invoice further shall include the cumulative amount of Pool Dollars charged to County to date, and the remaining Pool Dollars available for use in connection with future Additional Work or other Change Orders or Amendments.
- (5) If applicable, the amount due under Task 1 (Project Management) of Exhibit A (Statement of Work), which shall be the lesser of: (i) the maximum amount for Task 1 as enumerated in Exhibit B (Payment Schedule) or (ii) the total cost of Work performed for the invoiced period. The total cost of Work performed shall be calculated by multiplying the number of hours worked by the applicable Hourly Labor Rates set forth in Exhibit B (Payment Schedule).
- (6) Indication of the maximum amount remaining under Task 1 (Project Management) and each approved Task of Exhibit A (Statement of Work), which shall equal: (i) the maximum amount available for Task 1 and each approved Task as enumerated in Exhibit B (Payment Schedule) less (ii) the cumulative cost accrued for Work performed under Task 1 (Project Management) and each approved Task of Exhibit A (Statement of Work) to date.
- (7) The date of written approval of the tasks, subtasks, deliverables, services or other Work by County's Project Director or designee;
- (8) Indication of any applicable withhold amounts for payments claimed or reversals thereof;

- (9) Indication of any applicable credits due County under the terms of this Agreement or reversals thereof;
- (10) A copy of any applicable Acceptance certificates signed by County's Project Director and County's Project Manager; and
- (11) Any other information required by County's Project Director.

9.1.3 APPROVAL OF INVOICES

All invoices submitted by Contractor to County for payment shall have County's written approval as provided in this Paragraph 9.1, which approval shall not be unreasonably withheld. In no event shall County be liable or responsible for any payment prior to such written approval.

9.1.4 PARTIAL OR PROGRESS PAYMENTS

Contractor may be entitled to partial or progress payment for Work completed in respect of a task or a deliverable or other Work approved by the County only if authorized in writing by County's Project Director.

9.1.5 INVOICE DISCREPANCIES

County's Project Director will review each invoice for any discrepancies and will, within 30 days of receipt thereof, notify Contractor in writing of any discrepancies found upon such review and submit a list of disputed charges. Contractor shall review the disputed charges and send a written explanation detailing the basis for the charges within 30 days of receipt of County's notice of discrepancies and disputed charges. If County's Project Director does not receive a written explanation for the charges within such 30 day period, Contractor shall be deemed to have waived its right to justify the original invoice amount, and County, in its sole discretion, shall determine the amount due, if any, to Contractor and pay such amount in satisfaction of the disputed invoice, subject to the Dispute Resolution Procedure.

All County correspondence relating to invoice discrepancies shall be sent by e-mail, followed by hard copy, directly to County's Project Manager with a copy to County's Project Director at the addresses specified in Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement).

9.2 DELIVERY OF SOFTWARE MODIFICATIONS

It is in the intent of the parties that if any Software Modification or Documentation provided by Contractor under this Agreement, including any product of Additional Work, is delivered to County, such delivery shall be made either, (i) in electronic format (e.g., via electronic mail or internet download), or (ii) personally by Contractor staff who shall load Software and Documentation onto County's hardware but who will retain possession of all originals and copies of such tangible media (e.g., CD-ROM, magnetic tape, printed manuals) used to deliver the Software and Documentation to County.

Any Software and Documentation that is provided or delivered by Contractor to County in a tangible format shall be at Contractor's expense. The Contract Sum shown in

Paragraph 8.1 (Maximum Contract Sum) includes all amounts necessary for County to reimburse Contractor for all transportation and related insurance charges, if any, for Software Modifications and Documentation procured by County from Contractor pursuant to this Agreement. All transportation and related insurance charges, if any, shall be paid directly by Contractor to the applicable carrier. Contractor shall be solely liable and responsible for, and shall indemnify, defend, and hold harmless County from, any and all such transportation and related insurance charges.

9.3 PAYMENTS

Provided that Contractor is not in default under any provision of this Agreement, County will endeavor reasonably to process each invoice received by the Contractor within 30 days of receipt that have not been disputed in accordance with Paragraph 9.1.5 (Invoice Discrepancies) above. County's failure to pay within the 30 day period, however, shall not be deemed as automatic invoice approval or Acceptance by County of any deliverable for which payment is sought, nor shall it entitle Contractor to impose an interest or other penalty on any late payment.

9.4 COUNTY'S RIGHT TO WITHHOLD PAYMENT

Notwithstanding any other provision of this Agreement, and in addition to any rights of County given by law or provided in this Agreement, County may upon written notice to Contractor withhold payment for any deliverable while Contractor, with no fault of County, is in default hereunder or default related to Work.

10. OWNERSHIP AND LICENSE

10.1 OWNERSHIP

10.1.1 WORK PRODUCT

County shall remain the sole owner of Software, including Software Modifications, and all derivative works therein (hereinafter collectively "Work Product"). Contractor agrees that all such work, software modifications, and documentation produced by it under this agreement is a work made for hire with ownership vesting in the County.

10.1.2 THIRD PARTY SOFTWARE

Contractor shall not utilize Third Party Products without the prior written approval of County in accordance with Paragraph 2.4 (Approval of Work), to be granted or withheld in its sole discretion. County's Project Director shall also have the right on behalf of County to so approve all of the terms under which Contractor will license any proposed Third-Party Products from the third party licensor, including, without limitation, scope of license, risk allocation provisions, warranties, and financial terms.

Contractor represents and warrants that it has not modified and shall not modify, nor does Contractor have any need to modify, Third Party Software in order for the Software to fully perform in accordance with this Agreement. Contractor represents and warrants that all Third Party Software will be provided to County in the same unmodified form as received by Contractor from the applicable third party. Contractor represents and warrants that

Third-Party Software shall, together with the remainder of the Software, fully satisfy all functionality without the need for any modification of Third Party Software by Contractor or otherwise.

County acknowledges that it may have to execute certain third party license agreements in respect of such Third Party Software. These third party license agreements shall be at no additional cost to County. To the extent that any such third party license agreement conflicts with this Agreement or in any way restricts County's full use and enjoyment of the Software as contemplated herein, Contractor shall take all necessary action and pay all sums required for County fully to enjoy all the rights and benefits in respect of the Software granted under this Agreement. Contractor shall promptly and at no cost to County, either: (1) obtain a license from the appropriate third party which shall enable Contractor to modify such Third Party Software, and Contractor shall provide all necessary modifications, or (2) to the extent that Contractor is unable to obtain such a license, provide a Software Update or alternative solution, which is functionally equivalent, in the sole determination of Contractor's Project Manager and County's Project Manager, in lieu of modifying such Third Party Software.

11. SOFTWARE ACCEPTANCE

11.1 ACCEPTANCE TESTS

County shall conduct all Acceptance Tests specified in Exhibit A (Statement of Work) to ensure the Software's compliance with the Task Orders generated in accordance with Exhibit A (Statement of Work). Such Acceptance Tests shall test, among others, the Software's functionality, integration and interfacing, volume endurance and user acceptance.

11.2 PRODUCTION USE

The Software Modifications shall be ready for Production Use following County's Project Director written Acceptance and approval, as evidenced by the applicable Acceptance Certificate.

Following installation by Contractor and prior to Final Acceptance by County, County shall have the right to use, in production mode, any completed portion of the Software and Software Modifications where County determines that it is desirable or necessary for County operations. Such production use shall not restrict the Contractor's performance under this Agreement and shall not be deemed to be Contractor's achievement of Acceptance.

11.3 FINAL ACCEPTANCE

Acceptance of individual task orders shall be achieved following County's Project Director written Final Acceptance and approval, as evidenced by the applicable Acceptance Certificate of Exhibit A (Statement of Work). In the event the task order fails to successfully achieve Final Acceptance, Contractor shall provide County with a diagnosis of the Deficiencies and proposed solution(s). County and Contractor shall agree upon all such proposed solutions prior to their implementation.

11.4 FAILED TESTING

- 11.4.1 If County's Project Director makes a good faith determination at any time that the Software as a whole, or any component thereof, has not successfully completed an Acceptance Test, County's Project Director shall promptly notify Contractor in writing of such failure, specifying with as much detail as possible the manner in which the Software failed to pass the applicable test. Contractor shall immediately commence all reasonable efforts to complete, as quickly as possible, such necessary corrections, repairs and modifications to the Software as will permit the Software to be ready for retesting. Contractor shall notify County's Project Director in writing when such corrections, repairs and modifications have been completed, and the applicable test shall begin again. If, after the applicable test has been completed for a second time, County's Project Director makes a good faith determination that the Software again fails to pass the applicable test, County's Project Director shall promptly notify Contractor in writing, specifying with as much detail as possible the manner in which the Software failed to pass the applicable test. Contractor shall immediately commence all reasonable efforts to complete, as quickly as possible, such necessary corrections, repairs and modifications to the Software as will permit the Software to be ready for retesting.
- 11.4.2 Such procedure shall continue, subject to County's rights under Paragraphs 8.2.2 (Credits to County) and 8.2.3 (Termination/Suspension) in the event Contractor fails to timely complete any Task until such time as County notifies Contractor in writing either: (i) of the successful completion of such test or (ii) that County has concluded, subject to the Dispute Resolution Procedure, that satisfactory progress toward such successful completion of such test is not being made, in which latter event, County shall have the right to make a determination, which shall be binding and conclusive on Contractor, that a non-curable default has occurred and to terminate this Agreement in accordance with Paragraph 20 (Termination/Suspension for Default) on the basis of such non-curable default. In the event Contractor, using good faith effort, is unable to cure a Deficiency by re-performance after two (2) attempts, County and Contractor will work together to agree on a mutually acceptable resolution, provided that if County and Contractor cannot agree on a resolution, County may terminate this Agreement for default pursuant to Paragraph 20 (Termination/Suspension for Default).
- 11.4.3 Such a termination for default by County shall be, subject to the Dispute Resolution Procedure, either, as determined by County in its sole judgment: (i) a termination with respect to one or more of the components of the Software; or (ii) a termination of the entire Agreement, if County believes the failure to pass the applicable test materially affects the functionality, performance or desirability to County of the Software as a whole. In the event of a termination under this Paragraph 11.4, County shall have the right to receive from Contractor (i) reimbursement of all payments made to Contractor by County under this Agreement for the Software Modification (s) and related Deliverables as to which the termination applies or (ii) if the entire Agreement is terminated, all amounts paid by County to Contractor under this Agreement. The foregoing is without prejudice to any other rights that may accrue to County or Contractor under the terms of this Agreement or by law.

12. WARRANTIES AND CORRECTION OF DEFICIENCIES

12.1 GENERAL WARRANTIES

Contractor represents, warrants, covenants and agrees that throughout the term of this Agreement:

1. Contractor shall comply with the description and representations (including, but not limited to, Deliverable documentation, performance capabilities, accuracy, completeness, characteristics, specifications, configurations, standards, functions and requirements applicable to professional software design meeting industry standards) set forth in this Agreement, including the Exhibit A (Statement of Work) including all Attachments thereto.
2. Contractor shall not intentionally cause any unplanned interruption of the operations of Software or any component through any device, method or means including, without limitation, the use of any "virus", "lockup", "time bomb", or "key lock", "worm", "back door" or "Trojan Horse" device or program, or any disabling code, which has the potential or capability of compromising the security of County's confidential or proprietary information or of causing any unplanned interruption of the operations of, or accessibility of the Software to County or any User or which could alter, destroy, or inhibit the use of the Software, or the data contained therein (collectively referred to as "Disabling Device(s)"), which could block access to or prevent the use of the Software by County or Users. Contractor represents, warrants, and agrees that it has not purposely placed, nor is it aware of, any Disabling Device in Software Modifications provided to County under this Agreement, nor shall Contractor knowingly permit any subsequently delivered or provided Software Modification to contain any Disabling Device.

In addition, to the extent within Contractor's control or knowledge, Contractor shall prevent viruses from being incorporated or introduced into the Software or enhancements thereto prior to the installation onto the Software and shall prevent any viruses from being incorporated or introduced in the process of Contractor's performance of on-line support.

12.2 SOFTWARE WARRANTIES AND PROBLEM RESOLUTION

Contractor represents, warrants, covenants and agrees that throughout the term of this Agreement:

1. Any enhancements or upgrades shall be backward compatible with any County's operating system version(s) operated on traffic signal controllers.
2. The Software shall be capable of delivering all of the functionality, as such may be modified as a result of Software implementation or provision of Additional Work.

12.3 REMEDIES

County's remedies under the Agreement for the breach of the warranties set forth in this Agreement shall include the repair or replacement by Contractor, at its own expense, of

the non-conforming Software components and any other corrective measures specified in this Agreement.

12.4 BREACH OF WARRANTY OBLIGATIONS

Failure by Contractor to timely perform its obligations set forth in this Paragraph 12 shall constitute a material breach, upon which, in addition to County's other rights and remedies set forth herein, County may, after written notice to Contractor and provision of a reasonable cure period, terminate or suspend this Agreement in accordance with Paragraph 20 (Termination/Suspension for Default).

13. INDEMNIFICATION

Contractor shall indemnify, defend, and hold harmless the County of Los Angeles, its Special Districts, Elected Officials, Appointed Officers, Agents, Employees, and Volunteers ("County Indemnities"), from and against any and all liability including, but not limited to, demands, claims, actions, fees, costs, and expenses of any nature whatsoever (including attorney and expert witness fees), arising from or connected with Contractor's acts and/or omissions arising from and/or relating to this Agreement except for loss or damage arising from the sole negligence or willful misconduct of the County indemnitees. This indemnification also shall include any and all intellectual property liability, including copyright infringement and similar claims.

Any legal defense pursuant to Contractor's indemnification obligations under this Paragraph 13 shall be conducted by Contractor and performed by counsel selected by Contractor and approved by the County. Notwithstanding the preceding sentence, County shall have the right to participate in any such defense at its sole cost and expense.

14. WORKPLACE SAFETY INDEMNIFICATION

In addition to and without limiting the indemnification required by section 13 (above), and to the extent allowed by law, contractor agrees to defend, indemnify, and hold harmless the County of Los Angeles, its special districts, elected officials, appointed officers, agents, employees, and volunteers from and against any and all investigations, complaints, citations, liability, expense (including defense costs and legal fees), claims, and/or causes of action for damages of any nature whatsoever including, but not limited to, injury or death to employees of contractor, its subcontractors or County, attributable to any alleged act or omission of contractor and/or its subcontractors, which is in violation of any Cal/OSHA regulation. the obligation to defend, indemnify, and hold harmless County includes all investigations and proceedings associated with purported violations of section 336.10 of title 8 of the California code of regulations pertaining to multiemployer worksites. Contractor shall not be obligated to indemnify for liability and expenses arising from the active negligence of County. County may deduct from any payment otherwise due Contractor any costs incurred or anticipated to be incurred by County, including legal fees and staff costs, associated with any investigation or enforcement proceeding brought by Cal/OSHA arising out of the work being performed by Contractor under this Agreement.

15. INSURANCE**15.1 GENERAL INSURANCE REQUIREMENTS**

Without limiting Contractor's indemnification of County, and in the performance of this Agreement and until all of its obligations pursuant to this Agreement have been met, Contractor shall provide and maintain at its own expense insurance coverage satisfying the requirements specified in this Paragraph 15. These minimum insurance coverage terms, types and limits ("Required Insurance") also are in addition to and separate from any other contractual obligation imposed upon Contractor pursuant to this Agreement. County in no way warrants that the Required Insurance is sufficient to protect Contractor for liabilities, which may arise from or relate to this Agreement.

15.2 EVIDENCE OF COVERAGE AND NOTICE

- 15.2.1 Certificate(s) of insurance coverage (Certificate) satisfactory to County, and a copy of an Additional Insured endorsement confirming County and its Agents (defined below) has been given Insured status under the Contractor's General Liability policy, shall be delivered to County at the address shown below and provided prior to commencing services under this Agreement.
- 15.2.2 Renewal Certificates shall be provided to County not less than 10 days after renewal of Contractor's policy. County reserves the right to obtain complete certified copies of relevant sections of any required Contractor and/or subcontractor insurance policies at any time.
- 15.2.3 Certificates shall identify all Required Insurance coverage types and limits specified herein, reference this Agreement by name or number, and be signed by an authorized representative of the insurer(s). The Insured party named on the Certificate shall match the name of Contractor identified as the contracting party in this Agreement. Certificates shall provide the full name of each insurer providing coverage, its National Association of Insurance Commissioners (NAIC) identification number, its financial rating, the amounts of any policy deductibles or self-insured retentions exceeding Fifty Thousand Dollars (\$50,000), and list any County required endorsement forms.
- 15.2.4 Neither County's failure to obtain, nor County's receipt of, or failure to object to a non-complying insurance certificate or endorsement, or any other insurance documentation or information provided by the Contractor, its insurance broker(s) and/or insurer(s), shall be construed as a waiver of any of the Required Insurance provisions.
- 15.2.5 Certificates and copies of any required endorsements shall be sent to County's Contract Analyst at the address specified in Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement).
- 15.2.6 Contractor also shall promptly report to County any injury or property damage accident or incident, including any injury to a Contractor employee occurring on County property, and any loss, disappearance, destruction, misuse, or theft of County property, monies or securities entrusted to Contractor. Such report shall be made in writing within 24 hours or the next Business Day. Contractor also shall promptly notify County of any third party

claim or suit filed against Contractor or any of its subcontractors which arises from or relates to this Agreement and could result in the filing of a claim or lawsuit against Contractor and/or County.

15.3 ADDITIONAL INSURED STATUS AND SCOPE OF COVERAGE

The County of Los Angeles, its Special Districts, Elected Officials, Officers, Agents, Employees and Volunteers (collectively County and its Agents) shall be provided additional insured status under Contractor's General Liability policy with respect to liability arising out of Contractor's ongoing and completed operations performed on behalf of the County. County and its Agents additional insured status shall apply with respect to liability and defense of suits arising out of Contractor's acts or omissions, whether such liability is attributable to Contractor or to County. The full policy limits and scope of protection also shall apply to County and its Agents as an additional insured, even if they exceed the County's minimum Required Insurance specifications herein. Use of an automatic additional insured endorsement form is acceptable providing it satisfies the Required Insurance provisions herein.

15.4 CANCELLATION OF OR CHANGES IN INSURANCE

Contractor shall provide County, or Contractor's insurance policies shall contain, a provision that County shall receive written notice of cancellation or any change in Required Insurance, including insurer, limits of coverage, term of coverage or policy period. The written notice shall be provided to County not less than 10 days in advance of cancellation for non-payment of premium and 30 days in advance of any other cancellation or policy change. Failure to provide written notice of cancellation or any change in Required Insurance may constitute a material breach of this Agreement, in the sole discretion of the County, upon which County may suspend or terminate this Agreement.

15.5 FAILURE TO MAINTAIN INSURANCE

Contractor's failure to maintain or to provide acceptable evidence that it maintains the Required Insurance shall constitute a material breach of the Agreement, upon which County immediately may withhold payments due to Contractor, and/or suspend or terminate this Agreement. County, at its sole discretion, may obtain damages from Contractor resulting from said breach. Alternatively, the County may purchase the Required Insurance, and without further notice to Contractor, deduct the premium cost from sums due to Contractor or pursue Contractor reimbursement.

15.6 INSURER FINANCIAL RATINGS

Coverage shall be placed with insurers acceptable to County with A.M. Best ratings of not less than A:VII unless otherwise approved by County.

15.7 CONTRACTOR 'S INSURANCE SHALL BE PRIMARY

Contractor's insurance policies, with respect to any claims related to this Agreement, shall be primary with respect to all sources of coverage available to Contractor. Any County maintained insurance or self-insurance coverage shall be in excess of and not contribute to any Contractor coverage.

15.8 WAIVERS OF SUBROGATION

To the fullest extent permitted by law, Contractor hereby waives its rights and its insurer(s)' rights of recovery against County under all the Required Insurance for any loss arising from or relating to this Agreement. Contractor shall require its insurers to execute any waiver of subrogation endorsements, which may be necessary to effect such waiver.

15.9 DEDUCTIBLES AND SELF-INSURED RETENTIONS (SIRS)

Contractor's policies shall not obligate County to pay any portion of any Contractor deductible or SIR. County retains the right to require Contractor to reduce or eliminate policy deductibles and SIRs as respects County or to provide a bond guaranteeing Contractor's payment of all deductibles and SIRs, including all related claims investigation, administration and defense expenses. Such bond shall be executed by a corporate surety licensed to transact business in the State of California.

15.10 CLAIMS MADE COVERAGE

If any part of the Required Insurance is written on a claims made basis, any policy retroactive date shall precede the effective date of this Agreement. Contractor understands and agrees it shall maintain such coverage for a period of not less than 3 years following Agreement expiration, termination or cancellation.

15.11 APPLICATION OF EXCESS LIABILITY COVERAGE

Contractor may use a combination of primary, and excess insurance policies, which provide coverage as broad as ("follow form" over) the underlying primary policies, to satisfy the Required Insurance provisions.

15.12 SEPARATION OF INSURED

All liability policies shall provide cross-liability coverage as would be afforded by the standard ISO (Insurance Services Office, Inc.) separation of insureds provision with no insured versus insured exclusions or limitations

15.13 ALTERNATIVE RISK FINANCING PROGRAMS

County reserves the right to review, and then approve, Contractor use of self-insurance, risk retention groups, risk purchasing groups, pooling arrangements and captive insurance to satisfy the Required Insurance provisions. County and its Agents shall be designated as an Additional covered Party under any approved program.

15.14 COUNTY REVIEW AND APPROVAL OF INSURANCE REQUIREMENTS

County reserves the right to review and adjust the Required Insurance provisions, conditioned upon County's determination of changes in risk exposures.

15.15 COMPENSATION FOR COUNTY COSTS

In the event that the Contractor fails to comply with any of the indemnification or insurance requirements of this Contract, and such failure to comply results in any costs to the County, the Contractor shall pay full compensation for all costs incurred by the County.

15.16 INSURANCE COVERAGE REQUIREMENTS

15.16.1 COMMERCIAL GENERAL LIABILITY INSURANCE

15.16.2 Providing scope of coverage equivalent to ISO policy form CG 00 01, naming County and its Agents as an additional insured, with limits of not less than:

General Aggregate	\$2 million
Products/Completed Operations Aggregate	\$1 million
Personal and Advertising Injury	\$1 million
Each Occurrence	\$1 million

15.16.3 AUTOMOBILE LIABILITY INSURANCE

Providing scope of coverage equivalent to ISO policy form CA 00 01 with limits of not less than \$1 million for bodily injury and property damage, in combined or equivalent split limits, for each single accident. Insurance shall cover liability arising out of Contractor's use of autos pursuant to this Agreement, including owned, leased, hired, and/or non-owned autos, as each may be applicable.

15.16.4 WORKERS' COMPENSATION AND EMPLOYERS' INSURANCE

Insurance or qualified self-insurance satisfying statutory requirements, which includes Employers' Liability coverage with limits of not less than \$1 million per accident. If Contractor will provide leased employees, or, is an employee leasing or temporary staffing firm or a professional employer organization (PEO), coverage also shall include an Alternate Employer Endorsement (providing scope of coverage equivalent to ISO policy form WC 00 03 01 A) naming County as the Alternate Employer, and the endorsement form shall be modified to provide that County will receive not less than 30 days advance written notice of cancellation of this coverage provision. If applicable to Contractor's operations, coverage also shall be arranged to satisfy the requirements of any federal workers or workmen's compensation law or any federal occupational disease law.

15.16.5 TECHNOLOGY ERRORS AND OMISSIONS

Insurance for liabilities arising from errors, omissions, or negligent acts in rendering or failing to render computer or information technology services and technology products. Coverage for violation of software copyright should be included. Technology services should at a minimum include (1) software programming; (2) systems programming; (3) data processing; (4) systems integration; (5) outsourcing including outsourcing development and design; (6) systems design, consulting, development and modification; (7) training services relating to computer software or hardware; (8) management, repair and maintenance of computer products, networks and systems; (9) marketing, selling, servicing, distributing, installing and maintaining computer hardware or software; (10) data entry, modification, verification, maintenance, storage, retrieval or preparation of data

output, and any other services provided by the vendor with limits of not less than \$10 million.

16. PROPRIETARY CONSIDERATIONS

16.1 COUNTY MATERIALS

Except as otherwise provided in Paragraph 10 (Ownership and License), Contractor and County agree that all materials, including, but not limited to, designs, specifications, techniques, plans, reports, deliverables, data, photographs, diagrams, maps, images, graphics, text, videos, advertising, website plans and designs, drafts, working papers, outlines, sketches, summaries, software code and modifications thereto, edited and/or unedited versions of deliverables, and any other materials or information developed under this Agreement and any and all intellectual property rights to these materials, including any copyrights, trademarks, service marks, trade secrets, trade names, unpatented inventions, patent applications, patents, design rights, domain rights, know-how, and any other proprietary rights and derivatives thereof (collectively, "Intellectual Property"), is and shall be the sole property of County (hereafter collectively, "County Materials"). Contractor hereby assigns and transfers to County all Contractor's rights, titles, and interest in and to all such County Materials developed under this Agreement.

Notwithstanding such County ownership in the County Materials, Contractor may retain possession of working papers and materials prepared by Contractor under this Agreement. During and for a minimum of 5 years subsequent to the term of this Agreement, County shall have the right to inspect any and all such working papers and materials, make copies thereof and use the working papers and materials and the information contained therein.

16.2 TRANSFER TO COUNTY

Contractor shall execute all documents requested by County and shall perform all other reasonable acts requested by County to assign and transfer to, and vest in, County all Contractor's right, title and interest in and to the County Materials, including, but not limited to, all copyright, patent and trade secret rights. All material expense of effecting such assignment and transfer of rights shall be borne by County. Further, County shall have the right to assign, license or otherwise transfer any and all County's right, title, and interest, including, but not limited to, copyrights and patents, in and to the County Materials.

16.3 INDEMNITY

Contractor represents and warrants that the County Materials prepared herein under this Agreement, is the original work of Contractor and does not infringe upon any Intellectual Property or proprietary rights of third parties. For those portions of the County Materials that are not the original work of Contractor, Contractor represents and warrants that it has secured all appropriate licenses, rights, and/or permission from appropriate third parties to include such materials in the County Materials.

Contractor shall defend, indemnify and hold County harmless against any claims by third parties based on infringement of copyright, patent, trade secret, trademark, or any other

claimed Intellectual Property or proprietary right, arising from County's use of County Materials created and/or prepared by Contractor. Contractor will also indemnify and defend at its sole expense, any action brought against County based on a claim that County Materials furnished hereunder by Contractor and used within the scope of this Agreement infringe any copyright, patent, trade secret, trademark, or any other claimed intellectual property or proprietary right of third parties, and Contractor shall pay any costs, damages and attorney's fees incurred by County. County will notify Contractor promptly and in writing of any such action or claim and will permit Contractor to fully participate in the defense thereof.

16.4 CONTRACTOR'S OBLIGATIONS

Contractor shall protect the security of and keep confidential all County Materials and shall use whatever security measures are reasonably necessary to protect all such County Materials from loss or damage by any cause, including fire and theft.

Contractor shall affix the following notice to all County Materials: "© Copyright 2019 (or such other appropriate date of first publication), County of Los Angeles. All Rights Reserved." Contractor shall affix such notice on the title page of all images, photographs, documents and writings; and otherwise as County may direct.

16.5 PROPRIETARY AND CONFIDENTIAL

Any and all County Materials which are developed or were originally acquired by Contractor outside the scope of this Agreement, which Contractor desires to use hereunder, and which Contractor considers to be proprietary or confidential, must be specifically identified by Contractor to County's Project Director as proprietary or confidential, and shall be plainly and prominently marked by Contractor as "PROPRIETARY" or "CONFIDENTIAL", if applicable.

Notwithstanding any other provision of this Agreement, County shall not be obligated in any way under this Agreement for:

- (1) Any disclosure of any materials which County is required to make under the California Public Records Act or otherwise by law; or
- (2) Any Contractor's proprietary and/or confidential materials not plainly and prominently marked with restrictive legends.

16.6 ACKNOWLEDGMENT/ATTRIBUTION

County shall also have the sole right to control the preparation, modification and revisions to, all acknowledgment and/or attribution language for all County Materials resulting from this Agreement. County will however, exercise reasonable efforts to honor requests by Contractor seeking removal of all acknowledgment and/or attribution language relating to the Contractor, should Contractor no longer wish to receive attribution for its work on the County Materials.

17. DISCLOSURE OF INFORMATION

17.1 DISCLOSURE OF AGREEMENT

Contractor shall not disclose any terms or conditions of, or any circumstances or events that occur during the performance of this Agreement to any person or entity except as may be otherwise provided herein or required by law. In the event Contractor receives any court or administrative agency order, service of process, or request by any person or entity (other than Contractor's professionals) for disclosure of any such details, Contractor shall, to the extent allowed by law or such order, promptly notify County's Project Director. Thereafter, Contractor shall comply with such order, process or request only to the extent required by applicable law. Notwithstanding the preceding sentence, to the extent permitted by law, Contractor shall delay such compliance and cooperate with County to obtain relief from such obligations to disclose until County shall have been given a reasonable opportunity to obtain such relief.

However, in recognizing Contractor's need to identify its services and related clients in order to sustain itself, County shall not inhibit Contractor from publicizing its role under this Agreement under the following conditions:

- (1) Contractor shall develop all publicity material in a professional manner.
- (2) During the term of this Agreement, Contractor shall not, and shall not authorize another to, publish or disseminate any commercial advertisements, press releases, feature articles, or other materials using the name of County without the prior written consent of County's Project Director for each such item.

Contractor may, without the prior written consent of County, indicate in its proposals and sales materials that it has been awarded this Agreement with the County of Los Angeles, provided that the requirements of this Paragraph 17 shall apply.

17.2 REQUIRED DISCLOSURE

Notwithstanding any other provision of this Agreement, either party may disclose information about the other that: (i) is lawfully in the public domain at the time of disclosure; (ii) is disclosed with the prior written approval of the party to which such information pertains; or (iii) is required by law to be disclosed.

18. CONFIDENTIALITY AND SECURITY

18.1 CONFIDENTIALITY

18.1.1 CONFIDENTIAL INFORMATION

Each party shall protect, secure and keep confidential all records, materials, documents, data and/or other information, including, but not limited to, billing, sensitive financial or security related information, County records, data and information, County Materials, Data, Work Product, Software, health information and any other data, records and information, received, obtained and/or produced under the provisions of this Agreement (hereinafter also "Confidential Information"), in accordance with the terms of this Agreement and all applicable Federal, State or local laws, regulations, ordinances, and publicly known

guidelines and directives relating to confidentiality. As used in this Agreement, the term "Confidential Information" shall also include records, materials, data and information deemed confidential by County or the applicable law under Paragraph 3.6 (Rules and Regulations). Each party shall use whatever appropriate security measures are necessary to protect such Confidential Information from loss, damage and/or unauthorized dissemination by any cause, including but not limited to fire and theft.

Contractor shall inform all of its officers, employees, agents and subcontractors providing Work hereunder of the confidentiality provisions of this Agreement. Contractor shall ensure that all of its officers, employees, agents and subcontractors performing Work hereunder have entered into confidentiality agreements no less protective of County than the terms of this Agreement, including this Paragraph 18 and Exhibit G (Confidentiality and Assignment Agreement).

18.1.2 DISCLOSURE

With respect to any of County's Confidential Information or any other records, materials, data or information that is obtained by Contractor (hereinafter collectively for the purpose of this Paragraph 18.1.2 "information"), Contractor shall: (i) not use any such information for any purpose whatsoever other than carrying out the express terms of this Agreement; (ii) promptly transmit to County all requests for disclosure of any such information; (iii) not disclose, except as otherwise specifically permitted by this Agreement, any such information to any person or organization other than County without County's prior written authorization that the information is releasable; and (iv) at the expiration or termination of this Agreement, return all such information to County or maintain such information according to the written procedures provided to Contractor by County for this purpose.

Under State law no information shall be in any way relayed to anyone except those employees of County so designated without written authorization from County.

18.1.3 INDEMNIFICATION

Notwithstanding any provision of this Agreement to the contrary, whether expressly or by implication, Contractor shall indemnify, defend and hold harmless County, its officers, employees, and agents, from and against any and all loss, damage, liability and expense, including, but not limited to, defense costs and reasonable legal, accounting and other expert, consulting or professional fees, arising from any disclosure of such records and information by Contractor, its officers, employees, or agents, except for any disclosure authorized by this Paragraph 18.

18.2 SECURITY

18.2.1 SOFTWARE SECURITY

Notwithstanding anything to the contrary herein, Contractor shall provide all Work utilizing security technologies and techniques in accordance with the industry standards, Contractor's best practices and applicable County security policies, procedures and requirements provided by County to Contractor in writing as part of this Agreement or otherwise as required by law, including those relating to the prevention and detection of

fraud or other inappropriate use or access of systems and networks. Without limiting the generality of the foregoing, Contractor shall implement and use applications and tools and fraud prevention and detection and encryption technologies and prevent the introduction of any disabling or intrusive device into the Software. In no event shall Contractor's actions or inaction result in any situation that is less secure than the security that Contractor then provides for its own systems and data.

18.2.2 DATA SECURITY

Contractor hereby acknowledges the right of privacy of all persons as to whom there exists any Software Data or any other County data. Contractor shall protect, secure and keep confidential all Software Data in compliance with all federal, state and local laws, rules, regulations, ordinances, and publicly known guidelines and directives, relating to confidentiality and information security (including any breach of the security of the Software, such as any unauthorized acquisition of Software Data that compromises the security, confidentiality or integrity of personal information), including California Civil Code Section 1798.82. Further, Contractor shall take all reasonable actions necessary or advisable to protect all Software Data in its possession, custody or control from loss or damage by any cause, including fire, theft or other catastrophe. In addition, if requested by County's Project Director, Contractor shall provide notification to all persons whose unencrypted personal information was, or is reasonably believed to have been, acquired by any unauthorized person, and the content, method and timing of such notification shall be subject to the prior approval of County's Project Director. Contractor shall not use Software Data for any purpose or reason other than to fulfill its obligations under this Agreement.

18.3 REMEDIES

Contractor acknowledges that a breach by Contractor of this Paragraph 18 may result in irreparable injury to County that may not be adequately compensated by monetary damages and that, in addition to County's other rights under this Paragraph 18 and at law and in equity, County shall have the right to seek injunctive relief to enforce the provisions of this Paragraph 18. The provisions of this Paragraph 18 shall survive the expiration of termination of this Agreement.

Contractor shall take all reasonable actions necessary or advisable to protect the Software from loss or damage by any cause. Contractor shall bear the full risk of loss or damage to the Software by any cause other than resulting from force majeure or County's sole fault.

18.4 INFORMATION TECHNOLOGY SECURITY REQUIREMENTS

Contractor must comply with all County and Public Works information security policies and standards where applicable. Where Contractor is providing managed, offsite infrastructure or processing services, Contractor's data center and network operations must be compliant with generally accepted best security practices and regulatory requirements where applicable (e.g., PCI, HIPAA, etc.). If requested by Public Works, Contractor shall provide evidence of certifications such as SAS70, SAE16, ISO 27000, PCI compliance,

etc., or submit to an assessment of Contractor's information security policies and controls by the Public Works Department Information Security Officer (hereinafter "DISO"). Any questions or need for clarification regarding Public Works security policies and/or regulations should be addressed to the DISO. County's Project Manager and Contractor must obtain sign-off from the DISO.

19. PROHIBITION AGAINST ASSIGNMENT AND DELEGATION

- 19.1 Contractor shall not assign its rights and/or delegate its duties under this Agreement, whether in whole or in part, without the prior written consent of County, and any attempted assignment and/or delegation without such consent shall be null and void. County may exercise or withhold consent in its sole discretion. No assignment and/or delegation shall be effective unless and until there is a duly-executed, written amendment to this Agreement. For purposes of this paragraph, County consent shall require a written amendment to this Agreement, which is formally approved and executed by Contractor and the Board or if delegated by the Board, the Director and Contractor. Any payments by County to any approved delegate or assignee on any claim under this Agreement shall be deductible, at County's sole discretion, against the claims, which the Contractor may have against County.
- 19.2 Shareholders, partners, members, or other equity holders of Contractor may transfer, sell, exchange, assign, or divest themselves of any interest they may have therein. However, in the event any such sale, transfer, exchange, assignment, or divestment is effected in such a way as to give majority control of Contractor to any person(s), corporation, partnership, or legal entity other than the majority controlling interest therein at the time of execution of the Agreement, such disposition is an assignment requiring the prior consent of County in accordance with the applicable provisions of this Agreement.
- 19.3 Any assumption, assignment, delegation, or takeover of any of Contractor's duties, responsibilities, obligations, or performance of same by any entity other than Contractor, whether through assignment, subcontract, delegation, merger, buyout, or any other mechanism, with or without consideration for any reason whatsoever without County's express written approval shall be a material breach of the Agreement, which may result in the termination of this Agreement. In the event of such termination, County shall be entitled to pursue the same remedies against Contractor as it could pursue in the event of default by Contractor.

20. TERMINATION/SUSPENSION FOR DEFAULT

- 20.1 County may, by written notice to Contractor, terminate or suspend the whole or any part of this Agreement if:
- (1) Contractor fails to timely provide and/or satisfactorily perform any task, subtask, deliverable, service or other Work within the times specified in this Agreement, including the finalized Task Schedule; or
 - (2) Contractor fails to demonstrate a high probability of timely fulfillment of the performance requirements under this Agreement; or

- (3) Contractor fails to make progress as to endanger performance of this Agreement in accordance with its terms; or
- (4) Contractor in performance of Work under the Agreement fails to comply with the requirements of this Agreement, including but not limited to Exhibit A (Statement of Work); or
- (5) Contractor fails to perform or comply with any other provisions of this Agreement or materially breaches this Agreement;

and, unless a shorter cure period is expressly provided in this Agreement, does not cure such failure or fails to correct such failure or breach within 30 days (or such longer period as County may authorize in writing) of receipt of written notice from County specifying such failure or breach, except that Contractor shall not be entitled to any cure period, and County may terminate immediately, in the event that Contractor's failure to perform or comply is not reasonably capable of being cured.

20.2 If, after County has given notice of suspension or termination under the provisions of this Paragraph 20, it is determined by County that Contractor was not in default, or that the default was excusable, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to Paragraph 21 (Termination/Suspension for Convenience).

20.3 The rights and remedies of County provided in this Paragraph 20 shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Agreement.

21. TERMINATION/SUSPENSION FOR CONVENIENCE

21.1 This Agreement may be suspended or terminated, in whole or in part, permanently or from time to time, when such action is deemed by County to be in its best interest. Suspension or Termination of Work hereunder shall be effected by notice of suspension or termination to Contractor specifying the extent to which performance of work is suspended or terminated and the date upon which such suspension or termination becomes effective, which shall be no less than 60 calendar days after the notice is sent. In the event County has purported to suspend or terminate this Agreement for default by notice pursuant to Paragraph 20 (Termination/Suspension for Default) and it has later been determined that Contractor was not in default, no additional notice shall be required upon such determination.

21.2 After receipt of a notice of suspension or termination, Contractor shall:

- (1) Stop work under this Agreement on the date and to the extent specified in such notice.
- (2) Complete performance of such part of the work as shall not have been suspended or terminated by such notice.
- (3) Submit to County, in the form and with any certifications as may be prescribed by

County, Contractor's suspension or termination claim and invoice. Such claim and invoice shall be submitted promptly in accordance with Paragraph 24.

21.3 All material including books, records, documents, or other evidence bearing on the costs and expenses of Contractor under this Agreement shall be maintained by Contractor in accordance with Paragraph 30 (Records and Audits).

21.4 If this Agreement is suspended or terminated, Contractor shall complete within the Director's suspension or termination date contain within the notice of suspension or termination, those items of work which are in various stages of completion, which the Director has advised the Contractor are necessary to bring the work to a timely, logical, and orderly end. Reports, samples, and other materials prepared by Contractor under this Agreement shall be delivered to County upon request and shall become the property of County.

22. TERMINATION/SUSPENSION FOR IMPROPER CONSIDERATION

22.1 County may, by written notice to Contractor, immediately suspend or terminate the right of Contractor to proceed under this Agreement if it is found that consideration, in any form, was offered or given by Contractor, either directly or through an intermediary, to any County officer, employee or agent with the intent of securing this Agreement or securing favorable treatment with respect to the award, Amendment or extension of the Agreement or the making of any determinations with respect to Contractor's performance pursuant to this Agreement. In the event of such suspension or termination, County shall be entitled to pursue the same remedies against Contractor as it could pursue in the event of default by Contractor.

22.2 Contractor shall immediately report any attempt by a County officer or employee to solicit such improper consideration. The report shall be made either to County manager charged with the supervision of the employee or to County's Auditor-Controller Employee Fraud Hotline at (800) 544 6861.

22.3 Among other items, such improper consideration may take the form of cash, discounts, services, the provision of travel or entertainment, or tangible gifts.

23. TERMINATION/SUSPENSION FOR INSOLVENCY

23.1 County may suspend or terminate this Agreement immediately at any time upon the occurrence of any of the following:

- a. Insolvency of Contractor. Contractor shall be deemed to be insolvent if it has ceased to pay its debts for at least 60 days in the ordinary course of business or cannot pay its debts as they become due, whether or not a petition has been filed under the Federal Bankruptcy Code, and whether

or not Contractor is insolvent within the meaning of the Federal Bankruptcy Code.

- b. The filing of a voluntary or involuntary bankruptcy petition relative to Contractor under the Federal Bankruptcy Code.
- c. The appointment of a bankruptcy Receiver or Trustee for Contractor.
- d. The execution by Contractor of a general assignment for the benefits of creditors.

23.2 The rights and remedies of County provided in this Paragraph 23 shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Agreement.

23.3 Contractor agrees that if Contractor as a debtor-in-possession, or if a trustee in bankruptcy, rejects this Agreement, County may elect to retain its rights under this Agreement, as provided under Section 365(n) of the United States Bankruptcy Code (11 United States Code, Section 365(n)). Upon written request of County to Contractor or the trustee in bankruptcy, as applicable, Contractor or such trustee shall allow County to exercise all of its rights and benefits under this Agreement including, without limitation, such Section 365(n) (including, without limitation, the right to continued use of all source and object code versions of the Software and related Documentation, and shall not interfere with the rights and benefits of County as provided therein. The foregoing shall survive the termination or expiration of this Agreement for any reason whatsoever.

24. **TERMINATION/SUSPENSION FOR NON-ADHERENCE TO COUNTY LOBBYISTS ORDINANCE**

Contractor, and each County lobbyist or County lobbying firm as defined in Los Angeles County Code Section 2.160.010, retained by Contractor, shall fully comply with County's Lobbyist Ordinance, Los Angeles County Code Chapter 2.160. Failure on the part of Contractor or any County Lobbyists or County Lobbying firm retained by Contractor to fully comply with County's Lobbyist Ordinance shall constitute a material breach of this Agreement, upon which County may in its sole discretion, immediately suspend or terminate for default of this Contract.

25. **EFFECT OF TERMINATION/SUSPENSION**

In the event that County, upon notice to Contractor, suspends or terminates this Agreement in whole or in part as provided herein, then:

- (1) Contractor and County shall continue the performance of this Agreement to the extent not suspended or terminated;
- (2) Contractor shall stop work under this Agreement on the date and to the extent specified in such notice and provide to County all completed Work and Work in

progress, in a media reasonably requested by County;

- (3) Contractor shall promptly return to County any and all County's Confidential Information, including County data and County Materials, that relate to that portion of the Agreement and Work terminated by County;
- (4) County shall pay Contractor all monies due in accordance with the terms of the Agreement for the Work completed up to the time of termination;
- (5) Contractor shall return to County all monies paid by County, yet unearned by Contractor, including any prorated prepaid Service Fees calculated depending on the date of termination, if applicable. Notwithstanding the foregoing, upon termination by County for default during System implementation, Contractor shall return all Implementation Cost amounts paid by County to Contractor during such System implementation, and County will return to Contractor all products of the terminated Services;
- (6) Upon termination by County for default pursuant to Paragraph 20 (Termination/Suspension for Default) or for insolvency pursuant to Paragraph 23 (Termination/Suspension for Insolvency), County shall have the right to procure, upon such terms and in such a manner as County may deem appropriate, services and other Work, similar to those so terminated, and Contractor shall be liable to County for, and shall promptly pay to County by cash payment, any and all excess costs incurred by County, as determined by County, to procure and furnish such similar services and other Work.

26. INDEPENDENT CONTRACTOR STATUS

- 26.1 This Agreement is by and between County and Contractor and is not intended and shall not be construed to create the relationship of agent, servant, employee, partnership, joint venture, or association as between County and Contractor. The employees and agents of one party shall not be, or be construed to be, the employees or agents of the other party for any purpose whatsoever.
- 26.2 Contractor shall be solely liable and responsible for providing to, or on behalf of, all persons performing work pursuant to this Agreement all compensation and benefits. County shall have no liability or responsibility for the payment of any salaries, wages, unemployment benefits, disability benefits, Federal, State, or local taxes, or other compensation, benefits, or taxes for any personnel provided by or on behalf of Contractor.
- 26.3 Contractor understands and agrees that all persons performing work pursuant to this Agreement are, for purposes of Workers' Compensation liability, solely employees of Contractor and not employees of County. Contractor shall be solely liable and responsible for furnishing any and all Workers' Compensation benefits to any person as a result of any injuries arising from or connected with any work performed by or on behalf of Contractor pursuant to this Contract.
- 26.4 Contractor shall cause each employee performing services covered by this Agreement to sign and adhere to the "Contractor Employee Acknowledgement, Confidentiality, and

Copyright Assignment Agreement." Contractor shall cause each nonemployee performing services covered by this Agreement to sign and adhere to the "Contractor Nonemployee Acknowledgment, Confidentiality, and Copyright Assignment Agreement."

27. SUBCONTRACTING

27.1 County has relied, in entering into this Agreement, on the reputation of and on obtaining the personal performance of Contractor, specifically, Contractor Key Staff. Consequently, no performance by the Contractor Key Staff of this Agreement, or any portion thereof, shall be subcontracted by Contractor without notice to County as provided in this Paragraph 27. Any attempt by Contractor to subcontract any performance of this Agreement by the Contractor Key Staff without such notice shall be null and void and shall be deemed a material breach of this Agreement, upon which County may immediately suspend or terminate this Agreement.

27.2 In the event Contractor subcontracts any portion of its performance of the Agreement by the Contractor Key Staff, Contractor shall provide to County, in writing, a notice regarding such subcontract, which shall include:

- (1) The reasons for the particular subcontract;
- (2) Identification of the proposed subcontractor and an explanation of why and how the proposed subcontractor was selected;
- (3) A detailed description of the Work to be provided by the proposed subcontractor;
- (4) Confidentiality provisions applicable to the proposed subcontractor's officers, employees and agents, which would be incorporated into the subcontract;
- (5) include (i) Exhibit G (Confidentiality and Assignment Agreement), (ii) Exhibit D (Contractor's EEO Certification), (iii) Exhibit I (Safely Surrendered Baby Law), and (iii) any other standard County required provisions.
- (6) A representation from Contractor that:
 - a. the proposed subcontractor is qualified to provide the Work for which subcontractor is being hired;
 - b. either the proposed subcontractor maintains the insurance required by this Agreement or Contractor has procured and maintains such insurance coverage for the proposed subcontractor;
 - c. either the proposed subcontractor or Contractor shall be solely liable and responsible for any and all of subcontractor's taxes, payments and compensation, including compensation to its employees, related to the performance of Work under this Agreement; and
 - d. either the proposed subcontractor or Contractor shall provide for indemnification of County under the same terms and conditions as the indemnification provisions of this Agreement, including those specified in Paragraphs 13 (Indemnification); and

- (7) Other pertinent information and/or certifications reasonably requested by County.
- 27.3 County will review Contractor's request to subcontract and determine on a case-by-case basis whether or not to consent to such request, which consent shall not be unreasonably withheld.
- 27.4 Notwithstanding any provision of this Agreement to the contrary, whether expressly or by implication, Contractor shall indemnify, defend and hold harmless County, its officers, employees and agents, from and against any and all claims, demands, liabilities, damages, costs and expenses, including, but not limited to, defense costs and legal, accounting or other expert consulting or professional fees in any way arising from or related to Contractor's use of any subcontractor, including, without limitation, any officers, employees or agents of any subcontractor, in the same manner as required for Contractor, its officers, employees and agents, under this Agreement.
- 27.5 Notwithstanding any other provision of this Paragraph 27, Contractor shall remain fully responsible for any and all performance required of it under this Agreement, including those which Contractor has determined to subcontract, including, but not limited to, the obligation to properly supervise, coordinate and provide all Work required under this Agreement. All subcontracts shall be made in the name of Contractor and shall not bind nor purport to bind County. Furthermore, subcontracting of any Work under this Agreement shall not be construed to limit, in any way, Contractor's performance, obligations or responsibilities to County or limit, in any way, any of County's rights or remedies contained in this Agreement.
- 27.6 Subcontracting of any Work performed by the Contractor Key Staff under the Agreement shall not waive County's right to prior and continuing approval of any or all such Contractor Key Staff pursuant to the provisions of Paragraph 3.3 (Approval of Contractor's Staff), including any subcontracted members of the Contractor Key Staff. Contractor shall notify its subcontractors of this County's right prior to subcontractors commencing performance under this Agreement.
- 27.7 Notwithstanding subcontracting by Contractor of any Work under this Agreement, Contractor shall be solely liable and responsible for any and all payments and other compensation to all subcontractors, and their officers, employees, agents, and successors in interest, for any services performed by subcontractors under this Agreement.
- 27.8 In the event that County consents to any subcontracting, such consent shall apply to each particular subcontract only and shall not be, or be construed to be, a waiver of this Paragraph 27 or a blanket consent to any further subcontracting.
- 27.9 Employee Leasing is prohibited.

28. **RISK OF LOSS**

Contractor shall bear the full risk of loss due to total or partial destruction of any Software products loaded on CDs or other computer media, until such items are delivered to and accepted in writing by County as evidenced by County's signature on delivery documents.

29. MOST FAVORED PUBLIC ENTITY

If Contractor's prices decline, or should Contractor, at any time during the term of this Agreement, provide similar software, service levels, software models, components, or services under similar delivery conditions to the State of California or any county, municipality, or district of the State or to any other state, county or municipality at prices below those set forth in this Agreement, then such lower prices shall be immediately extended to County. County shall have the right, at County's expense, to utilize a County auditor or an independent auditor to verify Contractor's compliance with this Paragraph 29 by review of Contractor's books and records.

30. RECORDS AND AUDITS

- 30.1 Contractor shall maintain accurate and complete financial records of its activities and operations relating to this Agreement in accordance with generally accepted accounting principles. Contractor agrees that County, or its authorized representatives, shall have access to and the right to examine, audit, excerpt, copy, or transcribe any pertinent transaction, activity, or records relating to this Agreement to the extent required by law. All such material shall be kept and maintained by Contractor during the term of this Agreement and for a period of 5 years thereafter, unless County's written permission is given to dispose of any such material prior to such time. All such material shall be maintained by Contractor at a location in Los Angeles County, provided that if any such material is located outside Los Angeles County, Contractor shall make the necessary arrangements at its own cost and expense to have such material made available to the County within the County's borders.
- 30.2 In the event that an audit is conducted of Contractor specifically regarding this Agreement by any Federal or State auditor, then Contractor shall file a copy of such audit report with County's Auditor-Controller within 30 days of Contractor's receipt thereof, unless otherwise provided by applicable Federal or State law or under this Agreement. County shall make a reasonable effort to maintain the confidentiality of such audit report(s).
- 30.3 Failure on the part of Contractor to comply with any of the provisions of this Paragraph 30 shall constitute a breach of this Agreement upon which County may terminate or suspend this Agreement under the terms of Paragraph 20 (Termination/Suspension for Default).

31. COUNTY'S QUALITY ASSURANCE PLAN

County, or its agent, will evaluate Contractor's performance under this Agreement on not less than an annual basis. Such evaluation will include assessing Contractor's compliance with the terms and conditions of this Agreement. Contractor deficiencies, which County determines are severe or continuing and that may place performance of this Agreement in jeopardy, if not corrected, will be reported to the County's Board of Supervisors. The report will include improvements and/or corrective action measures taken by County and Contractor. If improvement does not occur consistent with the corrective action measures within 30 days of County's notice of Contractor deficiencies, County may, at its sole option, terminate this Agreement, in whole or in part, pursuant to Paragraph 20

(Termination/Suspension for Default) or Paragraph 21 (Termination/Suspension for Convenience), or impose other penalties as specified in this Agreement.

The County maintains databases that track/monitor contractor performance history. Information entered into such databases may be used for a variety of purposes, including determining whether the County will exercise a contract term extension option.

32. CONFLICT OF INTEREST

32.1 No County employee whose position with County enables such employee to influence the award of this Agreement or any competing agreements shall be employed in any capacity by Contractor or have any other direct financial interest in this Agreement. No officer or employee of Contractor, who may financially benefit from the performance of work hereunder, shall in any way participate in County's approval or ongoing evaluation of such work, or in any way attempt to unlawfully influence County's approval or ongoing evaluation of such work.

32.2 Contractor represents and warrants that it is aware of, and its authorized officers have read, the provisions of Los Angeles County Code, Section 2.180.010, "Certain Contracts Prohibited," and that execution of this Agreement will not violate those provisions. Contractor shall comply with all conflict of interest laws, ordinances and regulations now in effect or hereafter to be enacted during the term of this Agreement which are applicable to it as a software and services provider. Contractor warrants that it is not now aware of any facts which do create an unlawful conflict of interest for Contractor. If a party, hereafter becomes aware of any facts, which might reasonably be expected to create an unlawful conflict of interest for it, it shall immediately make full written disclosure of such facts to County. Full written disclosure shall include, but is not limited to, identification of all persons implicated and a complete description of all relevant circumstances. Failure to comply with the provisions of this paragraph shall be a material breach of this Agreement subjecting Contractor to either contract termination for default or debarment proceedings or both.

33. COMPLIANCE WITH APPLICABLE LAWS

33.1 In the performance of this Agreement, Contractor shall comply with all applicable Federal, State, and local laws, rules, regulations, ordinances, directives, guidelines, policies, and procedures, and all provisions required thereby to be included in this Agreement are hereby incorporated herein by reference.

33.2 Contractor shall indemnify, defend and hold harmless County, its elected and appointed officers, employees, and agents, from and against any and all claims, demands, damages, liabilities, losses, costs, and expenses, including, without limitation, defense costs and legal, accounting and other expert, consulting or professional fees, arising from, connected with, or related to any failure by Contractor, its officers, employees, agents or subcontractors, to comply with any such laws, rules, regulations, ordinances, directives, guidelines, policies, or procedures, as determined by County in its sole judgment. Any legal defense pursuant to Contractor's indemnification obligations under this Paragraph 33 shall be conducted by Contractor and performed by counsel selected by Contractor

and approved by County. Notwithstanding the preceding sentence, County shall have the right to participate in any such defense at its sole cost and expense, except that in the event Contractor fails to provide County with full and adequate defense, as determined by County in its sole judgment, County shall be entitled to retain its own counsel, including without limitation, County Counsel, and reimbursement from Contractor for all such costs and expenses incurred by County in doing so. Contractor shall not have the right to enter into any settlement, agree to any injunction or other equitable relief, or make any admission, in each case, on behalf of County without County's prior written approval.

- 33.3 Failure by Contractor to comply with such laws and regulations shall be material breach of this Agreement and may result in suspension or termination of this Agreement.

34. FAIR LABOR STANDARDS

Contractor shall comply with all applicable provisions of the Federal Fair Labor Standards Act and shall indemnify, defend, and hold harmless the County of Los Angeles, its Special Districts, Elected Officials, Officers, Agents, Employees, and Volunteers from any and all liability including, but not limited to, wages, overtime pay, liquidated damages, penalties, court costs, and attorneys' fees arising under any wage and hour law including, but not limited to, the Federal Fair Labor Standards Act, for work performed by Contractor's employees for which County may be found jointly or solely liable.

35. COMPLIANCE WITH CIVIL RIGHTS LAWS

- 35.1 Contractor herein certifies and agrees, and will re-certify upon County request no more frequently than once per year, that all persons employed by it, its affiliates, subsidiaries and holding companies will be treated equally during employment, without regard to race, color, religion, ancestry, national origin, sex, age, physical or mental disability, marital status or political affiliation, in compliance with all applicable Federal and State anti-discrimination laws and regulations. Such action shall include, but is not limited to: employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.
- 35.2 Contractor shall allow County representatives access to Contractor's employment records during regular business hours to verify compliance with the provisions of this Paragraph 35 when so requested by County. Contractor shall certify to, and comply with, the provisions of Exhibit F (Contractor's EEO Certification).
- 35.3 If County finds that any of the provisions of this Paragraph 35 have been violated, such violation shall, at the election of County, constitute a material breach of this Agreement upon which County may terminate or suspend this Agreement at County's option, either for material breach under Paragraph 20 (Termination/Suspension for Default) of this Agreement or for convenience under Paragraph 21 (Termination/Suspension for Convenience) of this Agreement. While County reserves the right to determine independently that the anti-discrimination provisions of this Agreement have been violated, in addition, a determination by the California Fair Employment Practices Commission or the Federal Equal Employment Opportunity Commission that Contractor has violated

State or Federal anti-discrimination laws or regulations shall constitute a finding by County that Contractor has violated the anti-discrimination provisions of this Agreement.

- 35.4 The parties agree that in the event Contractor is found to have violated the anti-discrimination provisions of this Agreement, and that such discrimination was directly associated with the performance of services provided under this Agreement, County may require, pursuant to Los Angeles County Code Section 4.32.010 (E), that Contractor pay the sum of Five hundred Dollars (\$500) for each such violation, in lieu of termination or suspension hereof, as liquidated damages are extremely difficult to ascertain or calculate precisely. In the alternative, County may elect to terminate this Agreement pursuant to Paragraph 20 (Termination/Suspension for Default).

36. RESTRICTIONS ON LOBBYING

36.1 FEDERAL FUNDS PROJECTS

If any Federal funds are to be used to pay for any portion of Contractor's work under this Agreement, County shall notify Contractor in writing in advance of such payment and Contractor shall fully comply with all certification and disclosure requirements prescribed by Section 319 of Public law 101-121 (31 United States Code Section 1352) and any implementing regulations, and shall ensure that each of its subcontractors receiving funds provided under this Agreement also fully complies with all applicable certification and disclosure requirements.

36.2 LOBBYIST ORDINANCE

Contractor, and each County lobbyist or County lobbying firm, as defined in Los Angeles County Code Section 2.160.010, retained by Contractor, shall fully comply with County's Lobbyist Ordinance, Los Angeles County Code Chapter 2.160. Failure on the part of Contractor or any County lobbyist or County lobbying firm retained by Contractor to fully comply with County Lobbyist Ordinance shall constitute a material breach of this Agreement, upon which County may immediately terminate or suspend this Agreement at County's option, either for material breach under Paragraph 21 (Termination/Suspension for Default) of this Agreement or for convenience under Paragraph 21 (Termination/Suspension for Convenience) of this Agreement.

37. EMPLOYMENT ELIGIBILITY VERIFICATION

- 37.1 Contractor warrants that it fully complies with all Federal and State statutes and regulations regarding employment of aliens and others and that all its employees performing Services under this Agreement meet the citizenship or alien status requirements contained in Federal and State statutes and regulations including, but not limited to, the Immigration Reform and Control Act of 1986 (P.L. 99-603), or as they currently exist and as they may be hereafter amended. Contractor shall retain all such documentation for all covered employees for the period prescribed by law.
- 37.2 Contractor shall obtain from all employees performing under this Agreement all verification and other documentation of employment eligibility status required by Federal statutes and

regulations as they currently exist and as they may be hereafter amended. Contractor shall retain such documentation for the period prescribed by law.

- 37.3 Contractor shall indemnify, defend, and hold harmless County, its officers, employees, and agents from and against any and all claims, demands, damages, liabilities, losses, costs, and expenses, including, but not limited to, defense costs and legal, accounting and other expert, consulting or professional fees, arising out of or in connection with any employer sanctions and any other liability which may be assessed against Contractor or County in connection with any alleged violation of any Federal or State statutes or regulations pertaining to the eligibility for employment of any persons performing work under this Agreement.

38. **CONTRACT HIRING**

38.1 **CONSIDERATION OF HIRING COUNTY EMPLOYEES TARGETED FOR LAYOFFS**

Should Contractor require additional or replacement personnel after the effective date of this Agreement to perform the work set forth herein, Contractor shall give first consideration for such employment openings to permanent County employees who are targeted for layoff or qualified former County employees who are on a re-employment list during the term of this Agreement.

38.2 **CONSIDERATION OF GAIN/GROW PROGRAM PARTICIPANTS FOR EMPLOYMENT**

Should Contractor require additional or replacement personnel after the Effective Date, Contractor shall give consideration for any such employment openings to participants in the County's Department of Public Social Services' Greater Avenues for Independence (GAIN) Program or General Relief Opportunity for Work (GROW) Program who meet Contractor's minimum qualifications for the open position. For this purpose, consideration shall mean that Contractor will interview qualified candidates. County will refer GAIN participants by job category to Contractor.

In the event that both laid-off County employees and GAIN/GROW participants are available for hiring, Contractor shall give County employees first priority.

38.3 **PROHIBITION AGAINST INDUCEMENT AND PERSUASION**

Contractor and County agree that, during the term of this Agreement and for a period of 1 year thereafter, neither party shall in any way intentionally induce or persuade any employee of one party to become an employee or agent of the other party. Notwithstanding the foregoing, such prohibition shall not apply to any hiring action initiated through a public announcement.

39. **FEDERAL EARNED INCOME CREDIT**

If required by applicable law, Contractor shall notify its employees, and shall require each subcontractor to notify its employees, that they may be eligible for the Federal Earned Income Credit under the Federal income tax laws. Such notice shall be provided, in accordance with the requirements set forth in Internal Revenue Service Notice 1015.

40. CONTRACTOR RESPONSIBILITY AND DEBARMENT

40.1 RESPONSIBLE CONTRACTOR

A responsible contractor is a contractor who has demonstrated the attribute of trustworthiness, as well as quality, fitness, capacity and experience to satisfactorily perform the Agreement. It is County's policy to conduct business only with responsible contractors.

40.2 CHAPTER 2.202

Contractor is hereby notified that, in accordance with Chapter 2.202 of the Los Angeles Code, if County acquires information concerning the performance of Contractor on this Agreement or other contracts which indicates that Contractor is not responsible, County may, in addition to other remedies provided in this Agreement, debar Contractor from bidding or proposing on, or being awarded, and/or performing work on, County agreements for a specified period of time, which generally will not exceed 5 years, although may exceed 5 years or be permanent if warranted by the circumstances, and terminate any or all existing agreements Contractor may have with County.

40.3 NON-RESPONSIBLE CONTRACTOR

County may debar Contractor if County's Board of Supervisors finds, in its discretion, that Contractor has done any of the following: (i) violated any term of a contract with County or a nonprofit corporation created by County; (ii) committed any act or omission, which negatively reflects on Contractor's quality, fitness or capacity to perform a contract with County, any other public entity or a nonprofit corporation created by County, or engaged in a pattern or practice which negatively reflects on same; (iii) committed an act or offense, which indicates a lack of business integrity or business honesty; or (iv) made or submitted a false claim against County or any other public entity.

40.4 CONTRACTOR HEARING BOARD

40.4.1 If there is evidence that Contractor may be subject to debarment, County's Project Director, or his/her designee, will notify Contractor in writing of the evidence, which is the basis for the proposed debarment and will advise Contractor of the scheduled date for a debarment hearing before County's Contractor Hearing Board.

40.4.2 The Contractor Hearing Board will conduct a hearing where evidence on the proposed debarment is presented. Contractor and/or Contractor's representative shall be given an opportunity to submit evidence at that hearing. After the hearing, the Contractor Hearing Board will prepare a tentative proposed decision, which shall contain a recommendation regarding whether Contractor should be debarred, and, if so, the appropriate length of time of the debarment. Contractor, County's Project Director, or his/her designee, and County's departments shall be provided with an opportunity to object to the tentative proposed decision prior to its presentation to County's Board of Supervisors.

40.4.3 After consideration of any objections, or if no objections are submitted, a record of the hearing, the proposed decision and any other recommendation of the Contractor Hearing Board shall be presented to County's Board of Supervisors. The Board of Supervisors

shall have the right to modify, deny or adopt the proposed decision and recommendation of the Contractor Hearing Board.

- 40.4.4 If Contractor has been debarred for a period longer than 5 years, then Contractor may, after the debarment has been in effect for at least 5 years, submit a written request for review of the debarment determination to reduce the period of debarment or terminate the debarment. County may, in its discretion, reduce the period of debarment or terminate the debarment if it finds that such Contractor has adequately demonstrated one or more of the following: (i) elimination of the grounds for which the debarment was imposed; (ii) a bona fide change in ownership or management; (iii) material evidence discovered after debarment was imposed; or (iv) any other reason that is in the best interests of County.
- 40.4.5 The Contractor Hearing Board will consider a request for review of a debarment determination only where (i) the requesting contractor has been debarred for a period longer than 5 years, (ii) the debarment has been in effect for at least 5 years and (iii) the request is in writing, states one or more of the grounds for reduction of the debarment period or termination of the debarment, and includes supporting documentation. Upon receiving an appropriate request, the Contractor Hearing Board will provide notice of the hearing on the request. At the hearing, the Contractor Hearing Board shall conduct a hearing where evidence on the proposed reduction of debarment period or termination of debarment is presented. This hearing shall be conducted and the request for review decided by the Contractor Hearing Board pursuant to the same procedures as for a debarment hearing.
- 40.4.6 The Contractor Hearing Board's proposed decision shall contain a recommendation on the request to reduce the period of debarment or terminate the debarment. The Contractor Hearing Board shall present its proposed decision and recommendation to County's Board of Supervisors. County's Board of Supervisors shall have the right to modify, deny, or adopt the proposed decision and recommendation of the Contractor Hearing Board.

40.5 **SUBCONTRACTORS OF CONTRACTOR**

The terms and procedures of this Paragraph 40 shall also apply to subcontractors, consultants and partners of Contractor performing work under this Agreement.

40.6 **PROHIBITION OF CONTRACT WITH SUSPENDED, DEBARRED, INELIGIBLE OR EXCLUDED CONTRACTOR BY FEDERAL OR STATE GOVERNMENT**

Contractor hereby acknowledges that County is prohibited from contracting with parties that are suspended, debarred, ineligible or excluded from securing State-funded or Federally-funded contracts. By executing this Contract, Contractor certifies that neither it nor any of its owners, officers, partners, directors, or other principals is currently suspended, debarred, ineligible or excluded from securing State-funded or Federally-funded Contracts. Further by executing this Contract, Contractor certifies that, to its knowledge, none of its subcontractors, at any tier, or any owner, officer, partner, director, or other principal of any subcontractor is currently suspended, debarred, ineligible or excluded from securing State-funded or Federally-funded contracts. During the term of this Contract, Contractor shall immediately notify County's Compliance Manager in writing

should it or any of its subcontractors or any principals of either be suspended, debarred, ineligible or excluded from securing State-funded or Federally-funded contracts. Failure of Contractor to comply with this provision shall constitute a material breach of this Agreement upon which County may immediately terminate or suspend this Agreement.

41. FEDERAL ACCESS TO RECORDS

If, and to the extent that Section 1861(v)(1)(I) of the Social Security Act (42 United States Code Section 1395x(v)(1)(i) is applicable, Contractor agrees that for a period of 4 years following the furnishing of services under this Agreement, Contractor shall maintain and make available, upon written request, to the Secretary of the United States Department of Health and Human Services or the Comptroller General of the United States or to any of their authorized representatives, the contracts, books, documents and records of Contractor which are necessary to verify the nature and extent of the costs of services provided hereunder. Furthermore, if Contractor carries out any of the services described in 42 United States Code Section 1395 through any subcontract with a value or cost of Ten Thousand Dollars (\$10,000) or more over a 12 month period with a related organization (as that term is defined under Federal law), Contractor agrees that each such subcontract shall provide for such access to the subcontract, books, documents and records of the subcontractor.

42. REQUIRED CERTIFICATIONS

Contractor shall obtain and maintain in effect during the term of this Agreement all licenses, permits, registrations, accreditations and certificates required by all Federal, State, and local laws, ordinances, rules, regulations, guidelines and directives, which are applicable to Contractor's provision of the Services under this Agreement. Contractor shall further ensure that all of its officers, employees, agents and subcontractors who perform Services hereunder, shall obtain and maintain in effect during the term of this Agreement all licenses, permits, registrations, accreditations and certificates, which are applicable to their performance hereunder. A copy of each such license, permit, registration, accreditation and certificate required by all applicable Federal, State, and local laws, ordinances, rules, regulations, guidelines and directives shall be provided, if required by law, in duplicate, to County's Project Manager at the address set forth in Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement).

43. NO THIRD-PARTY BENEFICIARIES

Notwithstanding any other provision of this Agreement, Contractor and County do not in any way intend that any person or entity shall acquire any rights as a third-party beneficiary of this Agreement, except that this provision shall not be construed to diminish Contractor's indemnification obligations hereunder.

44. CONTRACTOR PERFORMANCE DURING CIVIL UNREST AND DISASTER

Contractor recognizes that County provides services essential to the residents of the communities it serves, and that these services are of particular importance at the time of a riot, insurrection, civil unrest, natural disaster or similar event. Notwithstanding any other provision of this Agreement, full performance by Contractor during any riot, insurrection,

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civil unrest, natural disaster or similar event is not excused if such performance remains physically possible without related danger to Contractor's or subcontractors' employees and suppliers. During any such event in which the health or safety of any of Contractor's staff members would be endangered by performing their services on-site, such staff members may perform any or all of their services remotely.

45. WARRANTY AGAINST CONTINGENT FEES

45.1 Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon any agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by Contractor for the purpose of securing business.

45.2 For breach of this warranty, County shall have the right to terminate this Agreement and, at its sole discretion, deduct from the fees owed, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

46. SAFELY SURRENDERED BABY LAW

46.1 NOTICE

As required by applicable law, Contractor shall notify and provide to its employees, and shall require each subcontractor to notify and provide to its employees, a fact sheet regarding the Safely Surrender Baby Law, its implementation in Los Angeles County, and where and how to safely surrender a baby. The fact sheet is available on the Internet at <http://babysafela.org> for printing purposes.

46.2 ACKNOWLEDGMENT OF COMMITMENT

Contractor acknowledges that County places a high priority on the implementation of the Safely Surrendered Baby Law. Contractor understands that it is County's policy to encourage all County Contractors to voluntarily post County's "Safely Surrendered Baby Law" poster in a prominent position at Contractor's place of business. Contractor will also encourage its subcontractors, if any, to post this poster in a prominent position in the subcontractor's place of business. County's Department of Children and Family Services will supply Contractor with the poster to be used.

47. COMPLIANCE WITH COUNTY'S JURY SERVICE PROGRAM

47.1 JURY SERVICE PROGRAM

This Agreement is subject to the provisions of County's ordinance entitled Contractor Employee Jury Service Program (hereinafter "Jury Service Program" or "Program") as codified in Sections 2.203.010 through 2.203.090 of the Los Angeles County Code (hereinafter "County Code").

47.2 WRITTEN EMPLOYEE JURY SERVICE POLICY

47.2.1 Unless Contractor has demonstrated to County's satisfaction either that Contractor is not a "Contractor" as defined under the Jury Service Program (Section 2.203.020 of the

County Code) or that Contractor qualifies for an exception to the Jury Service Program (Section 2.203.070 of the County Code), Contractor shall have and adhere to a written policy that provides that its Employees (as defined in Paragraph 47.2.2 below) shall receive from Contractor, on an annual basis, no less than 5 days of regular pay for actual jury service. The policy may provide that Employees deposit any fees received for such jury service with Contractor or that Contractor deduct from the Employee's regular pay the fees received for jury service.

47.2.2 For purposes of this Paragraph 47, "Contractor" means a person, partnership, corporation or other entity which has an agreement with County or a subcontract with Contractor and has received or will receive an aggregate sum of Fifty Thousand Dollars (\$50,000) or more in any 12 month period under one or more County agreements or subcontracts. "Employee" means any California resident who is a full-time employee of Contractor. "Full time" means 40 hours or more worked per week, or a lesser number of hours if: (1) the lesser number is a recognized industry standard as determined by County, or (2) Contractor has a longstanding practice that defines the lesser number of hours as fulltime. Fulltime employees providing short term, temporary services of 90 days or less within a 12-month period are not considered fulltime for purposes of the Jury Service Program. If Contractor uses any subcontractor to perform services for County under this Agreement, the subcontractor shall also be subject to the provisions of this Paragraph 47. The provisions of this Paragraph 47 shall be inserted into any such subcontract and a copy of the Jury Service Program shall be attached to the agreement.

47.2.3 If Contractor is not required to comply with the Jury Service Program when the Agreement commences, Contractor shall have a continuing obligation to review the applicability of its "exception status" from the Jury Service Program, and Contractor shall immediately notify County if Contractor at any time either comes within the Jury Service Program's definition of "Contractor" or if Contractor no longer qualifies for an exception to the Program. In either event, Contractor shall immediately implement a written policy consistent with the Jury Service Program. County may also require, at any time during this Agreement and at its sole discretion, that Contractor demonstrate to County's satisfaction that Contractor either continues to remain outside of the Jury Service Program's definition of "Contractor" and/or that Contractor continues to qualify for an exception to the Program.

47.2.4 Contractor's violation of this Paragraph 47 of this Agreement may constitute a material breach of the Agreement. In the event of such material breach, County may, in its sole discretion, terminate this Agreement with Contractor and/or bar Contractor from the award of future County agreements for a period of time consistent with the seriousness of the breach.

48. CONTRACTOR'S WARRANTY OF ADHERENCE TO COUNTY'S CHILD SUPPORT COMPLIANCE PROGRAM

48.1 Contractor acknowledges that County has established a goal of ensuring that all individuals who benefit financially from County through County agreements are in compliance with their court ordered child, family and spousal support obligations in order to mitigate the economic burden otherwise imposed upon County and its taxpayers.

48.2 As required by County's Child Support Compliance Program (County Code Chapter 2.200) and without limiting Contractor's duty under this Agreement to comply with all applicable provisions of State and Federal law, Contractor warrants that to the best of its knowledge it is now in compliance and shall during the term of this Agreement maintain compliance with employment and wage reporting requirements as required by the Federal Social Security Act (42 USC Section 653(a)) and California Unemployment Insurance Code Section 1088.5, and shall, implement all lawfully served Wage and Earnings Withholding Orders or County's Child Support Services Department Notices of Wage and Earnings Assignment for Child or Spousal Support, pursuant to Code of Civil Procedure Section 706.031 and Family Code Section 5246(b).

49. **TERMINATION FOR BREACH OF WARRANTY TO MAINTAIN COMPLIANCE WITH COUNTY'S CHILD SUPPORT COMPLIANCE PROGRAM**

Failure of Contractor to maintain compliance with the requirements set forth in Paragraph 48 (Contractor's Warranty of Adherence to County's Child Support Compliance Program) shall constitute a default by Contractor under this Agreement. Without limiting the rights and remedies available to County under any other provision of this Agreement, failure to cure such default within 90 days of notice by County's Child Support Services Department shall be grounds upon which the Auditor-Controller or County's Board of Supervisors may terminate this Agreement pursuant to Paragraph 20 (Termination/Suspension for Default) and pursue debarment of Contractor pursuant to Paragraph 40 (Contractor Responsibility and Debarment).

50. **DEFAULTED PROPERTY TAX REDUCTION PROGRAM**

50.1 CONTRACTOR'S WARRANTY OF COMPLIANCE WITH COUNTY'S DEFAULTED PROPERTY TAX REDUCTION PROGRAM

Contractor acknowledges that County has established a goal of ensuring that all individuals and businesses who benefit financially from County through contract are current in paying their property tax obligations (secured and unsecured roll) in order to mitigate the economic burden otherwise imposed upon County and its taxpayers.

Unless Contractor qualifies for an exemption or exclusion, Contractor warrants and certifies that to the best of its knowledge it is now in compliance, and during the term of this Agreement will maintain compliance, with Los Angeles County Code Chapter 2.206.

50.2 TERMINATION FOR BREACH OF WARRANTY TO MAINTAIN COMPLIANCE WITH COUNTY'S DEFAULTED PROPERTY TAX REDUCTION PROGRAM

Failure of Contractor to maintain compliance with the requirements set forth in Paragraph 50.1 (Contractor's Warranty of Compliance with County's Defaulted Property Tax Reduction Program) shall constitute default under this Agreement. Without limiting the rights and remedies available to County under any other provision of this Agreement, failure of Contractor to cure such default within 10 days of notice shall be grounds upon which County may terminate this Agreement and/or pursue debarment of Contractor pursuant to County Code Chapter 2.206.

51. SHRED DOCUMENTS

Contractor shall ensure that all confidential documents/papers, as defined under State law relating to this Agreement must be shredded and not put in trash containers when Contractor disposes of these documents/papers. All documents/papers to be shredded are to be placed in a locked or secured container/bin/box and labeled "shred" until they are destroyed. No confidential documents/papers are to be recycled.

Documents for record and retention purposes in accordance with Paragraph 30 (Records and Audits) of this Agreement are to be maintained for a period of 5 years.

52. COUNTY AUDIT SETTLEMENTS

If, at any time during or after the term of this Agreement, representatives of County conduct an audit of Contractor regarding the work performed under this Agreement, and if such audit reasonably and accurately find that County's dollar liability for such work is less than payments made by County to Contractor, then the difference, together with County's reasonable costs of audit, shall be either repaid by Contractor to County by cash payment upon demand or deducted from any amounts due to Contractor from County, as determined by County. If such audit finds County's dollar liability for such work is more than payments made by County to Contractor, then the difference shall be repaid to Contractor by cash payment.

53. DISPUTE RESOLUTION PROCEDURE

- 53.1 Contractor and County agree to act immediately to mutually resolve any disputes, which may arise with respect to this Agreement. All such disputes shall be subject to the provisions of this Paragraph 53 (such provisions shall be collectively referred to as the "Dispute Resolution Procedure"). Time is of the essence in the resolution of disputes.
- 53.2 Contractor and County agree that, the existence and details of a dispute notwithstanding, both parties shall continue without delay their performance hereunder.
- 53.3 Neither party shall delay or suspend its performance during the Dispute Resolution Procedure.
- 53.4 In the event of any dispute between the parties with respect to this Agreement, Contractor and County shall submit the matter to their respective Project Managers for the purpose of endeavoring to resolve such dispute.
- 53.5 In the event that the Project Managers are unable to resolve the dispute within a reasonable time not to exceed 10 days from the date of submission of the dispute to them, then the matter shall be immediately submitted to the parties' respective Project Directors for further consideration and discussion to attempt to resolve the dispute.
- 53.6 In the event that the Project Directors are unable to resolve the dispute within a reasonable time not to exceed 10 days from the date of submission of the dispute to them, then the matter shall be immediately submitted to Contractor's Project Executive and the Director or designee. These persons shall have 10 days to attempt to resolve the dispute.

- 53.7 In the event that at these levels, there is not a resolution of the dispute acceptable to both parties, then each party may assert its other rights and remedies provided under this Agreement and/or its rights and remedies as provided by law.
- 53.8 All disputes utilizing this Dispute Resolution Procedure shall be documented in writing by each party and shall state the specifics of each alleged dispute and all actions taken. The parties shall act in good faith to resolve all disputes. At all three (3) levels described in this Paragraph 53, the efforts to resolve a dispute shall be undertaken by conference between the parties' respective representatives, either orally, by face to face meeting or by telephone, or in writing by exchange of correspondence.
- 53.9 Notwithstanding the foregoing, in the event of County's infringement of Contractor's intellectual property rights under the Agreement or violation by either party of the confidentiality obligations hereunder, the violated party shall have the right to seek injunctive relief against the other without waiting for the outcome of the Dispute Resolution Procedure.
- 53.10 Notwithstanding any other provision of this Agreement, County's right to seek injunctive relief to enforce the provisions of Paragraph 18 (Confidentiality and Security) shall not be subject to this Dispute Resolution Procedure. The preceding sentence is intended only as a clarification of County's rights and shall not be deemed to impair any claims that County may have against Contractor or County's rights to assert such claims after any such injunctive relief has been obtained.

54. ASSIGNMENT BY COUNTY

This Agreement may be assigned in whole or in part by County, without the further consent of Contractor, to a party which is not a competitor of Contractor and which agrees in writing to perform County's obligations under this Agreement.

55. NON-DISCRIMINATION IN SERVICES

- 55.1 Contractor shall not discriminate in the provision of services hereunder because of race, color, religion, national origin, ancestry, sex, age, or physical or mental handicap, in accordance with all applicable requirements of Federal and State law. For the purpose of this Paragraph 5556, discrimination in the provision of services may include, but is not limited to, the following: denying any person any service or benefit or the availability of the facility, providing any service or benefit to any person, which is not equivalent or is not provided in an equivalent manner or at an equivalent time to that provided to others; subjecting any person to segregation or separate treatment in any manner related to the receipt of any service; restricting any person in any way in the enjoyment of any advantage or privilege enjoyed by others receiving any service or benefit; and treating any person differently from others in determining admission, enrollment quota, eligibility, membership, or any other requirements or conditions which persons must meet in order to be provided any service or benefit.
- 55.2 Contractor shall ensure that recipients of services under this Agreement are provided services without regard to race, color, religion, national origin, ancestry, sex, age, or condition of physical or mental handicap.

56. UNLAWFUL SOLICITATION

Contractor shall inform all of its employees who provide services hereunder of the provisions of Article 9 of Chapter 4 of Division 3 (commencing with Section 6150) of California Business and Professions Code (i.e., State Bar Act provisions regarding unlawful solicitation as a runner or capper for attorneys) and shall take positive and affirmative steps in its performance hereunder to ensure that there is no violation of such provisions by its employees.

57. GOVERNING LAW, JURISDICTION AND VENUE

This Agreement shall be governed by, and construed in accordance with, the substantive and procedural laws of the State of California applicable to agreements made and to be performed within the State. Contractor agrees and consents to the exclusive jurisdiction of the courts of the State of California for all purposes regarding this Agreement and further agrees and consents that venue of any action brought hereunder shall be exclusively in the County of Los Angeles, California. For claims that are subject to exclusive Federal subject matter jurisdiction, Contractor agrees and consents to the exclusive jurisdiction of the Federal District Court of the Central District of California.

58. WAIVER

No breach of any provision hereof can be waived unless in writing. No waiver by County or Contractor of any breach of any provision of this Agreement shall constitute a waiver of any other breach or of such provision. Failure of County or Contractor to enforce at any time, or from time to time, any provision of this Agreement shall not be construed as a waiver thereof. The rights and remedies set forth in this Agreement shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Agreement.

59. AUTHORIZATION WARRANTY

Contractor and County represent and warrant that the person executing this Agreement or any Amendment thereto pursuant to Paragraph 4 (Changes Notices and Amendments) on its behalf is an authorized agent who has actual authority to bind it to each and every term, condition and obligation of this Agreement, and that all requirements of Contractor and County have been fulfilled to provide such actual authority.

60. VALIDITY AND SEVERABILITY

60.1 VALIDITY

The invalidity of any provision of this Agreement shall not render the other provisions hereof invalid, unenforceable or illegal, unless the essential purposes of this Agreement shall be materially impaired thereby.

60.2 SEVERABILITY

In the event that any provision herein contained is held to be invalid, void or illegal by any court of competent jurisdiction, the same shall be deemed severable from the remainder of this Agreement, if practicable, and shall in no way affect, impair or invalidate any other

provision contained herein. If any such provision shall be deemed invalid in its scope or breadth, such provision shall be deemed valid to the extent of the scope or breadth permitted by law. If any provision of this Agreement is adjudged void or invalid for any reason whatsoever, but would be valid if part of the wording thereof were deleted or changed, then such provision shall apply with such modifications as may be necessary to make it valid and effective.

61. NOTICES

61.1 All notices or demands required or permitted to be given or made under this Agreement, unless otherwise specified, shall be in writing and shall be addressed to the parties at the following addresses and delivered: (i) by hand with signed receipt; (ii) by first class registered or certified mail, postage prepaid; or (iii) by facsimile or electronic mail transmission followed within 24 hours by a confirmation copy mailed by first-class registered or certified mail, postage prepaid. Notices shall be deemed given at the time of signed receipt in the case of hand delivery, 3 days after deposit in the United States mail as set forth above, or on the date of facsimile or electronic mail transmission if followed by timely confirmation mailing. Addresses may be changed by either party by giving 10 days prior written notice thereof to the other party.

61.2 Director shall have the authority to issue all notices or demands, which are required or permitted to be issued by County under this Agreement.

61.3 To County, notices shall be sent to the attention of County's Project Manager and County's Project Director at the respective addresses specified in Section 1 (County Key Personnel) of Exhibit E (Administration of Agreement).

To Contractor, notices shall be sent to the attention of Contractor's Project Manager at the address specified in Section 2 (Contractor Key Personnel) of Exhibit E (Administration of Agreement), with a copy to Contractor's Project Executive.

61.4 Each party may change the names of the people designated to receive notices pursuant to this Paragraph 61 by giving written notice of the change to the other party, subject to County's right of approval in accordance with Paragraph 3.3 (Approval of Contractor's Staff).

61.5 In the event of suspension or termination of this Agreement, notices may also be given upon personal delivery to any person whose actual knowledge of such suspension or termination would be sufficient notice to Contractor. Actual knowledge of such suspension or termination by an individual Contractor or by a copartner, if Contractor is a partnership; or by the president, vice president, secretary, or general manager, if Contractor is a corporation; or by the managing agent regularly in charge of the work on behalf of said Contractor shall in any case be sufficient notice.

62. ARM'S LENGTH NEGOTIATIONS

This Agreement is the product of arm's length negotiations between Contractor and County, with each party having had the opportunity to receive advice from and representation by independent counsel of its own choosing. As such, the parties agree

that this Agreement is to be interpreted fairly as between them and is not to be strictly construed against either as the drafter or otherwise.

63. NON-EXCLUSIVITY

Nothing herein is intended nor shall be construed as creating any exclusive arrangement with Contractor. This Agreement shall not restrict County from acquiring similar, equal or like and/or services from other entities or sources.

64. CAPTIONS AND PARAGRAPH HEADINGS

Captions and paragraph headings used in this Agreement are for convenience only, are not a part of this Agreement, and shall not be used in construing this Agreement. If there is a conflict when referencing a Paragraph in this Agreement, between the Paragraph heading title and its number, the Paragraph heading title shall control.

65. FORCE MAJEURE

65.1 Neither party shall be liable for such party's failure to perform its obligations under and in accordance with this Agreement, if such failure arises out of fires, floods, epidemics, quarantine restrictions, other natural occurrences, strikes, lockouts (other than a lockout by such party or any of such party's subcontractors), freight embargoes, or other similar events to those described above, but in every such case the failure to perform must be totally beyond the control and without any fault or negligence of such party (such events are referred to in this sub-paragraph as "force majeure events"). Notwithstanding the foregoing, the current COVID-19 pandemic is a known event and does not excuse Contractor's performance of its obligations hereunder.

65.2 Notwithstanding the foregoing, a default by a subcontractor of Contractor shall not constitute a force majeure event, unless such default arises out of causes beyond the control of both Contractor and such subcontractor, and without any fault or negligence of either of them. In such case, Contractor shall not be liable for failure to perform, unless the services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit Contractor to meet the required performance schedule. As used in this sub-paragraph, the term "subcontractor" and "subcontractors" mean subcontractors at any tier.

65.3 In the event Contractor's failure to perform arises out of a force majeure event, Contractor agrees to use commercially reasonable best efforts to obtain services from other sources, if applicable, and to otherwise mitigate the damages and reduce the delay caused by such force majeure event.

66. FORMS AND PROCEDURES

All existing forms and procedures used by Contractor in implementation of the provisions of this Agreement are deemed "approved" by County for purposes of this Paragraph 66. Any new forms and procedures which materially affect Contractor's performance of this Agreement shall be subject to review and approval by County prior to use by Contractor.

67. DAMAGE TO COUNTY FACILITIES, BUILDINGS AND GROUNDS

67.1 Contractor shall repair, or cause to be repaired, at its own cost, any and all damage to County facilities, buildings, or grounds caused by Contractor or employees or agents of Contractor. Such repairs shall be made immediately after Contractor has become aware of such damage, but in no event later than 30 days after the occurrence.

67.2 If Contractor fails to make timely repairs, County may make any necessary repairs. All costs incurred by County, as determined by County, for such repairs shall be repaid by Contractor by cash payment upon demand or, without limitation of all County's other rights and remedies provided by law or under this Agreement, County may deduct such costs from any amounts due Contractor from County under this Agreement.

68. MINIMUM AGE, LANGUAGE SKILLS, AND LEGAL STATUS OF CONTRACTOR PERSONNEL AT FACILITY

Contractor cannot assign employees under the age of eighteen (18) to perform work under this Agreement. All of Contractor's employees working at County facilities must be able to communicate in English. Contractor's employees must be United State citizens or legally present and permitted to work in the United States.

69. NOTICE OF DELAYS

Exception as otherwise provided herein, when either party has knowledge that any actual or potential situation is delaying or threatens to delay the timely performance of this Agreement, that party shall, within five business days, give notice thereof, including all relevant information with respect thereto, to the other party.

70. RE-SOLICITATION OF BIDS AND PROPOSALS

70.1 Contractor acknowledges that, prior to the expiration or earlier termination of this Agreement, County, in its sole discretion, may exercise its right to invite bids or request proposals for the continued provision of the services delivered or contemplated under this Agreement. County shall make the determination to re-solicit bids or request proposals in accordance with applicable County policies.

70.2 Contractor acknowledges that County, in its sole discretion, may enter into an agreement for the future provision of services, based upon the bids or proposals received, with a provider or providers other than Contractor. Further, Contractor acknowledges that it obtains no greater right to be selected through any future invitation for bids or request for proposals by virtue of its present status as Contractor.

71. NO PAYMENT FOR SERVICES PROVIDED FOLLOWING EXPIRATION OR TERMINATION OF AGREEMENT

Contractor shall have no claim against County for payment of any money or reimbursement, of any kind whatsoever, for any services provided by Contractor after the expiration or other termination of this Agreement. Should Contractor receive any such payment, it shall immediately notify County and shall immediately repay all such funds to County. Payment by County for services rendered after expiration/termination of this

Agreement shall not constitute a waiver of County's right to recover such payment from Contractor. The provisions of this Paragraph 7271 shall survive the expiration, suspension, or other termination of this Agreement.

72. ACCESS TO COUNTY FACILITIES

Contractor, its employees and agents, may be granted access to County facilities, subject to Contractor's prior notification to County's Project Manager, for the purpose of executing Contractor's obligations hereunder. Access to County facilities shall be restricted to normal business hours, 7 a.m. until 6 p.m., Pacific Time, Monday through Thursday, County observed holidays excepted. Access to County facilities outside of normal business hours must be approved in writing in advance by County's Project Manager, which approval will not be unreasonably withheld. Contractor shall have no tenancy, or any other property or other rights, in County facilities. While present at County facilities, Contractor's personnel shall be accompanied by County personnel at all times, unless this requirement is waived in writing prior to such event by County's Project Manager.

73. COUNTY FACILITY OFFICE SPACE

In order for Contractor to perform Services hereunder and only for the performance of such Services, County may elect, subject to County's standard administrative and security requirements, to provide Contractor with office space and equipment, as determined at the discretion of the applicable County's Project Manager at County facilities, on a non-exclusive use basis. County shall also provide Contractor with reasonable telephone service in such office space for use only for purposes of this Agreement. County disclaims any and all responsibility for the loss, theft or damage of any property or material left at such County office space by Contractor.

74. PHYSICAL ALTERATIONS

Contractor shall not in any way physically alter or improve any County facility without the prior written approval of the Director, County's Project Director and the Director of County's Internal Services Department, in their discretion.

75. STAFF PERFORMANCE WHILE UNDER THE INFLUENCE

Contractor shall use reasonable efforts to ensure that no employee of Contractor shall perform services hereunder while under the influence of any alcoholic beverage, medication, narcotic or other substance which might impair his or her physical or mental performance.

76. RECYCLED PAPER

Consistent with the County's Board of Supervisors' policy to reduce the amount of solid waste deposited at the County landfills, Contractor agrees to use recycled-content paper to the maximum extent possible in this project.

77. LOCAL SMALL BUSINESS ENTERPRISE UTILIZATION

When requested by the County, the Contractor shall provide to the County via methods specified by the County, such as submission of electronic live (or dynamic) data on invoices

for the prime and all subcontractors using County-designated third party software system or to a County approved website, or other means of submitting expenditure information on subcontractors, including but not limited to the following information: the name, business address and telephone number/e-mail address of each subcontractor.

In addition, the Contractor shall be required to provide each of the specified subcontractor Local Small Business Enterprise (LSBE), Disabled Veteran Business Enterprise (DVBE), and Social Enterprise (SE) status (i.e., whether any of the listed subcontractors are Local SBEs) and the proposed monetary amount of the work the subcontractor will perform on each Notice to Proceed. At the time of submittal of each invoice, the Contractor shall indicate, via methods specified by the County, the actual dollar amounts paid to each listed subcontractor who performed work on the project. The subcontractor may be requested to confirm receipt of the actual payment to the subcontractor by the prime.

The parties agree that it will be impracticable or extremely difficult to fix the extent of actual damages resulting from the failure to the Contractor to comply with this Section. The parties will agree that under the current circumstances a reasonable estimate of such damages is specified in Exhibit F, Performance Requirements Summary, and that the Contractor shall be liable to the County for said amount.

If in the judgment of the Director, or his/her designee, the Contractor is deemed to be in non-compliance with the terms and obligations, the Director or his/her designee, at his/her option, in addition to, or in lieu of, other remedies provided in Exhibit F, Performance Requirements Summary, may deduct and withhold liquidated damages from County's final payment to the Contractor.

78. LOCAL SMALL BUSINESS ENTERPRISE PREFERENCE PROGRAM

This Agreement is subject to the provisions of County's ordinance entitled Local Small Business Enterprise Preference Program, as codified in Chapter 2.204 of the Los Angeles County Code.

Contractor shall not knowingly and with the intent to defraud, fraudulently obtain, retain, attempt to obtain or retain, or aid another in fraudulently obtaining or retaining or attempting to obtain or retain certification as a Local Small Business Enterprise.

Contractor shall not willfully and knowingly make a false statement with the intent to defraud, whether by affidavit, report, or other representation, to a County official or employee for the purpose of influencing the certification or denial of certification of any entity as a Local Small Business Enterprise.

If Contractor has obtained County certification as a Local Small Business Enterprise by reason of having furnished incorrect supporting information or by reason of having withheld information, and which knew, or should have known, the information furnished was incorrect or the information withheld was relevant to its request for certification, and which by reason of such certification has been awarded this Agreement to which it would not otherwise have been entitled, shall:

1. Pay to County any difference between this Contract amount and what County's costs would have been if this Contract had been properly awarded.
2. In addition to the amount described in subdivision (1), be assessed a penalty in an amount of not more than 10 percent of the amount of this Contract.
3. Be subject to the provisions of Chapter 2.202 of the Los Angeles County Code (Determinations of Contractor Nonresponsibility and Contractor Debarment).

The above penalties shall also apply to any business that has previously obtained proper certification, however, as a result of a change in their status would no longer be eligible for certification, and fails to notify the State and the Department of Consumer and Business Affairs of this information prior to responding to a solicitation or accepting a contract award.

79. DISABLED VETERAN BUSINESS ENTERPRISE PREFERENCE PROGRAM

This Contract is subject to the provisions of the County's ordinance entitled Disabled Veteran Business Enterprise (DVBE) Preference Program, as codified in Chapter 2.211 of the Los Angeles County Code.

Contractor shall not knowingly and with the intent to defraud, fraudulently obtain, retain, attempt to obtain or retain, or aid another in fraudulently obtaining or retaining or attempting to obtain or retain certification as a DVBE.

Contractor shall not willfully and knowingly make a false statement with the intent to defraud, whether by affidavit, report, or other representation, to a County official or employee for the purpose of influencing the certification or denial of certification of any entity as a DVBE.

If Contractor has obtained certification as a DVBE by reason of having furnished incorrect supporting information or by reason of having withheld information, and which knew, or should have known, the information furnished was incorrect or the information withheld was relevant to its request for certification, and which by reason of such certification has been awarded this contract to which it would not otherwise have been entitled, shall:

1. Pay to the County any difference between the Contract amount and what the County's costs would have been if the Contract had been properly awarded.
2. In addition to the amount described in subdivision (1), be assessed a penalty in an amount of not more than 10 percent of the amount of the Contract.
3. Be subject to the provisions of Chapter 2.202 of the Los Angeles County Code (Determinations of Contractor Nonresponsibility and Contractor Debarment).

Notwithstanding any other remedies in this contract, the above penalties shall also apply to any business that has previously obtained proper certification, however, as a result of a change in their status would no longer be eligible for certification, and fails to notify the

State and the Department of Consumer and Business Affairs of this information prior to responding to a solicitation or accepting a contract award.

80. SOCIAL ENTERPRISE PREFERENCE PROGRAM

This Contract is subject to the provisions of the County's ordinance entitled Social Enterprises (SE) Preference Program, as codified in Chapter 2.205 of the Los Angeles County Code.

Contractor shall not knowingly and with the intent to defraud, fraudulently obtain, retain, attempt to obtain or retain, or aid another in fraudulently obtaining or retaining or attempting to obtain or retain certification as an SE.

Contractor shall not willfully and knowingly make a false statement with the intent to defraud, whether by affidavit, report, or other representation, to a County official or employee for the purpose of influencing the certification or denial of certification of any entity as an SE.

If Contractor has obtained County certification as an SE by reason of having furnished incorrect supporting information or by reason of having withheld information, and which knew, or should have known, the information furnished was incorrect or the information withheld was relevant to its request for certification, and which by reason of such certification has been awarded this contract to which it would not otherwise have been entitled, Contractor shall:

1. Pay to the County any difference between the Contract amount and what the County's costs would have been if the Contract had been properly awarded.
2. In addition to the amount described in subdivision (1), be assessed a penalty in the amount of not more than 10 percent of the amount of this Contract.
3. Be subject to the provisions of Chapter 2.202 of the Los Angeles County Code (Determinations of Contractor Nonresponsibility and Contractor Debarment).

The above penalties shall also apply to any entity that has previously obtained proper certification, however, as a result of a change in their status would no longer be eligible for certification, and fails to notify the Department of Consumer and Business Affairs of this information prior to responding to a solicitation or accepting a contract award.

81. COMPLIANCE WITH COUNTY'S ZERO TOLERANCE ON HUMAN TRAFFICKING

Contractor acknowledges that County has established a Zero Tolerance on Human Trafficking Policy prohibiting contractors from engaging in human trafficking.

If Contractor or member of Contractor's staff is convicted of a human trafficking offense, County shall require that Contractor or member of Contractor's staff be removed immediately from performing any Work under the Agreement. County will not be under any obligation to disclose confidential information regarding the offenses other than those required by law.

Disqualification of any member of Contractor's staff pursuant to this Paragraph 78 shall not relieve Contractor of its obligation to complete all Work in accordance with the terms and conditions of this Agreement.

82. METHOD OF PAYMENT AND REQUIRED INFORMATION

The County may, at its sole discretion, determine the most appropriate, efficient, secure, and timely form of payment for any amounts due for goods and/or services provided under a Contract with the County. Proposers/Contractors further agree that the default form of payment shall be EFT or direct deposit, unless an alternative method of payment is deemed appropriate by the A-C.

Upon Contract award and at the request of the A-C and/or Public Works, the Contractor shall provide the A-C with electronic banking and related information for the Contractor and/or any other payee that the Contractor designates to receive payment pursuant to this Contract. Such electronic banking and related information includes, but is not limited to: bank account number and routing number, legal business name, valid taxpayer identification number or TIN, a working e-mail address capable of receiving remittance advices and other payment related correspondence, and any other information that the A-C determines is reasonably necessary to process the payment and comply with all accounting, recordkeeping, and tax reporting requirements.

Any provision of law, grant, or funding agreement requiring a specific form or method of payment other than EFT or direct deposit shall supersede this requirement with respect to those payments. Upon Contract award or at any time during the duration of the Contract, a Contractor may submit a written request for an exemption to this requirement. Such request must be based on specific legal, business or operational needs and explain why the payment method designated by the A-C is not feasible and an alternative is necessary. The A-C, in consultation with Public Works, shall decide whether to approve exemption requests.

83. COMPLIANCE WITH FAIR CHANCE EMPLOYMENT PRACTICES

Contractor shall comply with fair chance employment hiring practices set forth in California Government Code Section 12952, Employment Discrimination: Conviction History. Contractor's violation of this paragraph of the Contract may constitute a material breach of the Contract. In the event of such material breach, County may, in its sole discretion, terminate the Contract compliance with County Policy of equity

84. COMPLIANCE WITH THE COUNTY POLICY OF EQUITY

The Contractor acknowledges that the County takes its commitment to preserving the dignity and professionalism of the workplace very seriously, as set forth in the County Policy of Equity (CPOE) (<https://ceop.lacounty.gov/>). The contractor further acknowledges that the County strives to provide a workplace free from discrimination, harassment, retaliation, and inappropriate conduct based on a protected characteristic, and which may violate the CPOE. The Contractor, its employees and Subcontractors acknowledge and certify receipt and understanding of the CPOE. Failure of the Contractor, its employees or its Subcontractors to uphold the County's expectations of a workplace free from

harassment and discrimination, including inappropriate conduct based on a protected characteristic, may subject the Contractor to termination of contractual agreements as well as civil liability.

85. TIME OFF FOR VOTING

Contractor shall notify its employees and provide information regarding the time off for voting law (California Elections Code Section 14000). Not less than ten calendar days before every statewide election, every Contractor and subcontractor shall keep posted conspicuously at the place of work, if practicable, or elsewhere where it can be seen as employees come or go to their place of work, a notice setting forth the provisions of California Elections Code Section 14000.

86. SURVIVAL

In addition to any provisions in this Contract which specifically state that they shall survive the suspension, termination or expiration of the Contract, the provisions in the following Paragraphs shall also survive the expiration, suspension, or termination of this Contract for any reason:

- 2.4 Approval of Work
- 9.4 County's Right to Withhold Payment
- 10 Ownership and License
- 12 Warranties and Correction of Deficiencies
- 13 Indemnification
- 15 Insurance
- 16 Proprietary Considerations
- 17 Disclosure of Information
- 18 Confidentiality and Security
- 25 Effect of Termination/Suspension
- 30 Records and Audits
- 33 Compliance with Applicable Laws
- 34 Fair Labor Standards
- 37 Employment Eligibility Verification
- 41 Federal Access to Records

- 43 No THIRD-PARTY Beneficiaries
- 51 Shred Documents
- 52 County Audit Settlements
- 57 Governing Law, Jurisdiction and Venue
- 60 Validity and Severability
- 89 Prohibition from Participation in Future Solicitation(s)

87. **COMPLAINTS**

Contractor shall develop, maintain, and operate procedures for receiving, investigating, and responding to any complaints by any individual. Within 12 business days after this Contract's effective date, Contractor shall provide County with Contractor's policy for receiving, investigating, and responding to any complaints by any individual.

- a. County will review Contractor's policy and provide Contractor with approval of said plan or with requested changes.
- b. If County requests changes in Contractor's policy, Contractor shall make such changes and resubmit the plan within five business days for County approval.
- c. If, at any time, Contractor wishes to change Contractor's policy, Contractor shall submit proposed changes to County for approval before implementation.
- d. Contractor shall preliminarily investigate all complaints and notify the Contract Manager of the status of the investigation within five business days of receiving the complaint.
- e. When complaints cannot be resolved informally, a system of follow-through shall be instituted, which adheres to formal plans for specific actions and strict time deadlines.
- f. Copies of all written responses shall be sent to the Contract Manager within three business days of mailing to the complainant.

88. **GENERAL CONDITIONS OF CONTRACT WORK**

A. **Authority of Public Works and Inspection**

The Director will have the final authority in all matters affecting the work covered by this Contract's Terms, Requirement, Conditions, and Specifications. On all questions relating to work acceptability or interpretations of these Terms, Requirements, Conditions, and Specifications, the decision of the Director will be final.

B. Cooperation

Contractor shall cooperate with Public Works' forces engaged in any other activities at the jobsite. Contractor shall carry out all work in a diligent manner and according to instructions of the Director.

C. Cooperation and Collateral Work

Contractor shall perform work as directed by the Director. The Director will be supported by other Public Works personnel in assuring satisfactory performance of the work under these Specifications and that satisfactory Contract controls and conditions are maintained.

D. Equipment, Labor, Supervision, and Materials

All equipment, labor, supervision, and materials required to accomplish this Contract, except as might be specifically outlined in other sections, shall be provided by Contractor.

E. Jobsite Safety

Contractor shall be solely responsible for ensuring that all work performed under this Contract is performed in strict compliance with all applicable Federal, State, and local occupational safety regulations. Contractor shall provide at its expense all safeguards, safety devices, and protective equipment and shall take any and all actions appropriate to providing a safe jobsite.

F. Labor

No person shall be employed on any work under this Contract who is found to be intemperate, troublesome, disorderly, or is otherwise objectionable to Public Works. Any such person shall be reassigned immediately and not again employed on Public Works' projects or providing services.

G. Labor Law Compliance

Contractor, its agents, and employees shall be bound by and shall comply with all applicable provisions of the Labor Code of the State of California, as well as all other applicable Federal, State, and local laws related to labor including compliance with prevailing wage laws. The Contractor is responsible for selecting the classification of workers, which will be required to perform this service in accordance with the Contractor's method of performing the work and when applicable, is required to pay current prevailing wage rates adopted by the Director of the Department of Industrial Relations and will indemnify the County for any claims resulting from their failure to so comply. Contractor shall comply with Labor Code, Section 1777.5, with respect to the employment of apprentices.

H. Overtime

Eight hours labor constitutes a legal day's work. Work in excess thereof, or greater than 40 hours during any 1 week, shall be permitted only as authorized by and in accordance with Labor Code, Section 1815 et seq.

I. Prohibition Against Use of Child Labor

1. Contractor shall:

- a. Not knowingly sell or supply to County any products, goods, supply, or other personal property manufactured in violation of child labor standards set by the International Labor Organization through its 1973 Convention Concerning Minimum Age for Employment.
- b. Upon request by County, identify the country/countries of origin of any products, goods, supplies, or other personal property Contractor sells or supplies to County.
- c. Upon request by County, provide to County the manufacturer's certification of compliance with all international child labor conventions.
- d. Should County discover that any products, goods, supplies, or other personal property sold or supplied by Contractor to County are produced in violation of any international child labor conventions, Contractor shall immediately provide an alternative, compliant source of supply.

2. Failure by Contractor to comply with provisions of this paragraph will constitute a material breach of this Contract and will be grounds for immediate suspension or termination of this Contract for default.

J. Public Convenience

Contractor shall conduct operations to cause the least possible obstruction and inconvenience to public traffic or disruption to the peace and quiet of the area within which the work is being performed.

K. Public Safety

It shall be Contractor's responsibility to maintain security against public hazards at all times while performing work at contracted work locations. In the event Contractor determines a public hazard exists at a work location, Contractor shall immediately mark the location to prevent public access to the hazard and immediately notify the Contract Manager.

L. Quality of Work

Contractor shall provide the County high and consistent quality work under this Contract and which is at least equivalent to that which Contractor provides to all other clients it serves. All work shall be executed by experienced and well-trained workers. All work shall be under supervision of a well-qualified supervisor. Contractor also agrees that work shall be furnished in a professional manner and according to these Specifications.

M. Quantities of Work

Contractor shall be allowed no claims for anticipated profits or for any damages of any sort because of any difference between the work estimated by Contractor in responding to County's solicitation and actual quantities of work done under this Contract or for work decreased or eliminated by County.

N. Safety Requirements

Contractor shall be responsible for the safety of equipment, material, and personnel under Contractor's jurisdiction during the work.

O. Storage of Materials and Equipment

Contractor shall not store material or equipment at the jobsite, except as might be specifically authorized by this Contract. County will not be liable or responsible for any damage, by whatever means, or for the theft of Contractor's material or equipment from any jobsite.

P. Transportation

County will not provide transportation to and from the jobsite and will not provide travel around the limits of the jobsite.

Q. Work Area Controls

1. Contractor shall comply with all applicable laws and regulations. Contractor shall maintain work area in a neat, orderly, clean, and safe manner. Contractor shall avoid spreading out equipment excessively. Location and layout of all equipment and materials at each jobsite will be subject to the Contract Manager's approval.
2. Contractor shall be responsible for the security of any and all of Public Works/County facilities in its care. Contractor shall provide protection against vandalism and accidental and malicious damage, both during working and nonworking hours.

89. PROHIBITION FROM PARTICIPATION IN FUTURE SOLICITATION(S)

A Proposer, or a Contractor or its subsidiary or Subcontractor ("Proposer/Contractor"), is prohibited from submitting a bid or proposal in a County solicitation if the Proposer/Contractor has provided advice or consultation for the solicitation. A Proposer/Contractor is also prohibited from submitting a bid or proposal in a County solicitation if the Proposer/Contractor has developed or prepared any of the solicitation materials on behalf of the County. A violation of this provision shall result in the disqualification of the Contractor/Proposer from participation in the County solicitation or the termination or cancellation of any resultant County contract. This provision shall survive the expiration, or other termination of this Agreement.

IN WITNESS WHEREOF, the COUNTY has, by order of its Board of Supervisors, caused these presents to be subscribed by the Director of Public Works, and the CONTRACTOR has subscribed its name by and through its duly authorized officers, as of the day, month, and year first written above.

COUNTY OF LOS ANGELES

By _____
Director of Public Works

APPROVED AS TO FORM:

RODRIGO A. CASTRO-SILVA
Acting County Counsel

By _____
Deputy County Counsel

PARSONS TRANSPORTATION GROUP, INC.

By _____
Its President

Type or Print Name

By _____
Its Secretary

Type or Print Name

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EXHIBIT A
STATEMENT OF WORK

AGREEMENT
BY AND BETWEEN
THE COUNTY OF LOS ANGELES
AND
PARSONS TRANSPORTATION GROUP, INC.
FOR
LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE
DEVELOPMENT AND SUPPORT (LACO-4E DEVELOPMENT)
(BRC0000120)

1. PROJECT SCOPE

OVERVIEW

This document defines the scope of services and other Work for the LACO-4E Traffic Signal Controller Firmware Development and Support ("LACO-4E Development") Project (the "Project"). Capitalized terms used in this Exhibit A ("Statement of Work" or "SOW") without definition shall have the meanings given to such terms in the Base Agreement. Work for the Project described in this Exhibit A will be completed and delivered by Contractor to County in accordance with the terms of the Agreement.

This Exhibit A consists of Tasks, Subtasks, Deliverables, Services and other Work to be provided by Contractor to County as part of enhancing and maintaining the LACO-4E Software (also "Software"). The Project shall meet the requirements of this Agreement including those set forth in this Exhibit A and, unless specified otherwise, Attachments A.1 through A.2 thereto.

Since the 1990s, the County of Los Angeles Department of Public Works ("Public Works") has utilized various versions of their "LACO" brand traffic signal controller firmware to operate 170 type traffic signal controllers. This includes LACO1R, LACO3, and more recently, LACO-4E firmware. All of these versions are solely owned by Public Works and were developed with in-house staff or via contracted services.

LACO-4E is the latest in this series of traffic signal controller firmware programs. Its initial deployment was in 2005 in conjunction with deployment of the Public Works' traffic signal control system. Since that time, in addition to working with the Public Works' traffic control system, the software is also being utilized for the County of Los Angeles' Metropolitan Transportation Authority's Bus Signal Priority Program. The LACO-4E firmware has over 22,000 lines written in Motorola 6800 Assembly language, and is used to run Type 170E or 170 ATC traffic signal controllers equipped with an HC-11 Quad UART board. Currently, LACO-4E communicates with centralized traffic signal control systems using the AB3418E communications protocol. The LACO-4E program is being used Countywide in support of numerous City traffic signal control systems.

The general scope of required Work to be performed under this Agreement includes, but is not limited to, the following:

- Troubleshooting and repairs of the LACO-4E Software. Contractor will be responsible for providing troubleshooting and repairs for the LACO-4E Software as software Deficiencies become known.
- Enhancements of the LACO-4E Software. Contractor will be responsible for providing enhancements to the LACO-4E Software as the need arises.

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- Testing of the LACO-4E Software. Contractor will be responsible for complete unit and regression testing of any Software Modifications to the LACO-4E Software. Executables and corresponding Source Code will be submitted to Public Works for Acceptance Testing.
- Updating Source Code and User's Manual Documentation. Contractor will be responsible for including documentation of Software Modifications and updating the LACO-4E User's Manual, as needed.

The contractor shall meet the following list of requirements for the duration of the contract.

- Contractor's employees performing the requested services must maintain a minimum 5 years of experience providing all of the following services:
 - Working with RS-232 AB3418E communications.
 - Working with Model 170 Traffic Signal Controller architecture.
 - Working with an In-Circuit Emulator for the Motorola/Freescale MC68HC11F1.
 - Writing traffic signal controller applications in any programming language.
 - Writing applications using the Freescale's MC68HC11 in Assembly language.
- Contractor must maintain access to an In-Circuit Emulator for the Motorola/Freescale MC68HC11F1.
- Contractor must maintain access and provide their own Type 170 Controller in full controller cabinet environment.
- Contractor must possess a Software Development Compiler program that is fully compatible with Cosmic "C Cross Compiler/Assembler for Freescale HC11" Version 4.6.8 (or newer).

Without limiting the more detailed descriptions set forth in the subsequent sections of this Statement of Work and otherwise in the Agreement, Contractor's Work hereunder shall include the following, in each case in full accordance with this Statement of Work:

1. Contractor shall perform all Services and other Work to setup, configure, integrate, train and transfer knowledge to County staff to support and operate the Software.
2. Contractor shall perform, complete and deliver all Tasks, Deliverables, Services and other Work as set forth below or in any referenced document in full compliance with this Statement of Work and within the timeframes specified

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in each Task in accordance with the Payment Schedule. Such Tasks and Deliverables shall include all configurations, Software configuration, knowledge transfer, tests, training, and Documentation set forth or referenced herein. Also defined in this Statement of Work are those Tasks that involve participation of Contractor and County. Except to the extent expressly specified as an obligation of County, Contractor shall perform all Tasks and provide all Deliverables set forth herein.

3. A Deliverable shall only be deemed complete upon County's approval and acceptance, irrespective of the number of attempts it takes Contractor to provide a successful Deliverable.
4. County will provide the system hosting environment for testing and Production Use of Software. County will also provide training facilities as needed.
5. Contractor shall supply all materials not provided by County that are needed to comply with this Statement of Work and other requirements of this Agreement.

The general scope of work to be performed under this Agreement includes, but is not limited to, providing services necessary to implement, support and maintain the Software including Project Management and Additional Work, if any, provided by Contractor to County under the Contract.

Contractor's Work will be successfully completed upon delivery of a fully implemented, tested and County accepted- Software that meets the requirements and legal mandates of the County as detailed in the Agreement, while addressing all functions and requirements described or referenced within this SOW.

1.2 INSTRUCTIONS

Contractor shall provide all general correspondence and documentation to County in an electronic format or on media as mutually agreed to by County and Contractor, including without limitation for the following:

- All status reports and meeting minutes;
- All project Deliverables; and
- All invoices and billing documentation.

All Work must be approved by County, as evidenced by County's Project Manager and County Project Director's countersignature on the applicable Acceptance Certificate (Attachment A.2).

This Statement of Work under this Section 2 is comprised of the following Tasks:

Task 1 – Project Management

Task 2 – Troubleshooting, Repairs, and Enhancements

Task 3 – Additional Work

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The following Attachments are attached to, incorporated into and are deemed to be part of this Exhibit A:

Attachment A.1 – LACO-4E User's Manual

Attachment A.2 – Acceptance Certificate

2. TASKS AND DELIVERABLES

This Section of Exhibit A specifies all Tasks, Subtasks, and Deliverables, which shall be provided by Contractor to County. All payments for these Tasks shall be in accordance with and shall not exceed the maximum budget as shown in Exhibit B and Exhibit C.

TASK 1 – Project Management

Contractor's Project Manager ("Contractor's PM") will act as the principal contact for County. Contractor's PM is expected to oversee and participate in the day-to-day activities of the work required by the Agreement and should, therefore, have no concurrent assignments that would interfere with the successful and timely completion of all Tasks related to this Project. In addition, Contractor will prepare invoices, billings, and other financial information for review and approval by County, as required by this Agreement. Contractor shall employ project management industry standards and practices and coordinate with the County Project Manager with regards to any County responsibilities in the performance of all Work.

Contractor's activities under this Task shall include, but not be limited to:

- Providing effective and proactive coordination and communication with County to ensure Project success
- Maintaining Project communications through County's Project Manager
- Attending meetings with County Executives and Management as needed
- Coordinating and managing the activities of Contractor's Project personnel
- Contractor shall provide other ongoing project administration activities, which shall include, but not be limited to updating the Task Schedule.
- Preparing meeting minutes summarizing discussions at all meetings attended by the Contractor. Minutes should include summaries and follow-up action items.

Subtask 1.1 – Project Administration and Management

Contractor's Project Manager shall present to County's Project Manager a monthly written Status Report documenting Project progress, plans and outstanding issues. The first report shall be presented to County's Project Manager 4 weeks following the effective date, or at such later date as agreed to by County and Contractor, in a format approved by County.

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The status report items shall include:

- Tasks accomplished in that month
- A review of any incomplete Tasks and the reasons why they are not completed
- An outline of the Tasks anticipated to be accomplished in the next monthly period
- A list and status of outstanding issues, Deliverables, and Invoices as required by this Agreement
- Any Project risks or problems identified
- Tracking of all issues and their resolution

In addition, Contractor's Project Manager shall meet with or conduct a status update phone call with County's Project Manager on a monthly basis via teleconference, or as otherwise agreed to by County and Contractor, to review Project Status Reports and any related matters.

Subtask 1.1 - Deliverables

- Meeting Minutes and Agendas
- Participation in monthly Project Status Meetings
- Monthly Project Status Reports
- Invoice preparation/submittal (on a monthly basis)

TASK 2 – Troubleshooting, Repairs, and Enhancements

Subtask 2.1 – Troubleshooting and Repairs

The Contractor shall be responsible for providing troubleshooting and repairs for the LACO-4E Software as software Deficiencies become known. Upon discovering a firmware or Software Deficiency or set of Deficiencies, Public Works will prepare and submit a description of the Deficiency/Deficiencies and a request for repairs to the Contractor.

Upon receiving the description of the Deficiency and request for repairs from Public Works, Contractor shall acknowledge the request within two business days. The Contractor shall investigate the possible causes and identify solutions. Once the cause and repair solutions have been determined, the Contractor shall develop and submit a detailed scope of work, fee, and schedule estimate for the particular Task to Public Works within 30 days for review and approval. Upon approval of the fee and schedule by Public Works in writing, the Contractor shall proceed with the Task as described. Contractor shall notify County when expenditures for the approved Task reach 75 percent of the allocated Task Order amount.

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To ensure that the repairs have been successfully completed, the Contractor shall complete unit and regression testing in the Contractor's LACO-4E testing environment as necessary. Upon successfully passing the testing, Contractor shall conduct a peer review of the Source Code before submitting the executables and corresponding Source Code to Public Works. The peer review shall consist of using a second employee from Contractor's staff who was not involved in creating the repairs that took place under that Task. The peer review shall be done by an employee who is competent in the Source Code language used to write the LACO-4E firmware (Motorola Freescale's MC68HC11 Assembly Language). After the peer review has been conducted, the Contractor must document the employee's name along with the date and time the review was conducted in the Acceptance Certificate (See Attachment A.2). The employee who conducted the peer review must sign the Acceptance Certificate certifying that according to the review the changes made to the Source Code were strictly done to address the repair or enhancement requested by Public Works. No other changes to the Source Code will be accepted by Public Works unless they can be identified as necessary to the repair or enhancement being requested.

Once the Contractor's testing and the peer review is completed, the executables and corresponding Source Code will be submitted to Public Works for Acceptance Testing. The executables and corresponding Source Code shall be deposited into the Public Works' Revision Control Software. Public Works will provide Virtual Private Network (VPN) access into the Revision Control Software. Each repair shall be tested on an individual basis by Public Works staff in the LACO-4E staging environment to verify its operation. If bugs, errors, or other functionality Deficiencies persist due to work performed by the Contractor, the Contractor shall continue to troubleshoot and provide repair work to correct the Deficiencies at no additional cost to Public Works. Once Public Works has performed retesting and has verified that Deficiencies have been resolved, Public Works will accept the Work.

The updated LACO-4E shall then be transferred into the LACO-4E production environment. The Contractor shall achieve final acceptance of the Task once the LACO-4E has performed error free for a period of 90 consecutive days. Public Works will remain the sole judge regarding the acceptance of the completed Work.

Each Task shall also include Documentation of the repairs completed with all Source Code modules following industry best practice coding standards and include both end-line and standalone comments to achieve readability. The Software Modifications shall be Documented in the Revision Control Software referenced above in accordance with accepted industry standards. Updates will also include any changes, if necessary, to the LACO-4E User's Manual.

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Subtask 2.1 – Deliverable

Deliverable 2.1.1 – Repaired LACO-4E Software including Source Code Documentation

Deliverable 2.1.2 – Updated LACO-4E User's Manual, if necessary

Subtask 2.2 – Enhancements

The Contractor shall be responsible for providing enhancements to the LACO-4E Software as the need arises. When the need for an enhancement arises, Public Works will prepare and submit a description of the enhancement to the Contractor. The Contractor shall investigate the resources required to complete the enhancement and identify the required revisions to the Source Code.

Once the scope of the enhancements has been determined, the Contractor shall develop and submit a detailed Task Order, scope of work, and fee and schedule estimate to Public Works within 30 days for review and approval. Upon approval of the fee and schedule by Public Works in writing, the Contractor shall proceed with the Task Order as described. Contractor shall notify County when expenditures for the approved Task Order reach 75 percent of the allocated Task Order amount.

To ensure that the enhancements have been successfully completed, the Contractor shall complete unit and regression testing in the Contractor's LACO-4E testing environment as necessary. Upon successfully passing the testing, Contractor shall conduct a peer review of the Source Code before submitting the executables and corresponding Source Code to Public Works. The peer review shall consist of using a second employee from Contractor's staff who was not involved in creating the enhancements that took place under that Task. The peer review shall be done by an employee who is competent in the Source Code language used to write the LACO-4E firmware (Motorola Freescale's MC68HC11 Assembly Language). After the peer review has been conducted, the Contractor must document the employee's name along with the date and time the review was conducted in the Acceptance Certificate (See Attachment A.2). The employee who conducted the peer review must sign the Acceptance Certificate certifying that according to the review the changes made to the Source Code were strictly done to address the repair or enhancement requested by Public Works. No other changes to the Source Code will be accepted by Public Works unless the changes can be identified as necessary to the repair or enhancement being requested.

Once the Contractor's testing and the peer review is completed, the executables and corresponding Source Code will be submitted to Public Works for Acceptance Testing. The executables and corresponding Source Code shall be deposited into the Public Works' Revision Control Software. Public Works will provide Virtual Private Network (VPN) access into the Revision Control Software.

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Each enhancement shall be tested on an individual basis by Public Works staff in the LACO-4E staging environment to verify its operation. If bugs, errors, or other functionality Deficiencies persist due to work performed by the Contractor, the Contractor shall continue to troubleshoot and provide enhancement work to correct the Deficiencies at no additional cost to Public Works. Once Public Works has performed retesting and has verified that Deficiencies have been resolved, Public Works will accept the Task.

The updated LACO-4E shall then be transferred into the LACO-4E production environment. The Contractor shall achieve final acceptance of the Task once the LACO-4E has performed error free for a period of 90 consecutive days. Public Works will remain the sole judge regarding the acceptance of the completed Work.

Each Task shall also include Documentation of the enhancements completed with all Source Code modules following industry best practice coding standards and include both end-line and standalone comments to achieve readability. The enhanced Software shall be Documented in the Revision Control Software referenced above in accordance with accepted industry standards. Updates will also include any changes, if necessary, to the LACO-4E User's Manual.

Subtask 2.2 Deliverables

Deliverable 2.2.1 – Enhanced LACO-4E Software including Source Code Documentation

Deliverable 2.2.2 – Updated LACO-4E User's Manual, if necessary

Task 2 Payment Criteria:

Task 2 (Troubleshooting, repairs, and enhancements) Deliverables will be paid on a time and materials basis. Contractor shall receive 50 percent upon Public Works' acceptance of the repaired or enhanced LACO-4E Software and Source Code Documentation. The remaining 50 percent will be paid as follows: 30 percent when LACO-4E has performed error free for a period of 30 consecutive days, and the remaining 20 percent when LACO-4E has performed error free for a period of 90 consecutive days. After 90 days of error free operation, Public Works will provide Contractor with a Task/Deliverable Acceptance Certificate (Attachment A.2) to indicate Final Acceptance of each Task and the remaining 20 percent will be paid to the Contractor. Public Works will remain the sole judge regarding the acceptance of each completed Task.

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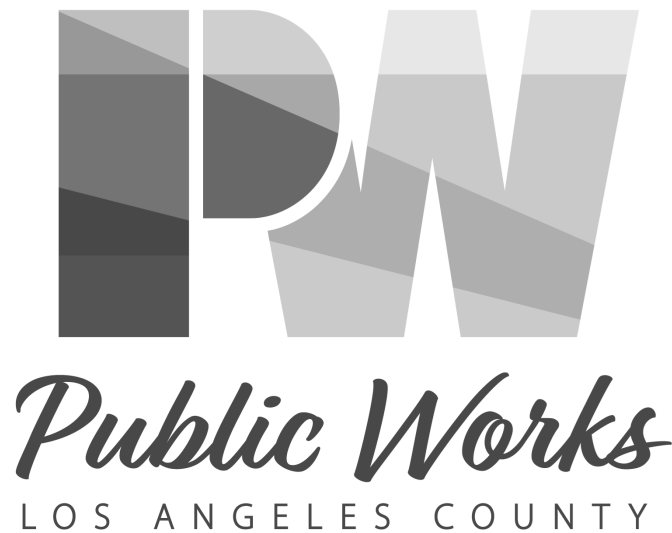
3. ADDITIONAL WORK

Contractor will provide Software support to assist County as needed. All efforts for this Task must receive prior approval from County's Project Manager. This assistance may be provided for Tasks such as installing and configuring Software on County-owned controllers, and other labor associated with the troubleshooting, repair, and enhancement of the Software. Activities associated with this Task will be reported as a part of Subtask 1 – Project Management monthly reports.

Contractor will perform activities on an hourly basis in accordance with the Hourly Labor Rates shown in Form PW-2 (Schedule of Prices). Contractor efforts under this task will be performed with approval of the County up to the budgeted amount shown in the RFP Part II (Required Contract).

These tasks may also include, but are not limited to, the following:

Documentation of the Existing Source Code



**LOS ANGELES COUNTY
PUBLIC WORKS**

LACO – 4E

**TRAFFIC SIGNAL CONTROL PROGRAM
USER'S MANUAL**

JANUARY 2019

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LACO-4E USERS MANUAL

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SECTION 1 INTRODUCTION

GENERAL

HARDWARE REQUIREMENTS/MEMORY MAP

GENERAL

Highlights of LACO-4E

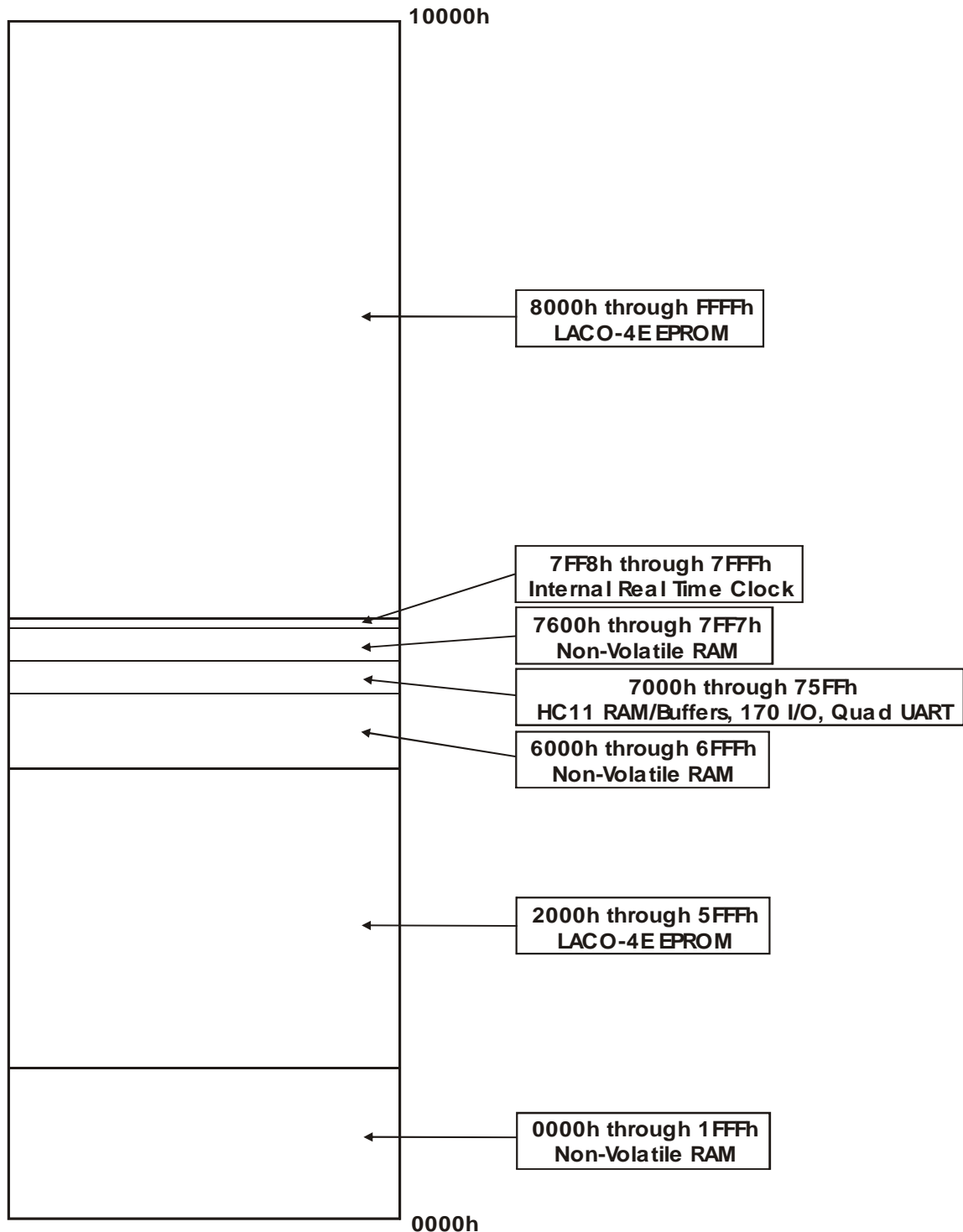
- Flexible Barrier Structure – This program is not restricted to the “Standard 8 phase quad” ring structure of other Type 170 controller-based programs. It allows the user to customize the ring structure of each intersection in a variety of configurations.
- AB3418E Slave and/or Master – Complies with the original AB3418E Specification for Slave mode. Also supports AB3418E Master mode in that it can transmit Time and Date to AB3418E compliant Slave controllers.
- Multiple communication capabilities – LACO-4E is capable of Central system to controller communications, and controller-to-controller communications.
- Two Coordination Methods – Supports Los Angeles County standard coordination and Zip Coordination, which is an abbreviated form of coordination logic.
- The most user-friendly User Interface available for the Type 170 controller platform – No memory paging schemes. All memory is directly accessible with either three keystrokes (for addresses in 1st two(2) Kbytes of memory) or five(5) keystrokes (for all other memory locations). Any memory location in the entire 170E controller memory map can be viewed in either hexadecimal or decimal format.
- Built in User-Data Validation – LACO-4E filters most critical data continuously to protect the program from invalid data entry.
- Intuitive Programmable Logic feature, including AND, OR, XOR logic, timers and switches, to modify default input and output logic.
- Integrated Intersection Flashout feature – This feature allows maintenance personnel to verify field to controller wiring without swapping out program EPROMS.
- Supports 68HC11 processor and Quad UART, with 64 byte receive and transmit FIFO's.
- Central System support using the AB3418E protocol.
- Bus Signal Priority logic - A non-preemptive routine designed to move transit vehicles more efficiently through intersections.

LACO-4E USERS MANUAL

SECTION 1 – INTRODUCTION

HARDWARE REQUIREMENTS/MEMORY MAP

The 170E controller must be specifically configured for operation with the LACO-4E program. This requires a CPU board with an HC11 processor, custom address decoders and a Quad UART for serial communication. Below is a pictorial representation of the LACO-4E memory map. The custom PAL/GAL's supplied by the manufacturer must conform to this mapping of the EPROM and NVRAM addresses for proper operation of the program.



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SECTION 2 DISPLAY AND KEYBOARD

DISPLAY MODES

- Base Display Mode**
- Detailed Ring Display**
- Table Display Mode**
- Clock Display Mode**
- Base Memory Display Mode**
- Extended Memory Display Mode**

CALL LIGHT INTERPRETATION

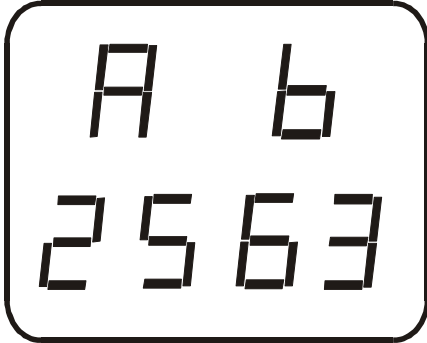
KEY PRESS SEQUENCES

LACO-4E KEY PRESS MAP

DISPLAY MODES

Base Display Modes

This is the default display mode for LACO-4E (and all Q5 program derivatives).



In the figure to the left, the “A” represents Ring A while the “25” directly beneath it represents Phase 2 and Interval 5 (Vehicle Extension), respectively.

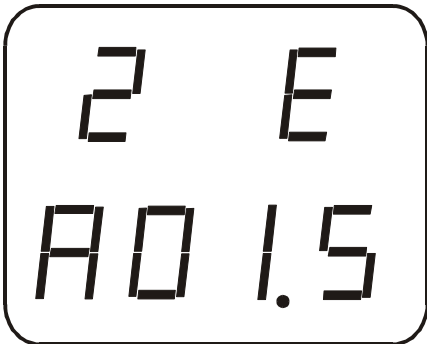
The “b” represents Ring B and the “63” directly beneath it represents Phase 6 and Interval 3 (Queue Hold), respectively.

In this display mode, Call Light 0 indicates Coordination status, Call Lights 1 through 8 indicate phase call status, and Call Light 9 indicates preemption status.

Detailed Ring Display Mode

This display mode provides timer information for the selected Ring (A or B).

Ring A

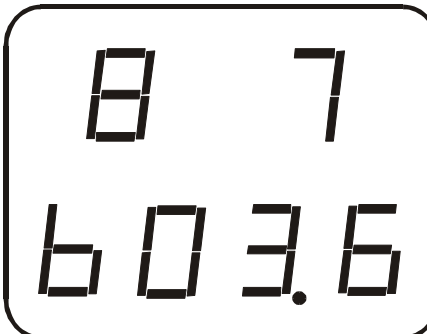


In the figure to the left, the “2” represents Phase 2 while the “E” represents Interval E (Yellow Clearance due to Force Off/Advance).

In the bottom portion of the display, the “A” represents Ring A and the “01.5” represents the Yellow Clearance time (in seconds) remaining for Phase 2.

In this display mode the Call lights reflect the same information as in the Base Display Mode above.

Ring B



In the figure to the left, the “8” represents Phase 8 while the “7” represents Interval 7 (Gap Reduction Green).

In the bottom portion of the display, the “b” represents Ring B, and the “03.6” represents the amount of time in the Ring B Gap Out Timer.

In this display mode the Call lights reflect the same information as in the Base Display mode above.

LACO-4E USERS MANUAL

SECTION 2 – DISPLAY/KEYBOARD

Table Display Mode

There are three types of tables in LACO-4E; Time of Day, Exception and BSP Override. The table at the lower left shows an Exception table. The “7/8” represents Table 7/Event 8 (the two numbers are alternately displayed). The number displayed for the shortest duration (0.3 seconds) is the Table number while the one displayed for the longest duration (0.7 seconds) is the Event number. The “1” indicates the Coordination table to be searched and the “1225” specifies the month/day (in this case Christmas) on which the Exception table search should occur. Call lights 2 through 6 ON indicate that this event will only be implemented on weekdays (Monday through Friday).

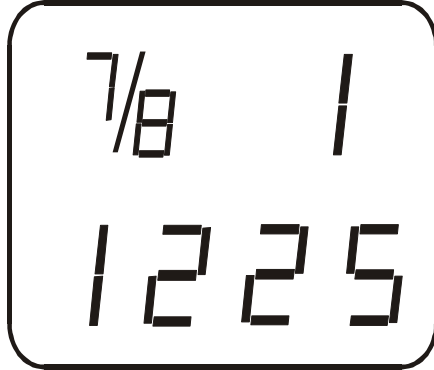
The lower right table is an example of a Time of Day table. The “0/2” represents Table 0/Event 2. The two numbers are alternately displayed at the same rate as the Exception Tables. The Coordination Plan/Function is shown in the upper right digit (in this case Plan 8). At the bottom of the display, the “0600” indicates the time of day that the Coordination Plan/Function is scheduled to start. Call lights 1 through 7 are illuminated indicating that Plan 8 should be run every day of the week starting at 6:00 a.m. Call lights 1 through 7 ON indicate that this event will be implemented every day of the week.

As in all display modes, Call Light 0 indicates Coordination status and Call Light 9 indicates Preemption status. Call Lights 1 through 7, however, indicate the days of the week that a Plan/Function is scheduled to run (for Tables 0 through 4), that an Exception Table is to be searched (for Tables 5 through 7) or that the BSP Direction Override phases (for Table 9) are to be implemented.

See section 8 for more information on the BSP Table.

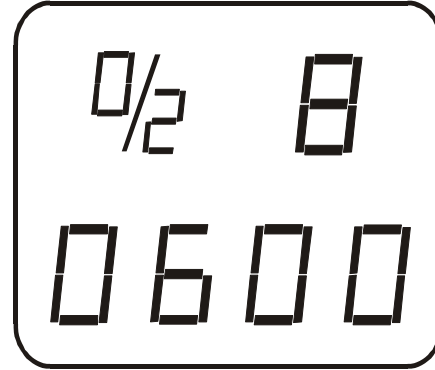
Exception Table

- ☐ 0
- ☐ 1
- ☒ 2
- ☒ 3
- ☒ 4
- ☒ 5
- ☒ 6
- ☐ 7
- ☐ 8
- ☐ 9



Time of Day Table

- ☐ 0
- ☒ 1
- ☒ 2
- ☒ 3
- ☒ 4
- ☒ 5
- ☒ 6
- ☒ 7
- ☐ 8
- ☐ 9

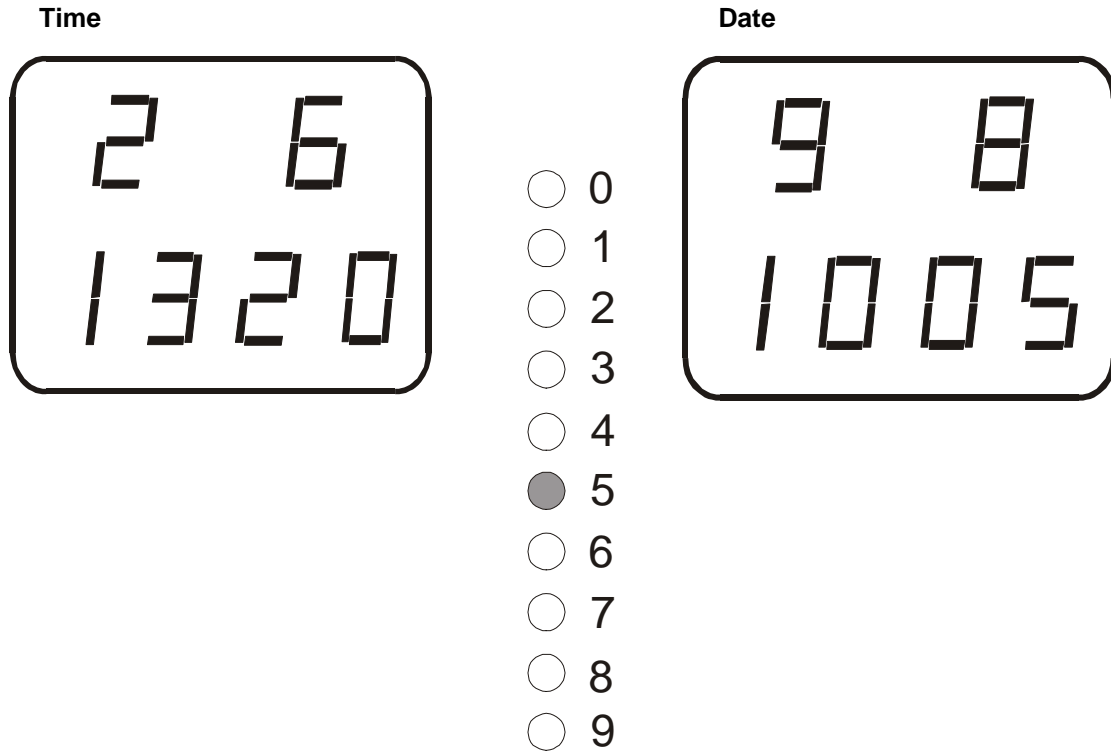


LACO-4E USERS MANUAL

SECTION 2 – DISPLAY/KEYBOARD

Clock Display Mode

The Clock Display mode is used to display the Time and Date of the 170E controller Real Time Clock. The time/date is shown in the LED Display, while Call Lights 1 through 7 indicate the Day of Week (Sunday through Saturday). The example at the lower left shows the time to be 13:20.26 (or 1:20.26 P.M.). The Day of Week is shown in call lights 1 through 7. On the right, the date is shown as October 5, 1998, which is a Thursday, so call light 5 would be illuminated (the call light data is only shown once here as it is the same for both the Time and the Date display).



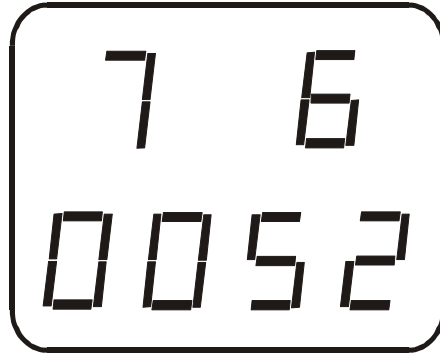
When modifying the time or date displays the first key press will set all display digits to "C" except for the left most Timing/Data digit, which will reflect the key just pressed. Each successive key press will modify the next digit to the right until the rightmost Timing/Data digit is modified. Finally the Phase and Interval digits are updated with the last two key presses. See Appendix A14, Setting The Real Time Clock, for more detailed information.

Base Memory Display Mode

This display mode can only be used to show data in memory locations 000 through 7FF. Base memory holds two types of data, Flag and Decimal. Flag data is displayed in Call Lights 1 through 8 and represents phases, status or control options. Decimal data is shown in the bottom portion of the LED Display and generally is used to display timers. The RAM maps in Appendix F of this manual indicate the data type for each Base memory location. Call Lights “0” and “9” reflect Coordination status and Preemption status, respectively.

Flag Data Display

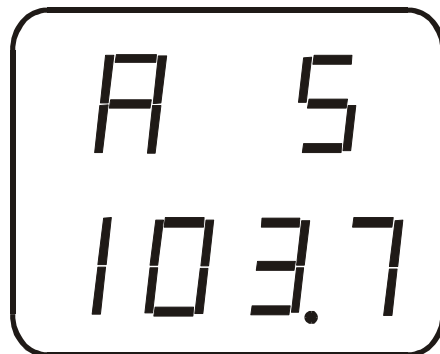
- ☐ 0
- ☐ 1
- ☒ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☒ 6
- ☐ 7
- ☐ 8
- ☐ 9



This example shows that memory location 076 (FAZNXT) has been accessed. Since this is Flag type data, its value is shown in the Call Lights. This example shows that phases 2 and 6 are the next phases to be served. The current value of the Local Cycle Timer (in this case “052”) is always shown in the LED Display when Flag data is being accessed.

Decimal Data Display

- ☐ 0
- ☐ 1
- ☒ 2
- ☐ 3
- ☒ 4
- ☐ 5
- ☒ 6
- ☐ 7
- ☒ 8
- ☐ 9

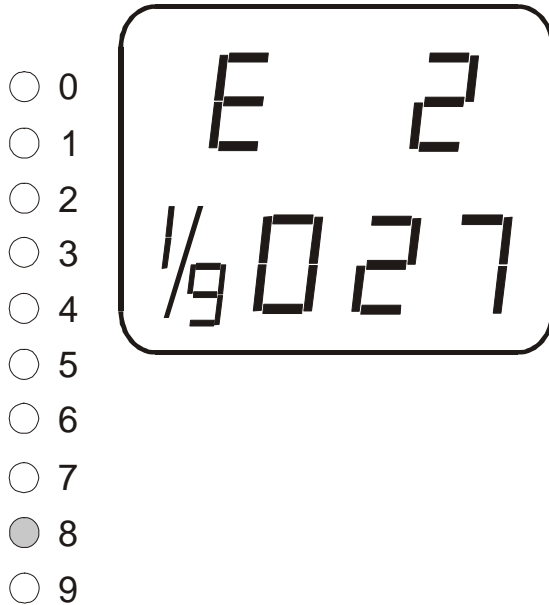


This example shows that memory location 1A5 (RAVEXT) has been accessed. Since this is Decimal type data, its value is shown in the lower portion of the LED Display. This example shows that the Ring A Vehicle Extension Timer has 3.7 seconds remaining. Current Call status is always shown in the Call Lights when Decimal data is being accessed. In this case all of the even numbered phases are calling.

Extended Memory Display Mode

Extended Memory Display mode can show the same data in two different ways, Decimal Display and Flag Display. When first accessing memory in this mode, the Flag Display is shown. Every time the Front Panel Stop Time switch is set to the ON position the LED display toggles between Decimal Display and Flag Display. This feature is particularly useful for the maintenance person. See Appendix H, Troubleshooting Guide for more detailed information on this display mode.

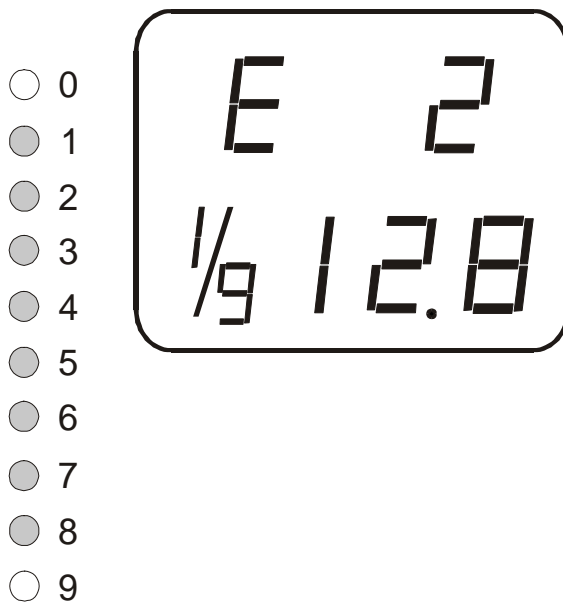
Flag Display



This example shows that location 19E2h has been accessed and the call lights show that its data contains a value of 80h (in hexadecimal format). The alternating “1/9” represents the memory Page (19h) and has the same display rate as in the Table Display mode. The “E2” indicates the memory location’s column and row, respectively. The “027” represents the current value of the Local Cycle Timer. In this mode, pressing any numeric key modifies the data immediately.

When the Front Panel Stop Time switch is placed to the ON position, the display format changes to Decimal Display as shown below.

Decimal Display



Now the data at location 19E2h is shown (in decimal form) in the Timing/Data digits. It shows “128” because that is the decimal equivalent of 80h. Also, in this display mode, the call lights reflect current Coordination status (0), phase call status (1 through 8) and preempt status (9). In this case, all phases have calls. To modify data in this display mode press any numeric key followed by “E” to save.

CALL LIGHT INTERPRETATION

The Call/Active indicators (call lights) on the 170E controller front panel provide a wide range of information about an intersection's timing and operation. There are ten call lights, numbered "0" through "9".

Call Light 0

Call light "0" always reflects the Local Coordinator status regardless of the display mode. It will be OFF when Local Manual (location 401) is set to "014". Otherwise, it will be ON except when the coordination Sync Pulse is TRUE. The exception to this is when the Local Coordinator is running in Offset Timing mode. In this case, call light "0" comes ON when the Offset Timing trigger is sensed and stays on for the duration of the cycle. At the end of the cycle, call light "0" goes OFF until the next Offset Timing trigger is sensed.

Call Lights 1 – 8

Call lights "1" through "8" have different interpretations, depending on which display mode the Function display is in. In both the Base display mode and Detailed Ring display mode, call lights "1" through "8" represent the call status of phases 1 through 8. A steady ON indication means there is a vehicle call for the corresponding phase. A ped call is indicated when the call light flashes at a rapid rate (5 Hz). If the call light is flashing at a slow rate (1 Hz), it means that the corresponding phase is flagged for Protected/Permissive Left Turn operation (at location 1FB), that phase is calling for service and a more lagging phase in that quadrant is or has already served since crossing the barrier. If this same phase is also configured as a ped phase, and a ped call is present for this phase, then the both flash rates are combined. That is, the call light will alternately be OFF for .5 seconds and then flash at a 5 Hz rate for .5 seconds.

The preceding description is also true when the Function display is in Base Memory display mode and accessing decimal data. If flag data is being accessed, the call lights represent the actual data (in hexadecimal format) at that location. This can either be "phase/overlap" data or "flag" data.

Call Light 9

Call light "9" always reflects the preemptor status regardless of the display mode.

- It will be ON whenever a Railroad preempt sequence is active.
- It will also be ON during the Active, Hold and Delay intervals of an EV preempt.
- It will be OFF at all other times.

KEY PRESS SEQUENCES

The following text refers to the LACO-4E Key Press Map at the end of this section. This map provides the user with a graphical presentation of all possible key presses subsequent key press options. Starting at the top of the map, the LED Display is in Base Display mode.

First Key Press

Keys 0 through 7 - Base Memory Display mode.

This is a 3 key sequence to access any byte of memory from 0000 to 07FF. The first key press selects a memory location Page. The second key press selects a memory location Column and the third key press selects a memory location Row. At this point, displayed data can be modified (using numeric keys) or direction keys (A, C, D, or F) can be pressed to access adjacent memory locations. Pressing "B" or "F" will return to Base Display Mode.

Key 8 - Extended Memory Display mode

This is a 5-key sequence to access any byte in the entire memory range of the 170E controller (0000 through FFFF). The first key press, "8", sets Extended Memory Display mode. The second and third key presses select a memory location Page, and any numbers between 00h and FFh are valid. The fourth and fifth key presses select a memory location Column and Row, respectively. When a memory location is first accessed, its data is displayed in Call Lights 1 through 8 (in hexadecimal format). The LED display shows the address of the memory location and the Local Cycle Timer. Toggling the Front Panel Stop Time switch changes the display format. Now the data is displayed in the LED display (in decimal format) and the Call Lights reflect Call status. Each time the Front Panel Stop Time switch is toggled on and off, the display mode also toggles.

Key 9 - Table Display mode.

This special key stroke sequence is used to populate the Coordination and BSP Tables. The first key press, "9", sets Table Display mode. The next key press sets the display to show Event 0 of the desired table (0-7 or 9). The next four key presses set the time (hh:mm), date (mm/dd) or exception pattern (mm/nn). The next key press sets the plan/function, table or direction override. The next key press, "E", saves the data, and the final key press(es) set the Day(s) of Week.

Key A - Detailed Ring Display mode (Ring A) or Clock Display mode

Press any key except "C" or "D" to return to Base Display mode. Pressing the "C" key puts the 170E controller into Clock Display mode showing the Time Display, while pressing "D" puts the 170E controller into Clock Display mode showing the Date Display. These key press sequences have been retained for those users familiar with LACO-1R and LACO-3. See "Key C" below for key press details on the Clock Display mode.

Key B - Detailed Ring Display mode (Ring B)

Press any key to return to Base Display mode.

Key C - Clock Display mode.

The first key press, "C", sets the Clock Display mode showing the Time Display. Press "A" or "D" to toggle back and forth between the Time Display and the Date Display. Press "B" or "F" to return to Base Display Mode. Press "C" to modify the Seconds component directly in the Time Display. If the 170E controller is configured with WWV/GPS, pressing the "E" key from the Time Display will force a repoll from WWV. If any numeric key (0-9) is

LACO-4E USERS MANUAL

SECTION 2 – DISPLAY/KEYBOARD

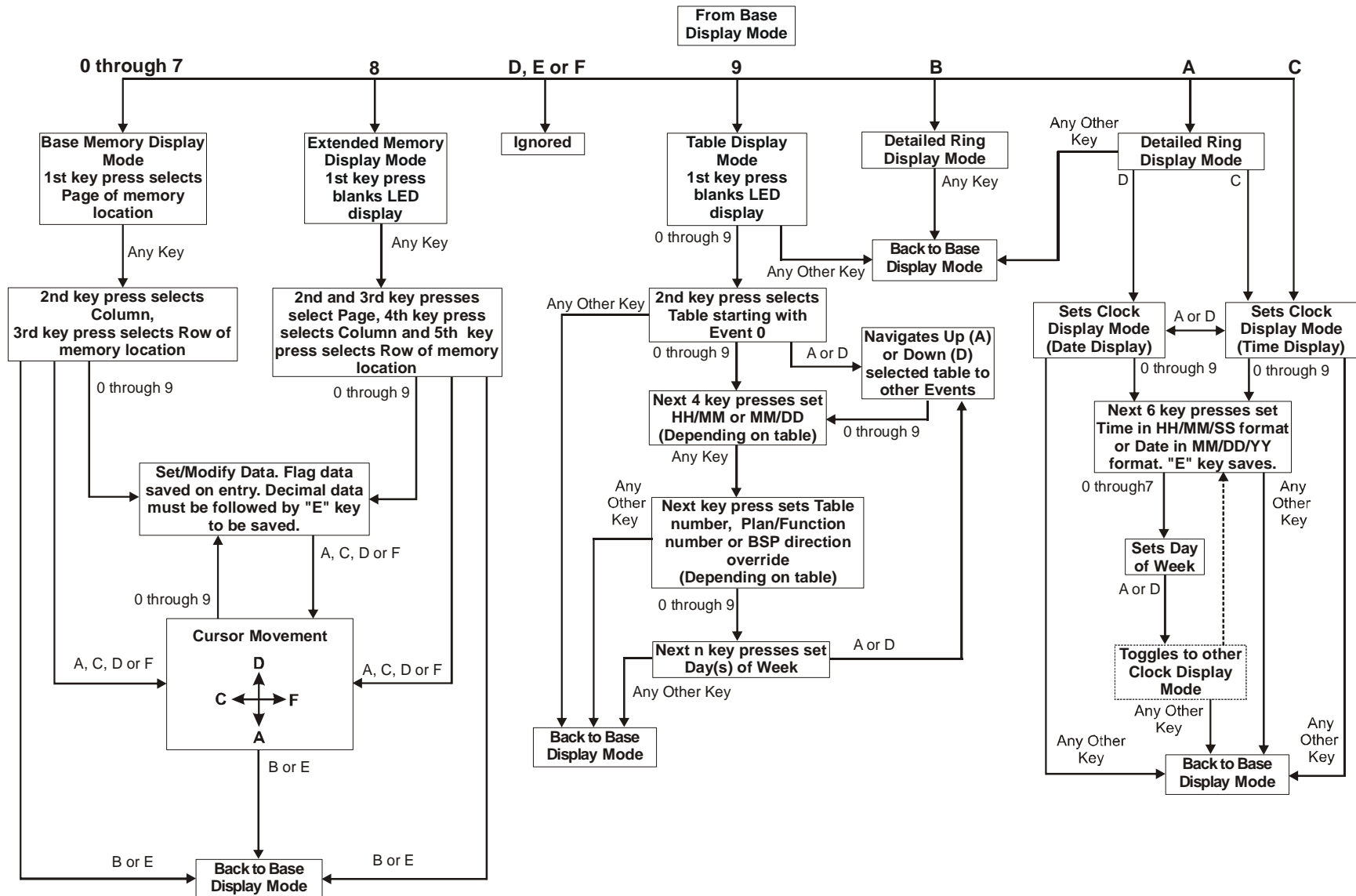
pressed, Data Modification mode is initiated. This allows the user to modify Seconds, minutes, Hours, and Day of Week in the Time Display and Year, Month, Day in Month and Day of Week in the Date Display. The Day of Week need only be set in either the Time or Date Display. It will automatically update the other Display. See Appendix A16, Setting The Real Time Clock.

Keys D, E, and F - Perform no action as first key press. The LED Display remains in Base Display mode

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LACO-4E USERS MANUAL

SECTION 2 – DISPLAY/KEYBOARD



LACO-4E Key Press Map

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SECTION 3 DETECTION AND I/O

GENERAL

VEHICLE DETECTION

DETECTOR ATTRIBUTES

SYSTEM DETECTORS

PED DETECTION

OTHER INPUTS

OUTPUTS

RS232 OUTPUTS

LACO-4E USERS MANUAL

SECTION 3 – DETECTION and I/O

GENERAL

LACO-4E supports forty-four physical inputs and fifty-six physical outputs via the C1 connector. These inputs and outputs have default mappings assigned to them based on the Caltrans 170E controller specification. LACO-4E offers exceptional I/O customization and almost any input or output can have its default function modified or reassigned. All references to input and output mapping in this section are in relation to the Caltrans 332 Input and Output Files. For a complete listing of this and other cabinet type default I/O, see Appendix E.

VEHICLE DETECTION

Up to twenty-eight-vehicle detector inputs are supported. Any single phase or multiple phases can be assigned to a detector. To simplify the programming effort, LACO-4E defaults phase assignments to the L. A. County default configuration. If a particular detector receives an actuation, and no phase is explicitly set for that detector, then the default phase for that detector will be called unless the detector is flagged as “System Detector”. The default phase assignments for each detector are indicated on the Detector timing sheet as a shaded block under the phase. Along with a phase assignment, each detector can have its basic operation modified by assigning any of eight detector attributes. Basic detector operation is such that each detector (on actuation) will call or extend its assigned phase(s) and will accumulate counts. Note that detector counts (for purposes of Added Initial Green computation) are disabled for detectors with multiple phase assignments.

Detector Extension (Carryover) timers are provided for each detector along with Detector Delay timers. The Extension timer and Delay timer can operate up to 25.5 seconds and 255 seconds, respectively. The default setting for both timers is zero seconds. A detector's Delay timer will count down while the detector is actuated and its assigned phase is Red. If the actuation is dropped, the Delay timer will be reset to its initial value. The detector's Extension timer is only active during the assigned phase's Green interval. If the input goes False (vehicle call is dropped), the detector's actuation will be extended for the duration of the Extension timer.

Each detector's delay **timer** address is offset by “60h” from the delay **time** location. For example, to set the delay **time** for detector I6U (in a 332 cabinet), go to 214h and enter the desired delay time. To view the delay **timer** for detector I6U, go to location 274h (214h + 60h = 274h), or simply press the “F” key six times from location 214. The same is true for a detector's extension timer and actuation counters. Below is a portion of the Detector Page RAM map that illustrates this.

Delay time		Extension Time		Detector Actuations		Delay timer		Extension Timer	
21	22	23	24	25	26	27	28	29	2A
DETIDX	DETJDX	DETICO	DETJCO	DETIVA	DETJVA	DTIDTM	DTJDTM	DTICTM	DTJCTM
2-1-4						2-7-4			

DETECTOR ATTRIBUTES

Each detector can be assigned either the “System Detector” attribute or any combination of the remaining seven attributes. If a detector is flagged as “System Detector”, that detector ignores the other seven attributes.

System Detector – Disables “phase-calling” for the flagged detector.

Red & Yellow Lock – This attribute causes an actuation to be locked if it occurs during the Red or Yellow interval of the phases selected for the detector. The locked actuation will drop when any of the selected phases begins service.

Yellow Disconnect – Causes an actuation to be ignored during the selected phase’s Yellow interval. Results in a “Red Lock only” operation when used in conjunction with the Red & Yellow Lock attribute above.

Red Calling Only – This attribute causes an actuation to be recognized only during the flagged phase's Red interval.

Queue Clearing – A Queue Clearing detector calls but will not extend a phase. This attribute provides stop bar “extension” without the restriction of a gap out timer. That is, once the detector’s assigned phase goes Green, the call to the phase is dropped and a Queue Hold is applied to that phase. The phase will stay Green (showing interval “3” in the front panel display) as long as the actuation is present and the phase’s Queue Limit timer has not expired. If either of these two conditions is not satisfied, the detector is disconnected until the next phase red.

Non-Counting – This attribute inhibits the detector’s count accumulator so that the Added Initial Green function for the detector’s assigned phase will not be operational.

Special Delay Option 1 – Selection of this attribute provides modified detector delay operation. This option causes the detector’s Delay timer to be ignored while the selected phases are timing.

Special Delay Option 2 – Same as Special Delay Option 1.

SYSTEM DETECTORS

LACO-4E supports System Detector functionality for all 28 detector inputs. System Detector data, Volume, Occupancy and Detector Diagnostics, is accumulated each collection period and stored in the AB3418E data buffers. This data is retrieved from the 170E controller by sending the AB3418E *GetSystemDetectorData* message from Central.

Configuration

System Detector configuration is minimal. There are only four user-set parameters, the data collection period and three detector diagnostics thresholds. These parameters are viewed in the Front Panel LED display.

Location	Parameter	Description
21F	Detector Stuck ON Threshold (default value = 0 minutes)	The length of time (in minutes) that a detector calls continuously before causing a Detector Stuck ON error. A value of "000" inhibits testing for Stuck ON error
22F	Detector Stuck OFF Threshold (default value = 0 minutes)	The length of time (in minutes) that a detector fails to call before causing a Detector Stuck OFF error. A value of "000" inhibits testing for Stuck OFF error
23F	Detector Chatter Threshold (default value = 0 actuations)	The number of actuations per Collection Period that will cause a Detector Chatter error. A value of "000" inhibits testing for Chatter error
24F	Collection Period Time (default value = 60)	The duration (in seconds) of the Collection Period

Operation

System detection operates automatically with no intervention from the user. Each detector input is monitored, ten times per second, while the Period timer is active for actuations, time ON and time OFF. When the Period timer counts down to "0", all detectors are compared to the three error thresholds. If a detector equals or exceeds an error threshold, the corresponding error code is set in that detector's Occupancy/Status byte. The AB3418E error codes implemented in LACO-4E are:

- 210 (0D2h) - Detector Stuck ON
- 211 (0D3h) - Detector Stuck OFF
- 215 (0D7h) - Detector Chattering

If no error is detected (or error checking is disabled for that detector) the detector's occupancy is computed and displayed in its Occupancy/Status byte. Occupancy is displayed in .5% increments from 000 through 200 (100%). Each detector's Volume is transferred to its AB3418E Volume buffer regardless of any error condition.

The AB3418E buffer data remains unchanged until **either...**

a) the end of a Collection period, at which time the old data is replaced with the most current data.

Or

b) the AB3418E *GetSystemDetectorData* is received and the response is sent by the controller, after which all of the AB3418E data buffers are cleared.

See section 7 for detailed information on AB3418E communications

PEDESTRIAN DETECTION

Up to six ped pushbuttons (PPB) inputs are supported; the four standard PPB's and two optional PPB's (called PedA and PedB) that can be remapped to override the Manual Control inputs. An actuation on any of these inputs will cause a locked ped call to be placed to their assigned phases. When the assigned phase goes green, ped service will start with it and the ped call will be dropped. The ped inputs are default mapped as follows:

- PedA – C1-80
- PedB – C1-53
- Ped2 – C1-67
- Ped4 – C1-69
- Ped6 – C1-68
- Ped8 – C1-70

Note: If either the PedA or the PedB input is configured, Manual Control logic is disabled.

OTHER INPUTS

LACO-4E supports up to six preempt inputs, two(2) Railroad (RR) and four(4) Emergency Vehicle (EV). The RR A input initiates flashing operation while the RR B input initiates limited service operation. The RR inputs use “Ground TRUE” logic. That is, *presence* of 115vac at the isolator input sets the 170E controller input FALSE and is treated as “Preempt OFF”, while *absence* of 115vac at the isolator input sets the 170E controller input TRUE and is treated as “Preempt ON”. Consequently, the RR inputs require an AC Isolator with inverted outputs for the input to be sensed properly. A RR input must be on for a minimum of ½ second before it is recognized. RR A input is mapped to C1-51 while RR B input is mapped to C1-52.

The four EV (A through D) inputs use “Ground FALSE” logic. LACO-4E does not currently support the Opticom discriminator (oscillating) inputs, therefore the input must be steady ON for the preempt logic to operate properly. The four EV inputs are default mapped as follows:

- EV A – C1-71
- EV B – C1-72
- EV C – C1-73
- EV D – C1-74

Manual Control inputs include Enable and Advance. These two inputs are default mapped to C1-80 (Advance) and C1-53 (Enable). These inputs are routed to the Police Panel Manual Control jack. When a plug is inserted in this jack, the Manual Control Enable input is set ON and the Manual Control Advance input is controlled by the toggling device attached to the plug. As mentioned above, if either PedA or PedB phases are selected, these inputs will act as the PPB inputs and Manual Control logic will be disabled.

The Flash Sense input is usually not user controlled. It is wired directly to the Conflict Monitor Unit (CMU) and is set ON whenever the CMU latches an error condition. This input is default mapped to C1-81.

The External Stop Time input, like the Flash Sense input, is wired directly to the CMU and is set ON at the same time that the CMU sets the Flash Sense input ON. It also can be turned ON by setting either the cabinet FLASH/AUTO switch or the Police Panel FLASH/NORMAL switch to FLASH. This does not affect the Flash Sense input. This input is default mapped to C1-82.

The Cabinet Door Open input is mapped to C1-54 and the Police Panel Door Open input is mapped to C1-75. These inputs are monitored for reporting to Central via AB3418E status messages.

OUTPUTS

LACO-4E is capable of driving twelve(12) 3-color outputs (signal heads), with any combination of eight phases and four 3-color overlaps. Additionally, up to six 2-color outputs can be accommodated with any combination of six peds and six(6) 2-color overlaps (all six of the overlaps can be used to drive 2-section signal heads). By default, phases 1 through 8 and Ped2, Ped4, Ped6, Ped8, overlap A and overlap B outputs are directed to the cabinet's Output File. The four(4) 3-color overlaps (C, D, E and F) are directed to the Auxiliary Output File (Aux File). Since the Aux File is typically not standard equipment, the 3-color overlaps may be redirected to any unused load switch in the Output File using the overlap Load Switch Assignment parameters.

The 170E controller also outputs a WatchDog Timer (WDT) signal to let the CMU know that the controller is still "alive". This is a 5 Hz signal that can be observed in an LED on the 170E controller Front Panel (usually labeled WDT on newer controllers). When the WDT signal is interrupted for more than .9 seconds, the CMU latches an error and puts the cabinet into flash. Note that not all Type 170 controllers have a WDT LED on their Front Panel.

The Detector Reset output is normally connected to each of the Input File slots. LACO-4E does not currently directly drive this output. However, it can be used in conjunction with the Programmable Logic feature to perform a user-defined operation.

The Preemption indicator drives the AUX3 Yellow output. This is user settable at location 3C0 and can be set to come on when any preemption or Manual Control is active.

Finally, the Time of Day Special Function (TODSPF) output can be turned on or off by the coordination TOD tables. This logic drives the AUX3 Green output and is useful for controlling signs/flashers at schools.

RS232 OUTPUTS

LACO-4E offers a broad range of serial outputs that can be used to send a variety of information to any controller on the same twisted-pair interconnect. Coordination data, Time/Date, AB3418E messaging and phase Green or Yellow can be sent with very simple configuration. The receiving controllers must be set to the same communications protocol that LACO-4E uses to transmit the data. Details about the serial outputs are provided in section 7, Communications.

SECTION 4 SIGNAL TIMING

INITIAL POWER UP

SIGNAL TIMING PARAMETERS

PHASE TIMING

CONFIGURATION

DETECTORS

SYSTEM DETECTORS

OVERLAPS

PREEMPTION

BUS SIGNAL PRIORITY

ZIP COORDINATION

COORDINATION

COORDINATION ATTRIBUTES

COORDINATION TABLES

PROGRAMMABLE LOGIC

LACO-4E USERS MANUAL

SECTION 4 – SIGNAL TIMING

7INITIAL POWER UP

When the 170E controller is started for the first time with a LACO-4E EPROM installed (and no LACO-4E timing saved on the Prom Module), signal timing is initialized as follows.

Location(s)	Function	Value
1E0	Main Street Phases	1, 2, 5, 6
1E1	Side Street Phases	3, 4, 7, 8
10F	Red Revert Time	02.0 seconds
11E	Phase 1 Yellow Clearance	05.0 seconds
12E	Phase 2 Yellow Clearance	05.0 seconds
13E	Phase 3 Yellow Clearance	05.0 seconds
14E	Phase 4 Yellow Clearance	05.0 seconds
15E	Phase 5 Yellow Clearance	05.0 seconds
16E	Phase 6 Yellow Clearance	05.0 seconds
17E	Phase 7 Yellow Clearance	05.0 seconds
18E	Phase 8 Yellow Clearance	05.0 seconds
190	AB3418E Comm Address	000
191 to 194	Ports 1-4 Comm Mode	000
1C0 to 1C4	Ports 1-4 Baud Rate	1200 bps (Call light 8 ON)
1C5 to 1C8	Ports 1-4 Parity	0
400	System Manual	014 (Free)
401	Local Manual	014 (Free)
409	Maximum Cycle Length	255 seconds
104	Program Number	005
All other Timing Sheet locations are set to zero time/no flags.		

These timings provide the controller with the minimum data necessary to start operation for the first time. The controller will start up with phases 4 and 8 timing Red Clearance (interval "F") as shown on the front panel display. After the 5 seconds of Red Clearance, the intersection will rest in red.

Basic 8 Phase fixed time operation can be quickly implemented by setting the following parameters:

- Permitted phases – Select all phases
- Minimum Vehicle Recall phases – Select all phases
- Ped Recall phases – Select all enabled peds
- Phase Minimum Green times – As desired
- Phase Yellow and/or Red Clearance times – As desired
- Ped Walk and Flashing Don't Walk times – As desired

SIGNAL TIMING PARAMETERS

The remainder of this section addresses the LACO-4E Timing Sheet entries starting at Page 1 (Phase Timing) and continuing through Page 14 (Programmable Logic). A minimum of two pages (Phase Timing and Configuration) is required to implement basic intersection timing. An intersection that takes advantage of all of the program's features could require up to 13 pages. The timing sheets are designed so that a major feature or function is implemented on one sheet. For instance, System Detectors, Preemption, Overlaps, and Programmable Logic are all on separate pages and if any of those particular functions is not required, then the respective timing sheet can be omitted. The header of each Timing Sheet has the label "Page ____ of ____" so that any combination of Timing Sheets can be assembled as a package and still be numbered sequentially. The table below lists each of the timing sheets and their applicable data categories.

Timing Sheet	Data Categories
Phase Timing	Phase intervals, Phase diagram, Miscellaneous timers
Configuration	Phase Function flags, Street Configuration flags, Miscellaneous flags, Communications Options, Manual Control Configuration
Detectors	Extension/Delay time, Phase flags, Attribute flags
System Detectors	Collection Period and Error Thresholds
Overlaps	Parent phase assignment, Clearance and Delay time, Load Switch assignment
Preemption	Railroad configuration, EV configuration, Preempt output configuration
Bus Signal Priority	BSP Table and configuration
Zip Coordination	Zip Coordination enable and configuration
Coordination 1	Plans 1 thru 9 Offsets, Plans 1 thru 3 Interval and Function flags
Coordination 2	Plans 4 thru 6 Interval and Function flags
Coordination 3	Plans 7 thru 9 Interval and Function flags
Coordination Attributes	Coordination Phase flags
Coordination Tables	Time of Day, Holiday and Exception tables
Programmable Logic	Logic Gates, Latches, Relays and Timers

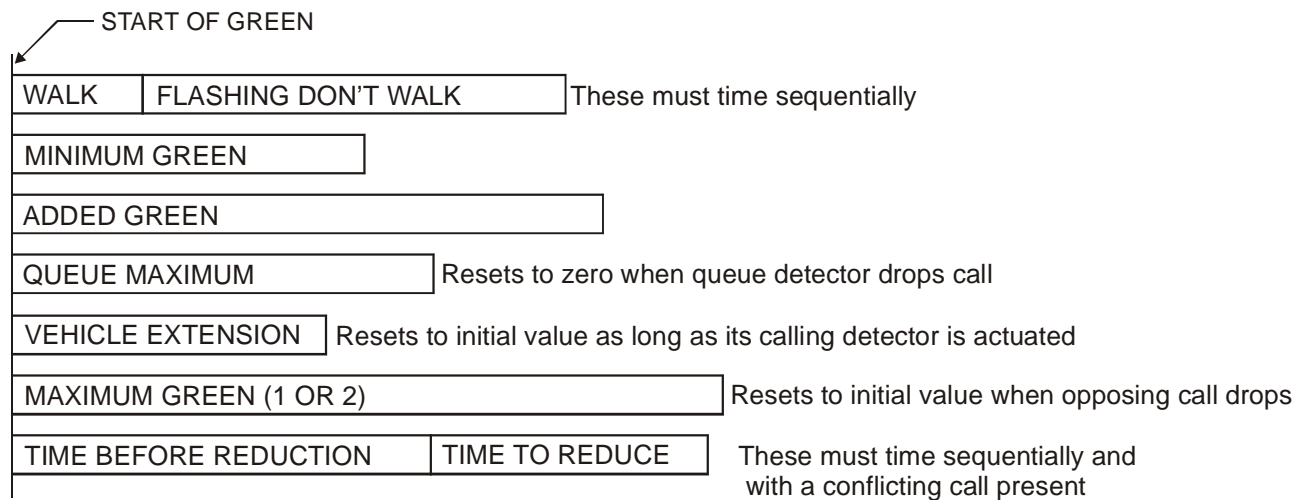
Following the fourteen timing sheets are five information sheets that can be included in a timing sheet package to assist maintenance personnel. They include the Programmable Logic Worksheet, Real Time Clock instructions/information, and three Maintenance Information sheets, which provide information on memory locations that are useful for equipment diagnostics or troubleshooting an intersection. In the following pages, each section of the LACO-4E timing sheets, beginning with sheet 1 (Phase Timing) is replicated with a description of the parameters therein. The majority of LACO-4E Phase Timing is the same as in previous LACO programs and users familiar with those programs will easily adapt to this version. Appendix D offers guidance in converting LACO-1R and LACO-3 program timing sheets to LACO-4E format.

PHASE TIMING

The first timing sheet, Phase Timing, includes all of the per-phase intervals, miscellaneous timers and the Phase Diagram block, which provides space to include information on the geometry of the intersection. The fields for Minimum Green and Yellow Clearance show the default values for all Permitted phases (set at location 1F0), if no data is entered for those parameters. The default values shown for pedestrian intervals only apply if that phase is flagged as a pedestrian movement (at locations 1E2 through 1E7). The bold, bracketed numbers following each interval description indicate the range of values that the interval will accept. Numbers with decimal points time in 0.1-second increments. Whole numbered intervals time in one second increments.

Timing Intervals

The Walk, Flashing Don't Walk, and Minimum Green intervals comprise a quantity referred to as "Minimums." Minimums are those portions of the green interval that are guaranteed to time, except when overridden by Preemption. As shown below, all green timers count down concurrently from start of green, and continue until zero (with exceptions noted below).



NOTE: The Walk, Flashing Don't Walk and Minimum Green timers **cannot** be overridden by a Force Off but **can** be overridden by Railroad preempt Advance. A Force Off or Railroad preempt Advance will override all other green timers.

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SECTION 4 – SIGNAL TIMING

Keystrokes: 1 + Phase + Interval	Phase								
Interval		1	2	3	4	5	6	7	8
Walk	0	0	1	0	1	0	1	0	1
Flashing Don't Walk	1	0	1	0	1	0	1	0	1
Minimum Green	2	10	10	10	10	10	10	10	10
Queue Maximum	3	0	0	0	0	0	0	0	0
Added Green per Actuation	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vehicle Extension	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time Before Reduction	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minimum Gap	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Green 1 (Free)	8	0	0	0	0	0	0	0	0
Max Green 2 (Coordination)	9	0	0	0	0	0	0	0	0
Max Added Green	A	0	0	0	0	0	0	0	0
Unused	B								
Unused	C								
Time to Reduce	D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow Clearance	E	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Red Clearance	F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Walk - The amount of time that the international walk symbol or "WALK" message is displayed on the pedestrian signal head. The minimum Walk time that can be entered into the 170E controller is 1 second. The Walk interval must time out completely unless an EV or Railroad Preempt occurs. In which case, the Walk timer is forced to zero and the Walk interval ends immediately. **[0 to 255]**

Flashing Don't Walk - The amount of time that the flashing international Don't Walk symbol or "DON'T WALK" message is displayed on the Pedestrian Head. The minimum Flashing Don't Walk time that can be entered into the 170E controller is 1 second. As with the Walk time, the Flashing Don't Walk interval must time out completely unless an EV or Railroad Preempt occurs. In the case of a Railroad Preempt, the Flashing Don't Walk timer is forced to zero and the flashing DON'T WALK indication goes to a steady DON'T WALK immediately. With an EV Preempt, LACO-4E allows two options. The default operation is to allow the Flashing Don't Walk interval to time out completely. By setting the appropriate flag on the Preemption Timing Sheet, the second option results in the immediate termination of the Flashing Don't Walk Interval. **[0 to 255]**

Minimum Green - The minimum length of time that a Vehicle indication will stay green (in the absence of a Preemption condition). **[0 to 255]**

Queue Maximum - The maximum length of time that a queue detector will hold a phase green. Queue Maximum times concurrently with Minimum Green. **[0 to 255]**

Added Green per Actuation - The amount of time that Added Green is increased for each calling detector actuation. Added Green times concurrently with Minimum Green. **[0.0 to 25.5]**

Vehicle Extension - The length of time that a phase will be held green (extended) in the absence of a detector actuation for that phase. Vehicle Extension begins timing when there is no actuation for the current phase and resets to its initial value when a call is reasserted. **[0.0 to 25.5]**

Time Before Reduction (TBR) - The amount of time that a phase waits before it begins timing Gap Reduction. TBR starts timing the moment when a conflicting call is present during the green. If no conflicting call is present the TBR timer resets to its initial value. **[0.0 to 25.5]**

Minimum Gap - The lower limit that a phase's Gap Out timer will be reached during Gap Reduction. Vehicle Extension will reduce down to this value only after the Time Before Reduction timer has expired. **[0.0 to 25.5]**

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SECTION 4 – SIGNAL TIMING

Max Green 1 and 2 - The maximum amount of green time that a phase will time. Max Green 1 is used during Free operation and Max Green 2 is used during coordinated operation. The Max Green timer begins timing at the start of the green interval. **[0 to 255]**

Max Added Green - The maximum amount of Added Green time that a phase can time. Limits the amount of Added Green resulting from excessive detector actuations. **[0 to 255]**

Time to Reduce (TTR) - The length of time to reduce the Gap Out timer (reduce Vehicle Extension time to Minimum Gap time). **[0.0 to 25.5]**

Yellow Clearance - The length of time that Yellow is displayed. Unless a phase is flagged for Yellow Ranging (at location 1DE), values less than 3.0 seconds will be changed to 3.0 seconds, and values greater than 5.0 seconds will be changed to 5.0 seconds. **[3.0 to 5.0]**

Red Clearance - The amount of time after the Yellow Clearance interval that a phase will display red. While this timer is active, no other phase in the same ring can start. **[0.0 to 25.5]**

Phase Diagram

TRUE NORTH	PHASE NORTH	1	2	3	4
		5	6	7	8

This is where the intersection phasing is to be indicated. The directions of True North and Phase North, and the movements associated with each phase should be indicated here. Overlap movements should also be identified in this diagram along with Restricted and/or Exclusive phases. Highlight the barrier-phase boundaries to emphasize the quad structure of the intersection. The example above shows Main Street phases (as set in location 1E0) to be 1, 2, 3, 5, and 6 with the barrier phases being 3 and 6. (Default barrier phases are 2 and 6).

Miscellaneous Timers

These are the timers that are not on a per-phase basis. Red Rest Delay, Green Rest Delay and Red Revert are per-ring intervals while Stuck All Red Fail Delay is a per-controller interval.

MISCELLANEOUS TIMERS		
Time/Timer	Location	
Red Rest Delay Time	106	0
Green Rest Delay Time	107	0
Stuck All Red Fail Delay Time	10E	30
Red Revert Time	10F	2.0

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Red Rest Delay Time - The time before a phase that is flagged to Rest in Red starts its termination sequence. At the beginning of green of the Red Rest phase, this value is copied to the respective Ring delay timer. Rings A and B have separate Red Rest Delay Timers that can be viewed at locations 1AC and 1BC, respectively. The Red Rest Delay Timer will count down when the Red Rest phase is resting in green (timing no interval with no opposing calls). Whenever this condition is not met, the Red Rest Delay Timer resets to the value entered here. **[0 to 255]**

Green Rest Delay Time - The time before a phase that is flagged to Rest in Green causes termination of a non-concurrent, non-Green Rest phase. At the beginning of green of any phase, this value is copied to the ring's Green Rest Delay Timer at location 19A/B. The Green Rest Delay Timer will count down when any non-Green Rest phase is resting in green. Whenever this condition is not met, the Green Rest Delay Timer resets to the value entered here. **[0 to 255]**

Stuck All Red Fail Delay Time - By default, the Stuck-All-Red logic will put the controller into software flash 30 seconds after an all Red (with calls) condition is detected. This parameter allows the user to vary the failure detection window. A non-zero value entered here overrides the default of 30 seconds. **[0 to 255]**

Red Revert Time - The absolute minimum time that a just terminated phase must wait before it can be served again. At the beginning of each phase green, this value is copied to the respective Ring Red Revert Timer. The Red Revert timer times concurrently with the (just terminated) phase's Red Clearance timer. Ring A and Ring B have separate Red Revert Timers that can be viewed at locations 1AB and 1BB respectively. **[0.0 to 25.5]**

CONFIGURATION

This timing sheet page includes all of the phase "flag" type parameters, controller Communications Options and Manual Control configuration parameters. The Phase Function, Street Configuration and Miscellaneous phase flags further define the intersection's basic operation. Items on this page will generally only be set once.

Phase Function Flags

PHASE FUNCTION FLAGS									
Keystrokes: 1 + F + row		1	2	3	4	5	6	7	8
Permitted Phases	0								
Red Lock	1								
Red and Yellow Lock	2								
Minimum Vehicle Recall	3								
Maximum Vehicle Recall	4								
Rest in Green	5								
Rest in Red	6								
Barrier Recall	7								
Double Entry	8								
Exclusive Phases	9								
Restricted Phases	A								
Protected/Permissive Left Turn	B								
Lag Phases (Free)	C		X		X		X		X
First Phases After Start Up	D								
Yellow Start-Up Phases	E								
Yellow Start-Up Overlaps	F								

Permitted Phases - The phases that will time during normal operation of the intersection. Any changes to this location will be implemented immediately. If a Permitted Phase is timing any of its Green Intervals and that phase is removed from Permitted Phases, it will be forced off (after timing its Minimums) and no calls to that phase will be recognized.

Red Lock - Calls placed to any phase set at this location will be locked if those calls are placed during the phase's Red interval. The locked call will be removed when the flagged phase starts its Green interval.

Red and Yellow Lock - The same operation as Red Lock above except it also includes calls placed during the phase's Yellow interval.

Minimum Vehicle Recall - Causes a call to be placed for a phase during its Red interval only. This call will remain in place until the phase goes green.

Maximum Vehicle Recall - Causes a continuous call to be placed for a phase. This results in the phase staying green until its Maximum Green Timer has expired (even if no Vehicle Extension time is set for the phase).

Rest in Green - Causes a call to be placed to a phase if that phase is not in service and no opposing calls to that phase exist.

Rest in Red - Causes a termination sequence to begin for a phase if that phase is resting in green and there are no opposing calls to that phase.

Barrier Recall - Causes a call to be placed at barrier crossing for phases flagged here.

Double Entry - Causes a call to be placed, at barrier crossing, for flagged phase if no other call exists in the quadrant of the flagged phase.

Exclusive Phases - Any phase flagged here must time by itself, even if a normally compatible phase has demand. If a normally compatible phase is in service when an Exclusive phase requests service, the non-Exclusive phase will terminate as if a normally non-compatible phase was requesting service. A barrier crossing is required to implement changes to this location.

Restricted Phases - A phase set in this location will not be permitted to time concurrently with another Restricted phase. Restricted phasing can only be implemented in a standard quad configuration (phases 1, 2, 5, and 6 set to Main Street). Also, Exclusive phasing and Restricted phasing are mutually exclusive operations (on the same street). Exclusive phasing operation has priority over Restricted phasing operation. The data validation logic will not permit selecting a phase as Restricted if any other phases on that street are already selected as Exclusive. However, one street may implement Restricted phasing while the other street implements Exclusive phasing. A barrier crossing is required to implement changes to this location.

Protected/Permissive Left Turn - Prevents the controller from backing up from a lagging phase to a leading phase. A call placed by a phase flagged for Prot/Perm Left Turn (while a lagging phase is green) will only be answered after the lag phases terminate and the controller crosses the barrier. Until then, the call will be ignored by the controller. A call placed by a Prot/Perm Left Turn phase, when a more lagging phase is green, is indicated by its Call light flashing at a slow rate. The call in this instance will be ignored.

Note:

A lag (barrier) phase that is flagged as Prot/Perm Left Turn will **never** be served nor will a call to that phase be recognized or indicated in its call light.

Care should be taken when flagging a lead phase for both Prot/Perm **and** ped operation. The same logic that prevents vehicle service will also prevent ped service.

Care should be taken when flagging a lead phase for both Prot/Perm and RR Limited Service operation. Its supplemental lag phase must also be flagged for RR Limited Service operation, or a cross street phase must be placed on recall, or a mechanism must be in place that generates a cross street call when the Prot/Perm phase places a call.

Lag Phases (Free) - This location sets the lagging-most (barrier) phase for each quadrant, before crossing the barrier, when running Free (not in coordination). If no phases are set, the default is set to all even numbered phases. This location is ignored in non-standard quad configurations and barrier phases will be used as lag phases. A barrier crossing is required to implement changes in this location. Lag phasing for Manual Control Operation is set at location 3C2 on the CONFIGURATION timing sheet. Lag phasing for Coordination is set at 7-x-0 (where x = Plan Number) on the Coordination Attributes timing sheet.

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First Phases after Startup - Phases set in this location will be the first phases to go green after a long power down restart. Flagged phases must be able to time concurrently or the data validation logic will modify the data so that only concurrent phases remain. If only a single ring is flagged here, any compatible phase may go green once the flagged phase goes green.

Yellow Startup Phases - Flagged phases will start up in Yellow Clearance interval after a long power down restart. As with First phases, flagged phases must be able to time concurrently or the data validation logic will modify the data so that only concurrent phases remain. Flagged phases will time 5.0 seconds of Yellow Clearance regardless of the Yellow Clearance time entered on the Phase Timing Sheet.

Yellow Start Up Overlaps - Causes any flagged Overlap to start up yellow after a long power down restart. At least one of the Overlap's parents must be flagged as a Yellow Start Up Phase at location 1FE. Columns 1 through 6 correspond to Overlaps A through F. Flagged Overlaps will time 5.0 seconds of Yellow Clearance regardless of the overlap Yellow Clearance time entered on the Overlap Timing Sheet.

Street Configuration Flags

STREET CONFIGURATION									
Keystrokes: 1 + E + row		1	2	3	4	5	6	7	8
Main Street Phases	0	X	X			X	X		
Side Street Phases	1			X	X			X	X
2 Ped Load Switch	2		X						
4 Ped Load Switch	3				X				
6 Ped Load Switch	4						X		
8 Ped Load Switch	5								X
Ped A Load Switch	6								
Ped B Load Switch	7								
Ped Recall	8								
STA Mode	9								
Unused	A								
Unused	B								
Unused	C								
Driveway Flash	D								
2 Head Driveway Flash	E								
Overlap Driveway Flash	F								

Main Street Phases - All phases that will be on the Main Street side of the barrier (even phases that may not be Permitted). On a long power down restart, if this location is not set, the program will default to a standard quad configuration, that is phases 1, 2, 5, and 6 will be set as Main Street phases. Since this parameter is so critical, User Flag Options (location 1DB) call light 2 must be turned on before this location can be changed. In addition, the change will not be implemented until a long power down restart occurs. Any phase not flagged as a Main Street phase will automatically be flagged as a Side Street Phase.

Side Street Phases - for observation only; the user cannot modify this location. After setting Main Street phases and performing a long power down restart, LACO-4E automatically sets Side Street phases based on phases set in Main Street phases above.

Ped Phase Assignments (locations 1E2 through 1E7) - Assigns a corresponding vehicle phase to each ped. Only one phase may be set in any of the six Ped assignments. Ped A and Ped B share Overlap A and Overlap B outputs, respectively. If either of these Overlaps is enabled (by setting parent phases on the Overlap Timing Sheet), the corresponding Ped assignment will be cleared. Note that Ped A and Ped B share the Manual Control inputs. If either Ped A or Ped B is set, the Manual Control feature will be disabled.

Ped Recall - Also referred to as Rest in Walk. Causes a ped call to be placed for the flagged Ped phases. The call is continuous except during the flagged ped's Walk interval. If no opposing call is present, the Ped indication will "rest" in Walk. The Walk interval will time down until 1 second remains in its timer. When an opposing call is placed, the remaining Walk time expires and the Flashing Don't Walk interval begins. If the opposing call drops any time before the phase's Flashing Don't Walk interval ends, the Ped Walk interval restarts and the process begins all over again. Only enabled Peds (as set in locations 1E2 through 1E7 above) can be flagged for Ped Recall.

Semi-Traffic Actuated (STA) Mode - Only enabled Peds (as set in locations 1E2 through 1E7 above) can be flagged for STA Mode. STA (Semi-Traffic actuated) mode is a modified form of Ped Recall that is used only in Coordination. While the controller is running in coordinated mode, the ped phases flagged here will be placed on recall. When the ped serves, it will time out its Walk interval and rest in Walk until the coordinator sets a Force Off for the phase. At that time the ped will time its Flashing Don't Walk interval and then terminate.

Driveway Flash Phases - Causes the green output of the flagged phase to flash (at the same flash rate as the Ped Clearance interval) while timing its green intervals.

2 Head Driveway Flash - Causes the red output of the flagged phase to be set ON during the flagged phase's yellow interval. Any phase flagged here must also be flagged in Driveway Flash Phases above. Used when a 2 section (red and green only) signal head is providing indications for the flagged phase.

Driveway Flash Overlaps - Causes the green output of the flagged overlap to flash (at the same frequency as the Ped Clearance interval) while in its green interval. The 2 Head Driveway Flash modifier above does not apply to this parameter.

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Miscellaneous Flags

MISCELLANEOUS FLAGS									
Keystrokes: 1 + d + row		1	2	3	4	5	6	7	8
Unused	0								
Associated Phase Recall-1	1								
Associated Phase Recall-2	2								
Associated Phase Recall-3	3								
Associated Phase Recall-4	4								
Associated Phase Recall-5	5								
Associated Phase Recall-6	6								
Associated Phase Recall-7	7								
Associated Phase Recall-8	8								
Yellow Calling Phase	9								
Yellow Phase Called	A								
User Flags	B								
Green Offset Sync Pulse	C								
Yellow Offset Sync Pulse	D								
Yellow Ranging Phase	E								
Yellow Ranging Overlap	F								

Associated Phase Recall - 1 - Any phase flagged here will have a locked call placed to it when phase 1 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 2 - Any phase flagged here will have a locked call placed to it when phase 2 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 3 - Any phase flagged here will have a locked call placed to it when phase 3 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 4 - Any phase flagged here will have a locked call placed to it when phase 4 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 5 - Any phase flagged here will have a locked call placed to it when phase 5 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 6 - Any phase flagged here will have a locked call placed to it when phase 6 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 7 - Any phase flagged here will have a locked call placed to it when phase 7 goes green. The call is dropped if the flagged phase is green.

Associated Phase Recall - 8 - Any phase flagged here will have a locked call placed to it when phase 8 goes green. The call is dropped if the flagged phase is green.

Yellow Calling Phase - If a phase flagged here is timing its yellow interval, a locked call is placed to all phases flagged in Yellow Phase Called, below.

Yellow Phase Called - A locked call is placed to all phases flagged here if a phase flagged in Yellow Calling Phase, above, is timing its yellow interval. This parameter is ignored if no phases are flagged in Yellow Calling Phase.

User Flags - Eight(8) flags that enable or disable functions and features. Press the number corresponding to the desired feature to enable/disable it.

User Flag Options (1DB)

1. Mid-Block Ped Crossing
2. Modify Main Street Phases (1E0)
3. Delay RR Track Clearance Phase Green
4. Modified Barrier Crossing (Ignore True Max)
5. Disable Daylight Savings Time Update
6. Enable Output File Editing
7. Freeway Offramp Anti-Backup Logic
8. Ignore Stuck-All-Red Failure

1 = Mid-Block Ped Crossing – Enables the special field indications for the vehicle phase when phase 4 ped is active. (See section 8)

2 = Modify Main Street Phases – This flag must be set in order to change the Main Street phases at location 1E0. A long power down is then required to implement the change at which time the flag is automatically cleared.

3 = Delay Track Clearance Phase Green until All overlaps have terminated - Inhibits the start of Track Clearance Green if any overlap is timing any of its clearance intervals.

4 = Modified Barrier Crossing – Permits a barrier crossing when any combination of Max-out and Gap-out occurs. If this flag is cleared, both rings must either Gap out or Max out.

5 = Disable Daylight Savings Time Update – Prevents the automatic “Fall back” and “Spring ahead” time adjustment for those agencies that do not recognize Daylight Savings Time.

6 = Disable Ped Recycle logic – Disables Ped Recycle logic for peds flagged as either STA Mode or Ped Recall.

7 = Freeway Off Ramp Anti-Backup Logic – Used to prevent freeway off-ramp traffic from backing up onto the freeway lanes. Causes priority service of the off-ramp phase when its advance detector stays actuated for a specified length of time. (See section 8)

8 = Ignore Stuck-All-Red Failure - Prevents the intersection from going into software flash if it gets stuck in an all-Red condition with active calls for more than 30 seconds. (Does not prevent the intersection from getting stuck all Red).

Green Offset Sync Phase - Used to notify another controller (usually the next one downstream in a communications link) when the flagged phase is green. Generally only one phase should be flagged at this location. Only used if one of this controller's Comm Ports is configured for comm option 2, Transmit 7-Wire Data (see next page).

Yellow Offset Sync Phase - Used to notify another controller (usually the next one downstream in a communications link) when the flagged phase is yellow. Generally only one phase should be flagged at this location. Only used if one of this controller's Comm Ports is configured for comm option 2, Transmit 7-W Data (see next page).

Yellow Ranging Phase - Allows the flagged phase to accept a time of less than 3.0 seconds (including 0.0 seconds) or greater than 5.0 seconds (up to 25.5 seconds) for its Yellow Clearance time.

Yellow Ranging Overlap - Allows the flagged overlap to accept a time of less than 3.0 seconds (including 0.0 seconds) or greater than 5.0 seconds for its Yellow Clearance time.

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Communications Options (See section 7 for more information on Communications)

COMMUNICATIONS OPTIONS			System ID = 1 to 255							
System ID	190		Port Mode Options 1 - WWV 2 - Transmit 7 Wire 3 - Receive 7 Wire 4 - Transmit Time/Date 5 - Receive Time/Date 6 - Transmit Plan (not used) 7 - AB3418 Master 8 - AB3418 Slave 9 - Bus Signal Priority							
Port 1 Mode	191									
Port 2 Mode	192									
Port 3 Mode	193									
Port 4 Mode	194									
			1	2	3	4	5	6	7	8
Port 1 Baud	1C0									
Port 2 Baud	1C1									
Port 3 Baud	1C2									
Port 4 Baud	1C3									
Port 1 Parity	1C4									
Port 2 Parity	1C5									
Port 3 Parity	1C6									
Port 4 Parity	1C7									
Baud Rate: 1 - 115.2K 2 - 57.6K 3 - 38.4K 4 - 19.2K 5 - 9600 6 - 4800 7 - 2400 8 - 1200			Parity: 0 - No Parity 1 - Odd Parity 2 - Even Parity							

System I.D - Communications address for the controller. Provides a unique identifier to an external polling system, on-street master, etc based on the AB3418E communications protocol. A value of "0" disables AB3418E Slave operation. **[0-63]**

Comm Port 1

Port 1 Mode - Assigns one of eight Communications options to Communications Port 1 (C2S). Any of the options may be assigned to any Comm Port. Any value other than the ones described below is ignored. **[0-9]**

0 = Communications disabled.

1 = *WWV* - Sets up the Comm Port to communicate with a *WWV* Clock.

2 = *Transmit 7- Wire Data* - Sets up the Comm Port to transmit coordination information in 7-Wire format.

3 = *Receive 7 Wire Data* - Sets up the Comm Port to receive coordination information in 7-Wire format. This is either serial data transmitted from another controller via modem or actual 7-Wire parallel data that has been converted to serial data within the cabinet and then routed to the controller's Comm Port.

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4 = Transmit Time and Date - Sets up the Comm Port to transmit the controller's time and date information. Data is transmitted once per minute. Six(6) bytes are sent; Hours, Minutes, Day of Week (DOW), Day, Month and Year.

5 = Receive Time and Date - Sets up the Comm Port to receive time and date information from another 170E controller. The received time and date overwrites the controller's existing time and date.

6 = Transmit Plan Data – No longer used.

7 = AB3418E Master - Sets up the Comm Port to transmit the controller's time and data information in AB3418E format to any type controller that is capable of receiving AB3418E messages. This information is sent once per hour, on the hour.

8 = AB3418ESlave - Sets up the Comm Port to receive and respond to AB3418E messages from Central or on-street AB3418E Master.

9 = Bus Signal Priority - Sets up the Comm Port to receive and transmit Bus Priority messages.

Port 1 Baud - Assigns any one of eight baud rates to Communications Port 1 (C2S). Only one baud rate can be selected.

Port 1 Parity - Selects the parity for Communications Port 1 (C2S).

Comm Port 2 - Same as Comm Port 1 configuration

Comm Port 3 - Same as Comm Port 1 configuration

Comm Port 4 - Same as Comm Port 1 configuration

Manual Control Configuration (See section 5 for more information on Manual Control operation)

Manual Control Configuration									
Option	Location	1	2	3	4	5	6	7	8
Omit Phases	3C1								
Lag Phases	3C2								
Recall Type	309								

Omit Phases - Phases to be omitted while in Manual Control operation. All phases flagged here will be ignored when the Manual Control Enable input is ON.

Lag Phases - This location sets the last phase for each quadrant (before crossing the barrier) while in Manual Control operation. If no phases are set, the default is all even numbered phases. This location is ignored in non-standard quad configurations and barrier phases will be used as lag phases. A barrier crossing is required to implement changes in this location

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Recall Type - This location determines what type of recall is in force during Manual Control operation. Any value other than the ones described below is ignored. [0-3]

00 = Disable Manual Control - Causes Manual Control operation to be ignored.

01 = No recall - Only phases or peds with detector actuations will be served.

02 = Vehicle Recall Only - All Permitted phases will be placed on recall while in the Manual Control Enable input is ON.

03 = Ped and Vehicle Recall - All Permitted phases and enabled peds will be placed on recall while the Manual Control Enable input is ON.

DETECTORS

The Detector timing sheet contains all of the parameters related to vehicle or system detection. This is where the phases to be called by a detector are assigned along with any “attributes” which may modify the basic operation of each detector. Additionally, the detector Delay and Extension times are set here. Several other fields are provided for textual description only. A representative portion of the Detector Timing sheet is shown below

			File/ Slot/ Channel	Delay		Extended Call		Phase Flags								Attribute Flags									
App	Lanes	Description		Code	Seconds	Code	Seconds	Code	1	2	3	4	5	6	7	8	Code	1	2	3	4	5	6	7	8
				210		230		2B0									2D0								
				211		231		2B1									2D1								
				212		232		2B2									2D2								

Delay Time - (For each of 28 detectors). Any time entered here will cause the detector’s actuation to be ignored for the duration of the delay timer. The delay timer resets to its initial value whenever the detector is **not** actuated or when its assigned phase is yellow. If multiple phases are assigned to a detector, the delay timer reset is disabled during any assigned phase yellow interval. The delay timer will count down to zero as long as an actuation is present. The delay timer is ignored when the detector’s assigned phase is not red. **[0 to 255]**

Extended Call Time - (For each of 28 detectors). A time entered here will cause the detector’s actuation to be extended (or carried over) for the duration of the extension timer. The extension timer resets to its initial value whenever the detector is actuated and counts down to zero as long as there is no actuation. The extension timer is ignored when the detector’s assigned phase is not green. **[0 to 25.5]**

Phase Flags - (For each of 28 detectors) Default phase assignments are indicated by shaded boxes. If no phase is assigned for a detector, then actuation of that detector will cause the shaded phase to be called. Any phase entry for a particular detector will disable the default calling logic for that detector. Any phase or phases can be assigned to any detector. Some detector attributes (described below) will be ignored if multiple phases are assigned.

Attribute Flags - (For each of 28 detectors) Select the number of the desired Attribute(s).

DETECTOR ATTRIBUTES	
FLAG 1 - System Detector	FLAG 5 - Queue Clearing
FLAG 2 - Red & Yellow Lock	FLAG 6 - Non-Counting
FLAG 3 - Yellow Disconnect	FLAG 7 - Special Delay Option 1
FLAG 4 - Red Calling Only	FLAG 8 - Special Delay Option 2

1 = System Detector - Prevents the flagged detector from placing a phase call when actuated.

2 = Red and Yellow Lock - Causes an actuation to be locked if it occurs during the detector phase’s Red or Yellow interval.

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3 = Yellow Disconnect - Causes an actuation to be ignored if it occurs during the detector phase's Yellow interval.

4 = Red Calling Only - Causes an actuation to place a call to the detector's assigned phase **only** if it occurs during the detector phase's Red interval.

5 = Queue Clearing - Allows a detector to use Queue Clearing logic. A call will be placed to the detector's phase only during the phase's Red or Yellow interval. When the phase goes green, a Queue hold will be placed on the phase. If the actuation drops or the Queue Max timer expires, the detector will become disabled for the remainder of the current phase's service. Actuation of this type detector during its assigned phase green interval will not cause phase extension to occur.

6 = Non-Counting - This attribute will inhibit count accumulation for the purposes of Added Initial Green computations.

7 = Special Delay Option 1 - Allows the user to select phases that, when in service, override the detector's delay timer. These phases are selected in Special Delay Option 1 Phases (location 2F8).

8 = Special Delay Option 2 - Allows the user to select phases that, when in service, override the detector's delay timer. These phases are selected in Special Delay Option 2 Phases (location 2F9).

SPECIAL DETECTOR DELAY ASSIGNMENTS		Phase							
All Options: Delay Timer resets during detector phase yellow.	Code	1	2	3	4	5	6	7	8
Special Delay Option 1 (Attribute Bit 7) - Bypasses delay while flagged phases are timing.	2F8								
Special Delay Option 2 (Attribute Bit 8) - Bypasses delay while flagged phases are timing.	2F9								

Special Delay Option 1 Phases - Used in conjunction with Detector Attribute 7. When phases selected here are in service, the detector's delay timer is overridden and actuation is registered immediately. Multiple phases may be selected here.

Special Delay Option 2 Phases - Used in conjunction with Detector Attribute 8. When phases selected here are in service, the detector's delay timer is overridden and actuation is registered immediately. Multiple phases may be selected here.

SYSTEM DETECTORS

Stuck ON Threshold - The length of time, in minutes, that a detector must show **constant** presence before reporting a Stuck ON error condition. This location should be set to 2 minutes or greater. Setting this location to "000" disables Stuck ON error detection. Default value is 000.

Stuck OFF Threshold - The length of time, in minutes, that a detector must show **no** presence before reporting a Stuck OFF error condition. This location should be set to 2 minutes or greater. Setting this location to "000" disables Stuck OFF error detection. Default value is 000.

Chatter - The number of actuations per minute that a detector must register before reporting a Chatter error condition. This location should be set to 2 actuations per minute or greater. Setting this location to "000" disables Chatter error detection. Default value is 000.

Data Collection Period - Defines the period over which Volume, Occupancy and detector diagnostics are collected and computed. Default value is 60 seconds.

OVERLAPS

(See section 5 for details on Overlap operation)

Note: Only Overlap A timings are described here but timings for Overlaps B through F are identical.

OVERLAP A								
Keystrokes: 3 + row + A	1	2	3	4	5	6	7	8
NORMAL PARENTS	A							
GREEN OMIT PARENTS	B							
RR PREEMPT PARENTS	C							
EV PREEMPT PARENTS	D							
LOAD SWITCH ASSIGNMENT	0							
DELAY TIME	1							
GREEN EXTENSION TIME	2							
YELLOW CLEARANCE TIME	3							
RED CLEARANCE TIME	4							

Normal Parents - (For each of 6 overlaps) Parent phases to be used during normal (i.e. non-preempt) service. Phases flagged here must be flagged as Permitted (location 1F0) or they will be ignored.

Green Omit Parents - (For each of 6 overlaps) Prevents the overlap green output from coming on when any parent phase flagged here is green.

RR Preempt Parents - (For each of 6 overlaps) Parent phases to be used during Railroad preemption. Phases flagged here must also be flagged for Railroad Limited Service (location 3A3) or they will be ignored.

EV Preempt Parents - (For each of 6 overlaps) Parent phases to be used during Emergency Vehicle preemption. Phases flagged here must also be flagged as Normal parents and/or RR Preempt parents.

Load Switch Assignment - Allows a three-color overlap output to be sent to any available load switch **in addition** to its default load switch assignment. This will override the output that is normally sent to this load switch. The value entered here corresponds to the CMU channel number assigned to each load switch. "00" means "not echoed", "01" thru "08" sends the overlap output to a vehicle load switch and "13" thru "16" echoes the overlap output to a ped load switch. Any other value is treated as "00". **[1 thru 8 or 13 thru 16]**

Delay Time - (For each of 6 overlaps) Causes the start of overlap green to be delayed for the length of time specified here. The overlap delay timer is set to its initial value whenever the overlap goes red. When any parent phase (not set as a Green Omit Parent) goes green, the delay timer begins to decrement. As long as the delay timer is active, the overlap will output red. When the delay timer expires, if a parent phase is still green, the overlap will go green. **[0 to 25.5]**

Green Extension Time - (For each of 6 overlaps) Causes the overlap to continue to output green beyond its normal termination point. If another overlap parent goes green while this timer is active, the timer will be reset until the next overlap termination sequence begins. **[0 to 25.5]**

Yellow Clearance Time - (For each of 6 overlaps) The length of time that the overlap will output yellow when it terminates. The time entered here is restricted to between 3.0 and 5.0 seconds unless the overlap is selected in Yellow Ranging Overlap (location 1DF). **[3.0 to 5.0]**

Red Clearance Time - (For each of 6 overlaps) The length of time that the overlap will display red during termination. **[0 to 25.5]**

PREEMPTION

(See section 5 for details on Preemption operation)

Railroad Configuration

RAILROAD CONFIGURATION		
RAILROAD SELECT (1, 2 or 3)	360	
ALL RED TIME AFTER RAILROAD FLASH	361	
RAILROAD TRACK CLEARANCE TIME	362	
LIMITED SERVICE MAX TIME	363	
RAILROAD LINK TO EV (see note to right)	364	
FREE TIME AFTER PREEMPT	365	
FREE TIME AFTER PREEMPT, TIMER	366	
MAX TIMER, MINUTES	367	
MAX TIMER, SECONDS	368	

Railroad Select - Sets the Railroad mode for this controller as follows:

0 = Railroad Preemption logic disabled.

1 = Railroad A only - Responds to the RR A input only and can only be configured for RR Flash operation.

2 = Railroad B only - Responds to the RR B input only and can be configured for RR Flash or Limited Service operation.

3 = Railroad A and Railroad B - Responds to both RR A and RR B inputs with Railroad A configured for RR Flash operation and Railroad B configured for Limited Service operation.

Any other value entered here will be changed to "01" automatically and treated as Railroad A only.

All Red After RR Flash - The length of time that the intersection will display all-Red after RR Flash stops at the end of preempt. If this location is set to "00.0", and a RR Flash operation occurs, 5.0 seconds will be loaded into the Ring A and Ring B timers when RR operation ends. **[0 to 25.5]**

Track Clearance Time - The length of time that the phases flagged for Track Clearance (location 3A0) will spend in the green interval. If no time is entered here, then the intersection will go into RR Flash after all phases have terminated, regardless of what is entered for Railroad Select. **[0 to 255]**

Limited Service Max Time - The maximum length of time (in minutes) that Railroad B service will provide Limited Service operation. When this timer expires and the Railroad B input is still active, all phases in service will terminate and the intersection will go to RR Flash. If this location is set to "00", then RR Limited Service operation will never occur. **[0 to 255]**

Railroad Link to EV - This enables an EV preempt sequence that will service automatically following the end of a Railroad preempt sequence. This can be used to provide guaranteed service (as defined by the linked EV's parameters) to selected phases after a RR preempt. **[1, 2, 3 or 4 (for EV A, B, C or D)]**

Free Time After Preempt - Causes the intersection to remain Free after a preempt sequence has ended. Allows phases to serve by demand only in order to clear any backup that may have occurred during the preempt. The running timer may be observed at location 366. **[0 to 255 seconds]**

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Railroad Phases

RAILROAD PHASES		1	2	3	4	5	6	7	8
TRACK CLEARANCE	3A0								
RAILROAD EXIT	3A1								
RAILROAD PED ONLY	3A2								
LIMITED SERVICE	3A3								

Track Clearance Phases - The phases that become active in order to clear vehicles from the railroad tracks before a train arrives at the intersection. If no phases are selected here, then the intersection will go into RR Flash after all phases have terminated regardless of what is entered for Railroad Select. Phases entered here must be able to time concurrently.

Railroad Exit Phases - The phases that will service first after the Railroad preempt sequence ends. Phases entered here must be able to time concurrently.

Railroad Ped Only Phases - Ped movements that will service without a corresponding vehicle service. Generally set for phases for which ped service is desired but which are not selected as Limited Service Phases. Phases entered here must also be enabled on the Configuration timing sheet.

Limited Service Phases - Phases that will time normally after the Track Clearance interval of a RR B preempt service. Any phases may be entered here.

Aux 3 Yellow Output Control

AUX 3 YELLOW OUTPUT CONTROL (Keypress 3+C+0)		
	1	Railroad A
	2	Railroad B
	3	Emergency Vehicle A
	4	Emergency Vehicle B
	5	Emergency Vehicle C
	6	Emergency Vehicle D
	7	Manual Control
	8	unused

Aux 3 Yellow Output Control - Allows the Aux 3 Yellow output to reflect the status of preemption and Manual Control. This output can be used to provide advance warning to motorists, etc. The Aux 3 Yellow output will go ON whenever any of the flagged functions is active.

EV Configuration

EV CONFIGURATION		1	2	3	4	5	6	7	8
EV FLAGS	390								
EV A CLEARANCE PHASES	391								
EV B CLEARANCE PHASES	392								
EV C CLEARANCE PHASES	393								
EV D CLEARANCE PHASES	394								

EV Flags - Modifies the default EV operation as follows:

1 thru 4 = not used

5 = EV A truncates Ped Flashing Don't Walk interval. If the EV preempt occurs during the Walk interval, the Flashing Don't Walk interval will be skipped. If the EV preempt occurs during the Flashing Don't Walk interval, the remainder of the Flashing Don't Walk time will be skipped.

6 = EV B truncates Ped Flashing Don't Walk interval. If the EV preempt occurs during the Walk interval, the Flashing Don't Walk interval will be skipped. If the EV preempt occurs during the Flashing Don't Walk interval, the remainder of the Flashing Don't Walk time will be skipped.

7 = EV C truncates Ped Flashing Don't Walk interval. If the EV preempt occurs during the Walk interval, the Flashing Don't Walk interval will be skipped. If the EV preempt occurs during the Flashing Don't Walk interval, the remainder of the Flashing Don't Walk time will be skipped.

8 = EV D truncates Ped Flashing Don't Walk interval. If the EV preempt occurs during the Walk interval, the Flashing Don't Walk interval will be skipped. If the EV preempt occurs during the Flashing Don't Walk interval, the remainder of the Flashing Don't Walk time will be skipped.

EV A Clearance Phases - Those phases that will serve during the EV A clearance interval. Flagged phases must also be either Permitted phases or Railroad Limited service phases. Phases entered here must be able to time concurrently. If no phases are set, the preempt is ignored.

EV B Clearance Phases - Those phases that will serve during the EV B clearance interval. Flagged phases must also be either Permitted phases or Railroad Limited service phases. Phases entered here must be able to time concurrently. If no phases are set, the preempt is ignored.

EV C Clearance Phases - Those phases that will serve during the EV C clearance interval. Flagged phases must also be either Permitted phases or Railroad Limited service phases. Phases entered here must be able to time concurrently. If no phases are set, the preempt is ignored.

EV D Clearance Phases - Those phases that will serve during the EV D clearance interval. Flagged phases must also be either Permitted phases or Railroad Limited service phases. Phases entered here must be able to time concurrently. If no phases are set, the preempt is ignored.

EVA Setup

EV A SETUP		
DELAY	310	
ACTIVE	311	
CLEARANCE	312	
MAXIMUM	313	
LINK TO EV	314	
MINIMUM	315	

Delay - Prevents any EV preempt from taking control of the intersection. The delay timer (observed at location 300) gets set and begins timing when an EV preempt input goes TRUE. While the delay timer is active, no Holds, Calls or Force Offs will be placed by the preempt logic. **[0 to 255]**

Active - The active timer (observed at location 301) gets set when an EV preempt input goes TRUE. When the delay timer expires, the active timer begins. During this period, the preempt logic places Holds and Calls to all of the EV Clearance phases. **[0 to 255]**

Clearance - This is the guaranteed length of time that the EV Clearance phases will display green. The clearance timer (observed at location 302) gets set when an EV preempt input goes TRUE. The clearance timer counts down after both the active and delay timers have expired and once all EV Clearance phases are green. If this time is not set, then the preempt sequence will go out of service as soon as the EV Clearance phases go green. **[0 to 255]**

Maximum - This time is used as a safeguard against a stuck ON preempt input. The max timer (observed at location 303) gets set when an EV preempt input goes TRUE. It begins to count down, in whole seconds, after both the active and delay timers have expired. **NOTE:** If this time is not set, then there will be no protection against stuck ON preempt inputs. **[0 to 255]**

Link to EV - This enables an EV preempt sequence that will service automatically following the end of this preempt sequence. This can be used to provide guaranteed service (as defined by the linked EV's parameters) to selected phases after a RR preempt. The EV will not be permitted to link to itself. Also, any value greater than "004" will be ignored. **[1, 2, 3 or 4]**

Minimum - This parameter is used to inhibit reservice of a preempt sequence for a set time. The EV minimum timer (location 316 for EVA, 326 for EVB, 336 for EVC and 346 for EVD) gets set when the preempt input goes ON. When the EV Clearance expires (indicating end of the preempt sequence), the EV minimum timer counts down to zero. As long as this timer is non-zero, further EV input actuations will be ignored. **[0 to 255]**

BUS SIGNAL PRIORITY (BSP)

(See section 8 for details on BSP operation)

BUS PRIORITY CONTROL			
Manual Control		1E00	
SINGLE BUS	MULTI BUS		
Primary Addr.	Bus Address	1E01	
Secondary Addr.	Unused	1E02	
City Code	City Code	1E03	
Hardwired ETA	Early Green	1E04	
Trip Point	Green Extension	1E05	

BSP MODE (1E00) Options
Single Bus Priority Modes
0 = Auto
1 = Logic OFF
2 = Logic ON/No Communications
4 = Headway/No Communications
7 = Hardwire
11 = Multi Bus Priority
14 = BSP OFF

Bus Priority Control

Manual Control - Use the decimal display mode for this location. Setting it to zero activates the BSP Communications and Logic routines. **[0, 1, 2, 4, 7, 11 or 14]**

Single Bus – Bus priority modes associated with one direction

Primary Address - The first of two address locations allowed under the BSP (modified NTCIP) protocol format. This location contains the lower order address information and has a range of 1-255. Address zero is undefined and will be ignored. Set the display to decimal mode to enter or view the data. **[0-255]**

Secondary Address - If this address location is not used, it must remain zero. The Secondary Address is actually an extension of the Primary Address. Each number in this location equals 256. For controller addresses greater than 255 set the extension number (1-31) at this location and the lower order address in the Primary Address. (i.e. controller address 300. Set Primary Address 1 = 1 and Secondary Address 2 = 44: $256 \times 1 + 44 = 300$). Set the display to decimal mode. **[0-31]**

City Code - The unique city code number assigned to your city by the MTA. This location is part of the addressing logic and must be set correctly to receive the Bus priority message. Set the display to decimal for this location. **[0-127]**

Hardwired ETA - Used when running the BSP program in the hardwired mode (7). In this mode of operation, there is no communication from the bus to the traffic signal controller. The operator must set an average ETA, in seconds, for the priority buses based on the detection system in use. Enter this number in the decimal display mode. **[0-255]**

Trip Point - The minimum time, in seconds, that the ETA timer can count down to and still perform the priority service. The operator should take into account the phase minimum timings and set the Trip Point accordingly. Set this location in the decimal display mode. **[0-255]**

Multi Bus – Bus priority assignable to multiple directions.

Bus Address - The packet address in the Signal Priority Message Format has a range of 1-255. Address zero is undefined and will be ignored. Set the display to decimal mode to enter or view the data. **[0-255]**

City Code - The unique city code number assigned to your city by the MTA. This location is part of the addressing logic and must be set correctly to receive the Bus priority message. Set the display to decimal for this location. **[0-127]**

Early Green Time—The time in seconds that the phase timing may be adjusted to allow the priority phase to enter green early. In free operation this value may be subtracted from the max time of non-

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priority phases. In coordination the intervals for non-priority phases may be shortened by this value. Any phases selected for No Early Green (**1E08**) will not have their max time or interval time shortened, nor will any phases that are currently in demand override (**1E17**). Enter this number in the decimal display mode. **[0-255]**

Bus Green Extension - The time in seconds that the green time of a priority phase may be extended to service a bus priority. This value is added to the bus's most current ETA. Set this location in the decimal display mode. **[0-255]**

BUS PHASES			1	2	3	4	5	6	7	8
SINGLE	MULTI									
Priority	Ext. Only	1E08								
Demand	Demand	1E09								
NB	Bus A	1E0A								
SB	Bus B	1E0B								
EB	Bus C	1E0C								
WB	Bus D	1E0D								

Bus Phases – Single Bus

Priority - Allows the operator to select which phases will be given the priority consideration. These phases will receive the additional green time from the non-priority phases.

Set the display mode for binary and enter in the phases (typically one phase per ring within the same barrier) that will be given priority consideration.

Demand - Selects which phases will be included in the demand override logic.

Phases selected have their status flag at locations **1E18-1E1F** updated each time the phase ends. If the phase maxes out or reaches its force off the status flag is incremented by one. When the status flag count reaches 3, the phase is set in Demand Override (**1E17**, BSPDFAZ). If the phase gaps out, the status flag is decreased by one. When the status flag reaches zero, the phase is cleared in BSPDFAZ.

When the demand logic has set a phase in the Demand Override flags (**1E17**), it will prevent the reallocation of that phase's green time during bus priority. This allows phases with continual heavy demand to be excluded from the BSP logic, If a BSP request is received for a priority phase that is in demand override, the request will be denied with a "demand override" response.

Northbound - The North bound priority vehicle. Using the binary display mode, set the priority phase that corresponds to buses traveling in the North bound direction. Assign one phase only.

Southbound - The South bound priority vehicle. Using the binary display mode, set the priority phase that corresponds to buses traveling in the South bound direction. Assign one phase only.

Eastbound - The East bound priority vehicle. Using the binary display mode, set the priority phase that corresponds to buses traveling in the Eastbound direction. Assign one phase only.

Westbound - The West bound priority vehicle. Using the binary display mode, set the priority phase that corresponds to buses traveling in the West bound direction. Assign one phase only.

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Bus Phases – Multi Bus

No Early Green - Allows the operator to select which non-priority phases will not have their max timer shortened in free or their interval shortened in coordination. Set the display mode for binary and to enter the phases.

Demand – Same as for single bus mode.

Northbound/Bus A – Phase to be active for a Bus A priority request. Using the binary display mode, set the priority phase that correspond to Bus A priority requests. Assign one phase only.

Southbound/Bus B - Phase to be active for a Bus B priority request. Using the binary display mode, set the priority phase that correspond to Bus B priority requests. Assign one phase only.

Eastbound/Bus C - Phase to be active for a Bus C priority request. Using the binary display mode, set the priority phase that correspond to Bus C priority requests. Assign one phase only.

Westbound/Bus D - Phase to be active for a Bus D priority request. Using the binary display mode, set the priority phase that correspond to Bus D priority requests. Assign one phase only.

BSP Override Table									
	Hour:Min	Dir	S	M	T	W	T	F	S
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

Bus Override Table

Data Entry for BSP Override Table

1. "9" + "9" sets controller to Table Entry mode pointing to BSP Table, Event 0.

2. Press "A" or "D" to move to desired Event.

3. Enter 4 digit Time of Day.

4a. For **Single Bus**, enter 1 digit Direction Override:

1 = N 3 = N+S A = S+W D = N+S+W

2 = S 5 = N+E C = E+W E = S+E+W

4 = E 6 = S+E 7 = N+S+E F = All

8 = W 9 = N+W B = N+E+W 0 = None

4b. For Multi Bus, enter Bus to override or clear:

A = A B = B C = C D = D

1 = clr A 2 = clr B 3 = clr C 4 = clr D

F = ALL 0 = None

Then press "E" to select Days of Week

5. Select Day(s) of Week.

6. Press "A" or "D" to move to next Event.

7. Repeat steps 3 through 6 for each Event

8. Press "F" key to finish.

The BSP Override Table (Table 9) allows sixteen entries and requires four user entered values: Hour followed by Min followed by the Direction override code and the Day of Week flag(s). This table is searched every minute along with the TOD tables. If a search of this table matches the current time and day of week in the controller, all priority phases associated with the "Dir/Bus" entry will be disabled.

ZIP COORDINATION

(See section 6 for details on Zip Coordination operation)

The following parameters are common to both Zip Coordination and Standard Coordination and are described in the Coordination subsection:

- System Manual (4-0-0)
- Local Manual (4-0-1)
- Minimum Cycle Length (4-0-8)
- Maximum Cycle Length (4-0-9)
- Plan Offsets (7-A-1 through 7-A-9)
- Midnight Sync Pulse Hour (7-A-B) and Minute (7-A-C)
- Offset Timing Plan (7-A-A)

The following parameters apply to Zip Coordination only:

Parameters		Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8	Plan 9
		1	2	3	4	5	6	7	8	9
Cycle Length	0									
Force Off Ø 1	1									
Force Off Ø 2	2									
Force Off Ø 3	3									
Force Off Ø 4	4									
Force Off Ø 5	5									
Force Off Ø 6	6									
Force Off Ø 7	7									
Force Off Ø 8	8									
Hold Release	9									

Zip Coord Enable - Set this location to any non-zero value to enable the Zip Coord timing and disable the Standard Coordination timing.

NOTE: The following parameters can be set for each of nine plans.

Cycle Length - The length of the coordination cycle to be timed. This time must be greater than the Minimum Cycle Length and less than the Maximum Cycle Length above. **[0 to 255]**

Force Off 1 (through Force Off 8) - The point in the current cycle at which a Force Off is placed for the applicable phase. Force Off 1 applies to phase 1 and so on through Force Off 8. The Force Off is applied for 1 second. The time entered here must be less than the cycle length. **[0 to 255]**

Hold Release - The point in the cycle at which the coordination Hold is released from phases 2 and 6 (the default coordinated phases). The time entered here must be less than the cycle length. **[0 to 255]**

COORDINATION

(See section 6 for details on Coordination operation)

The following parameters are common to both Zip Coordination and Standard Coordination. Refer to the Coordination 1 Timing Sheet (Appendix A7).

Plan Offset Times - The desired offset time between the Master Cycle Timer and the Local Cycle Timer, for each of the nine plans. Values entered here should be less than the plan's Cycle Length. **[0 to 255]**

Offset Timing Plan - This defines which plan number to run when the Local Coordinator is configured for Offset Timing Mode. If no plan is entered, the default is Plan 3. **[1 to 9]**

Midnight Sync Pulse - The Hour and Minute that the Midnight Sync pulse will be transmitted to slave controllers in the "Transmit 7-Wire" communication message. Hour **[0 to 23]**, Minute **[0 to 59]**

System Manual - This parameter sets the Master operating mode. Available entries are:

0 = Automatic Time Base mode. Searches the Time Of Day table (as indicated in location 405) and runs the plan/function found there.

1 through 9 = The Master coordinator is manually set to operate the plan number indicated.

14 = Manually sets the Master coordinator to operate in the Free mode.

Any Other entry = The entry is ignored and the last commanded plan is used.

Local Manual - A non-zero value here overrides the plan commanded by the Master (as indicated in System Manual, above) or the TMC (as indicated in location 404). The available entries are:

0 = Automatic Time Base mode. Searches the Time of Day table (as indicated in location 405) and runs the plan/function found there.

1 through 9 = manually runs the plan number entered here.

11 = manually causes the local coordinator to run in Slave Mode.

12 = manually causes the local coordinator to run in Offset Timing Mode.

14 = manually disables Local Coordination.

15 = manually sets the controller to operate in Flash mode (Local Coordinator runs Free).

Minimum Cycle Length - The minimum cycle length that can be timed. If this value is set to "255", it will automatically be changed to "254". **[0 to 254]**

Maximum Cycle Length - The maximum cycle length that can be timed. This value must be greater than the Minimum Cycle Length, above, or it will automatically be changed to 255. **[11 to 255]**

The remaining entries in this first column are controlled by the program and are for observation only.

- Master Plan (402) – The Plan number being commanded by the Master Coordinator.
- Local Plan (403) – The Plan number actually implemented by the Local Coordinator.
- TMC Override (404) – Overrides Time of Day plan when downloaded from Central.
- Time of Day Plan (405) – The Plan number that is selected by the Local Coordinator's TOD logic.
- Special Function (406) – The currently commanded state of the Special Function output.
- Current Table (407) – The TOD table that the Local Coordinator is using to select the Time of Day Plan.
- Master Cycle Timer (40A) – The current value of the Master Cycle timer, updated each second.
- Local Cycle Timer (40B) – The current value of the Master Cycle timer, updated each second.
- New Offset Time (40C) – The Offset time associated with the current commanded Plan
- Current Offset Time (40D) – The current offset time. This may be different from the New Offset time when the coordinator is in transition.
- Last Master Cycle (40E) – The time in the Master Cycle timer when the last Sync Pulse was sensed.
- Last Local Cycle (40F) – The time in the Local Cycle timer when the last Sync Pulse was sensed.

Intervals – Intervals are discrete points within a plan cycle indicating when a coordination function is turned ON or OFF. The first interval (row 0) defines the plan's Cycle Length (but is also treated by the program as Interval 1 with a fixed time of zero seconds). It should be the largest value of any entry in that column. Interval times should be in increasing value with increasing row number and cannot be greater than the cycle length. Also, all entries must be sequential (no entry can be skipped). **[0 to 255]**

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Coordination Functions:

Coordination Functions work in conjunction with the Coordination Interval parameters. For example, if there is a time entered for interval 3 of Plan 2 (location 423), then the functions below will be applied to the phases entered in row 3 of Plan 2 (locations 483, Force Off; 493, Hold; 4A3, Ped Restrict; 4B3, Call).

Force Offs – Indicates the phases to be terminated at the desired interval when an opposing call is present. The Force Off will remain in effect until the phases are no longer indicated in the subsequent intervals (or until cycle zero if there are no subsequent intervals).

Holds - Indicates the phases to be held at the desired interval. The Hold will remain in effect until the phases are no longer indicated in the subsequent intervals (or until cycle zero if there are no subsequent intervals).

Ped Restricts - Indicates the phases for which the ped operation will be restricted (not be answered) at the desired interval. The Ped Restrict will remain in effect until the phases are no longer indicated in the subsequent intervals (or until cycle zero if there are no subsequent intervals).

Calls - Indicates the phases to be called at the desired interval. The Call will remain in effect until the phases are no longer indicated in the subsequent intervals (or until cycle zero if there are no subsequent intervals).

COORDINATION ATTRIBUTES

Attributes		PLAN 1							
		1	2	3	4	5	6	7	8
Coordination Lagging Phases	0								
Minimum Vehicle Recall Phases	1								
Pedestrian Recall Phases	2								
Maximum Vehicle Recall Phases	3								
Barrier Recall Phases	4								
Green Calling Phases	5								
Green Call-To Phases	6								
	7								
Phases to use Max 1	8								
Red Rest Phases	9								
Omitted Phases	A								
Phases to Omit Systems Detectors	B								
STA Mode Phases	C								
	D								
	E								
	F								

The coordination phase attributes operate the same as the Phase Function Flags on the Configuration Timing Sheet. The coordination phase attributes are only active when their corresponding coordination plan is active. Any phases flagged here must also be flagged as Permitted phases (location 1F0).

Any phases flagged here will be **in addition** to any phases flagged for the equivalent Phase Function Flag (on Timing Sheet 2). For example, if phases 2 and 6 are flagged for Phase Function Flag minimum recall and phases 3 and 7 are flagged for Plan 2 Coordination Minimum Recall, then phases 2, 3, 6 and 7 will all be on minimum recall while Plan 2 is active.

Coordination Lagging Phases - This location sets the lagging-most (barrier) phase for each quadrant, before crossing the barrier, when running coordinated. If no phases are set, the default is set to all even numbered phases. This location is ignored in non-standard quad configurations and barrier phases will be used as lag phases. A barrier crossing is required to implement changes in this location. If no phases are selected here, then those phases set at location 1FC (LAGFRE) will be used.

Minimum Vehicle Recall Phases - Causes a call to be placed for a phase during its Red interval only. This call will remain in place until the phase goes green.

Ped Recall Phases - Causes a ped call to be placed for the flagged Ped phases. The call is continuous except during the flagged Ped's Walk interval. If no opposing call is present, the Ped indication will "rest" in Walk. The Walk interval will time down until 1 second remains in its timer. When an opposing call is placed, the remaining Walk time expires and the Flashing Don't Walk interval begins. If the opposing call drops any time before the phase's Flashing Don't Walk interval ends, the Ped Walk interval restarts and the process begins all over again. Only enabled Peds (as set in locations 1E2 through 1E7) can be flagged for Ped Recall.

Maximum Vehicle Recall Phases - Causes a continuous call to be placed for a phase. This results in the phase staying green until its Maximum Green Timer has expired (even if no Vehicle Extension time is set for the phase).

Barrier Recall Phases - Causes a call to be placed at barrier crossing for flagged phase(s).

Green Calling Phases - This parameter works in conjunction with Green Call-To phases, below. While any phase flagged here is green, the Green Call-To phases will have a locked call placed for them. Both of these parameters must be set or they will be ignored.

Green Call-To - This parameter works in conjunction with Green Calling phases, above. A locked call will be placed to all phases flagged here whenever any Green Calling phases are green. Both of these parameters must be set or they will be ignored.

Phases to Use Max I - Forces the flagged phases to use Max I green time instead of the default Max II green time.

Red Rest Phases - Causes a phase to terminate and rest in red if that phase is resting in green and there are no opposing calls to that phase.

Omitted Phases - Causes the program logic to ignore all phases flagged here while the configured plan is active. If a flagged phase is in service when the plan takes effect, it will be forced off (even if there is no call to a conflicting phase).

Phases to Omit System Detectors - Future implementation.

STA (Semi-Traffic Actuated) Mode Phases - Only enabled Peds (as set in locations 1E2 through 1E7) can be flagged for STA Mode. While the controller is running in coordinated mode, the ped phases flagged here will be placed on recall. When the ped serves, it will time out its Walk interval and rest in Walk until the coordinator sets a Force Off for the phase. At that time the ped will time its Flashing Don't Walk interval and then terminate.

COORDINATION TABLES

(See section 6 for details on Coordination Tables)

Coordination tables provide the user with more flexibility and options as to what Plan or Function to run and when to run it. The tables fall into two categories, Time of Day tables and “Exception” tables. Table 0 is the default Time of Day table.

Time of Day Tables (0 through 4)

TABLE 0 - Time Of Day

Event	Hour:Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
A									
B									
C									
D									
E									
F									

Plan:

1 through 9

Function:

A – Special Function Output Steady ON

B – Special Function Output Flashing

C – Offset Timing Mode

D – Special Function Output OFF

E – Free Mode

F – Time of Day Flash

Hour: Min - Specifies the time of day, military time, that the indicated plan or function is to take effect.

Plan or Function - One of nine coordination plans or six coordination functions to take effect at the specified time and day.

Day of Week - Indicates which days of the week a plan or function is to take effect.

Annual Event Table (5)

This table is used for any user-defined Annual events.

TABLE 5 - Annual Events

Event	Month/Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0									
1									
2									
3									
4									
5									
6									
7									
8									
9									
A									
B									
C									
D									
E									
F									

Month/Day – Enter the month and day, in MM/DD format, of the annual event to be searched for.

Table – Enter the Time of Day table number (tables 0 through 4) to be used when the annual event occurs.

Day of Week – Enter the day(s) of the week that the annual event must fall on in order to run the selected table.

Floating Holiday Table (6)

This table is populated with the Los Angeles County default Floating Holiday data.

TABLE 6 - Floating Holidays

Event	Month/Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	01/03	1		X					
1	02/03	1		X					
2	05/09	1		X					
3	09/01	1		X					
4	11/04	1					X		
5									
6									
7									
8									
9									
A									
B									
C									
D									
E									
F									

Month/Day - Indicates the month and on which occurrence of the specified day of week that specified table is to be used. For example, Event 0 will invoke Time of Day table 1 on the 3rd Monday in January.

Table - Enter Time of Day table number (0 through 4) to be used, or "B" to ignore BSP Priority logic for the specified holiday.

Day of Week - Indicates which day of week that the holiday must fall on in order for the indicated table to be run.

Exception Day Table (7)

This table indicates all fixed holidays. All fixed holidays observed by Los Angeles County are defaulted here.

TABLE 7 - Exception Days

Event	Month/Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	01/01	1		X	X	X	X	X	
1	01/02	1		X					
2	07/04	1		X	X	X	X	X	
3	07/05	1		X					
4	11/10	1						X	
5	11/11	1		X	X	X	X	X	
6	11/12	1		X					
7	12/24	1		X	X	X	X	X	
8	12/25	1		X	X	X	X	X	
9	12/26	1		X				X	
A									
B									
C									
D									
E									
F									

Month/Day – Enter the month and day, in MM/DD format, of the exception day to be searched for.

Table – Enter the Time of Day table number (tables 0 through 4) to be used, or "B" to ignore BSP Priority logic for the specified holiday.

Day of Week – Enter the day(s) of the week that the exception day must fall on in order to run the selected table.

PROGRAMMABLE LOGIC

This feature is new to the LACO series of programs. It provides all common logic operations including AND, OR and XOR gates (plus their negations), a Set/Reset Latch, a Relay, and Delay, Extension and One-Shot timers. Only C1 input pins can be modified but both C1 input pins and output pins can be used to modify the input. This timing sheet uses “logic” pin numbers that are derived from the I/O port and bit numbers. The logic pin numbers (and their associated I/O function and C1 pin number) can be found on the Programmable Logic Worksheet in Appendix A15, Appendix E1 (Inputs) and Appendix E2 (Outputs). See section 8 for details on this feature, including operation of each of the gates/functions and examples.

Note that this data is accessed using the Extended Memory Display mode. This requires that the first key press be “8” followed by the 4-digit memory location. For example, to enter data for Input 1 of And Gate 1, the 5-key sequence would be “8-1-2-8-0”. See section 2 for details on the Extended Memory Display mode.

Logic Gate Inputs – Enter the logic pin number of the input, output or logic gate link that is to be used for the desired logic operation. Logic pin numbers are entered just as they appear in the appendix referenced above. For example “22” corresponds to the I1 detector input.

Logic Gate Outputs – Enter the logic pin number of the input that gate logic is to act on (or logic gate link if this output is to be used as in input for another logic function).

Latch Inputs - Enter the logic pin number corresponding to the input, output or logic gate link that is to be used as the latch Set or Reset input.

Latch Outputs – Enter the logic pin number of the input that the Latch logic is to act on (or logic gate link if this output is to be used as in input for another logic function).

Relay Input - Enter the logic pin number corresponding to the input, output or logic gate link that is to be used as the Relay input.

Relay Coil - Enter the logic pin number corresponding to the input, output or logic gate link that is to be used as the Relay Coil control.

Relay Outputs - Enter the logic pin number of the input that the Relay logic is to act on (or logic gate link if this output is to be used as in input for another logic function).

Timer Input - Enter the logic pin number corresponding to the input, output or logic gate link that is to be used as the Timer input.

Timer Type – This parameter allows the user to select the timer type. The available options are:

01 = .1 second Delay timer

10 = Whole second Delay timer

02 = .1 second Extension timer

20 = Whole second Extension timer

03 = .1 second One Shot timer

30 = Whole second One Shot timer

Timer Time – Enter the desired timer interval here. The time entered here depends on the scale of the selected timer type. For a 3.0 second “tenth seconds” timer, enter “030”. For a 3 second “whole second” timer enter “003”.

Timer Output – Enter the logic pin number of the input that the Timer logic is to act on (or logic gate link if this output is to be used as in input for another logic function).

SECTION 5 OVERLAPS AND PREEMPTION

OVERLAPS

PREEMPTION

PREEMPTION OUTPUT

RAILROAD

EMERGENCY VEHICLE

MANUAL CONTROL

OVERLAPS

LACO-4E offers the industry standard Overlap functionality with a few enhancements:

- Parents can be selected separately for Normal, RR or EV operation.
- All 3-color overlap outputs can be redirected to unused vehicle or ped load switches.
- All overlaps can be configured to time a delay prior to start of green.
- Green Omit logic is available to overlaps for ped protection on right turns.
- Individual clearance times are available for green, yellow and red indications.

Basic overlap logic is such that when any parent phase is green, the overlap is also green. Additionally, the overlap will remain green if a parent phase to that overlap is terminating to another parent phase. The only exception to this logic is when a green parent phase is also flagged as a Green Omit parent. When *any* Green Omit parent phase is green, the overlap will be **dark**. This is true of both 3-color overlaps and 2-color overlaps.

NOTE

The Green Omit feature is intended for two section field displays. Any 3-color overlap that uses the Green Omit feature should be redirected to an unused ped load switch. If that is not possible, the output channel should be configured in the cabinet such that a Red Fail condition is not triggered when the green indication goes dark.

The LACO-4E logic normally allows selection of FAZNXT (the phases to serve next) up until the last 0.1 second of the terminating phase's Red Clearance time. This provides crisp response to actual intersection demand. An exception is made if an overlap is green. When an overlap parent phase terminates, the phase that caused termination of the parent phase is locked at the beginning of the terminating phase's yellow interval. This phase will be serviced next even if the demand drops.

As mentioned above, each overlap can have separate parent phase assignments for Normal operation, Railroad preempt or Emergency preempt. For Normal parents, the selected phases must also be permitted phases. For Railroad parents, the selected phases must also be either Track Clearance phases or Limited Service phases. For Emergency Vehicle parents, the selected phases must also be either permitted phases or Limited Service phases. If an overlap is in service during Normal operation when a Railroad or EV preempt sequence starts, the overlap will continue or terminate based on the parent phases selected for each operation.

If an overlap is due to terminate (because its parent phase is terminating to a non-parent phase) across the barrier, and a parent phase exists in a non-calling ring across the barrier, then a call will be placed to the first parent phase in the non-calling ring so that the overlap may continue. This is done to eliminate the occurrence of an inactive ring in such situations. This logic is analogous to the phase Barrier Recall logic but is fixed and cannot be disabled by the user.

Any 3-color overlap output can be echoed to any of the Output File load switches. This is done by entering the location of the new load switch for the desired overlap, i.e. location 30D for Overlap D. The CMU channel numbering system is used as a reference for this parameter. Enter "001" through "008" to echo to the phase load switches or "013" through "016" to echo to the ped load switches. Any other value will be reset to "000" and no echo will take place. Note that this is a "blind" echo in that the echoed overlap will overwrite any other indications being sent to the load switch. Therefore, care should be taken to ensure that the load switch is not being used by another phase or ped.

PREEMPTION

LACO-4E's preemption logic is exceptionally flexible and versatile as indicated below:

Railroad

- Three different modes of operation
- Two prioritized (concurrent) inputs
- Both limited service and flash operation supported
- Concurrent emergency vehicle service is supported during railroad limited service operation
- Ped only logic is supported during railroad limited service operation
- Can link to a selected EV sequence following the railroad sequence
- Three timers provided
- Four phase flags provided

Emergency Vehicle

- Four equal priority inputs
- Five timers provided
- Can link to a (different) selected EV sequence following the actuated sequence

Manual Control

- Dedicated Omitted phases
- Dedicated Lag phases
- Three phase/ped recall options

PREEMPT OUTPUT

Auxiliary output file slot 3 (AUX 3) can be set to output preemption and manual control indications. At location 3C0, select any combination of Railroad preempt, Emergency Vehicle preempt or Manual Control desired. When any of the selected operations is active, the Aux 3 Yellow output will be turned on. This output can then be used to provide a visible preempt condition at the intersection or it can be sent up/down stream to provide preempt status to adjacent controllers. This can be useful if the receiving controller has some form of programmable logic similar to LACO-4E.

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SECTION 5 – OVERLAPS and PREEMPTION

RAILROAD

The Railroad preemption feature contains logic that one would expect to find in the higher end ATC controllers, plus it has one function that is unique to LACO programs. All conventional programs provide two Railroad preempts and four Emergency Vehicle preempts (some also offer an additional four low priority preempts, generally intended for implementation of Bus Priority Service). LACO-4E provides the same six preempts with two significant enhancements.

- **The two Railroad inputs are processed concurrently providing prioritization of railroad service.** The higher priority input, RR A, results in Flash operation while the lower priority input, RR B, results in Limited Service operation. If the RR B preempt is active, a RR A input will override the RR B sequence. Conversely, the RR B input is ignored when the RR A sequence is active.
- **An Emergency Vehicle preempt sequence can serve concurrently under a Railroad Limited Service preempt sequence (nested preempts).** Any EV preempt sequence with Clearance phases that are also Railroad Limited Service phases may be serviced while that Limited Service operation is active.

The following parameters can be used in any combination to provide customized response to Railroad preemption:

Railroad Select - Three operating modes; RR Flash only (single input), Limited Service only (single input) or RR Flash and Limited Service together (dual input).

All Red time after Flash – This is the length of time the intersection will show all Red outputs. If no value is entered here, the controller will time 6.0 seconds of all Red.

Railroad Track Clearance time - This will be the minimum length of time that the Track Clearance phases can output a green indication. If this value is set to zero, then track clearance is skipped and the intersection defaults to RR Flash operation, regardless of the entry in Railroad Select.

Limited Service Max time - If a non-zero value is entered here, when the RR Max timers expire, the intersection will revert to RR Flash operation for the duration of the preempt sequence. If zero is entered here, no time limit is placed on the duration of the Limited Service sequence.

Railroad Link to EV - Entering an EV number here causes that EV sequence to service immediately following the end of the Railroad preempt sequence. This can provide a more controlled transition from Railroad operation to Normal operation.

Free Time After Preempt - This parameter is used for both Railroad and EV operation. When any preempt sequence goes active, the local coordinator is suspended and control of the coordination function outputs is given to the preemption logic. After the preemption sequence ends, the Free Time After Preempt *timer* (seconds) must expire before control of the coordination function outputs is passed back to the local coordinator. This allows a period of Free operation following a preemption sequence.

Track Clearance phases - Select the phase numbers corresponding to the movements that cross the path of the oncoming train. Phases entered here must be concurrent. The data validation logic prohibits entry of non-concurrent phases. If no phases are selected here, then track clearance is skipped and the intersection defaults to RR Flash operation, regardless of the entry in Railroad Select.

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SECTION 5 – OVERLAPS and PREEMPTION

Railroad Exit phases - Under default operation, when a preempt sequence ends, the next phases to be served are determined by which railroad mode was in operation. For RR Flash, the next phases (with demand) following the preempted phase(s) will serve first. This includes any phases which may have been called by actuation (even if later dropped) while the preempt sequence was active. For Limited Service, the next phases (with demand) following the last phases in service when the preempt sequence ended will serve first. In both of these modes, Railroad Exit phases will override the default operation and serve first. Only concurrent phases can be entered here. The data validation logic prohibits entry of non-concurrent phases.

Railroad Limited Service phases – These are phases that correspond to vehicle movements that are safe to service while a train is crossing one of the intersection's approaches. Generally this includes any phases except the Track Clearance phases. During Limited Service operation, all Limited Service phases operate as normal.

Railroad Ped Only phases - This parameter allows ped operation for a disallowed phase during Limited Service operation only. Normally, any phase not selected as a Limited Service phase has both its vehicle and ped logic disabled. However, it's not unusual to desire ped service for a phase that can't allow vehicle service. When the railroad preempt sequence begins its Limited Service segment, the controller will respond to all Railroad Ped Only calls (actuated or recall) the same as in Normal operation with one exception. When the ped phase begins, that ring's Max timer is set to zero. Consequently the ped will only serve once when there is a conflicting call. During the ped service, the vehicle indication will remain Red and only the Walk and Don't Walk intervals will time.

Mode 1 Operation

This mode uses the RR A input only and results in Flashing operation. Typically, when the RR A input (C1-51) goes ON, all phases in service go immediately to their termination sequence. No ped service is permitted during Track Clearance and all ped indications go immediately to solid Don't Walk. If an overlap is Green and at least one of the Track Clearance phases is selected as a Railroad Overlap parent, then the overlap will continue Green through those phases. Once all Track Clearance phases have gone Green, the Track Clearance timer begins counting down to zero. When the Track Clearance timer expires, all phases and overlaps in service terminate. When no phases or overlaps are in service, the controller puts the intersection into software flash and the ped heads go dark. Flashing operation remains in effect until the RR A input goes OFF. At this point the controller outputs all red (steady Don't Walk for the ped indications) for the length of time set in All Red Time After Railroad Flash (location 361). When this timer expires, Railroad Exit phases will service first if set. Otherwise, service will begin for the first phase (with demand) after the phase(s) in service when preemption started.

Mode 2 Operation

This mode uses the RR B input only and results in either Flashing operation or Limited Service operation. Typically when the RR B input (C1-52) goes ON, all phases in service go immediately to their termination sequence. No ped service is permitted during Track Clearance and all ped indications go immediately to solid Don't Walk. If an overlap is Green and at least one of the Track Clearance phases is selected as a Railroad Overlap parent, then the overlap will continue Green through those phases. Once all Track Clearance phases have gone Green, the Track Clearance timer begins counting down to zero. When the Track Clearance timer expires, all phases and overlaps in service terminate. If neither Limited Service phases nor Railroad Ped Only phases have been set, the operation is the same as in Mode 1 above (Flashing Operation). If either of those two parameters is set, then vehicle, overlap (using Railroad Overlap parents) and ped service will occur as during Normal operation. Additionally, this mode allows Emergency Vehicle (EV) service during the Limited Service segment. EV service is the same as during Normal operation except only those EV Clearance phases that are **also** Limited Service phases will serve.

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SECTION 5 – OVERLAPS and PREEMPTION

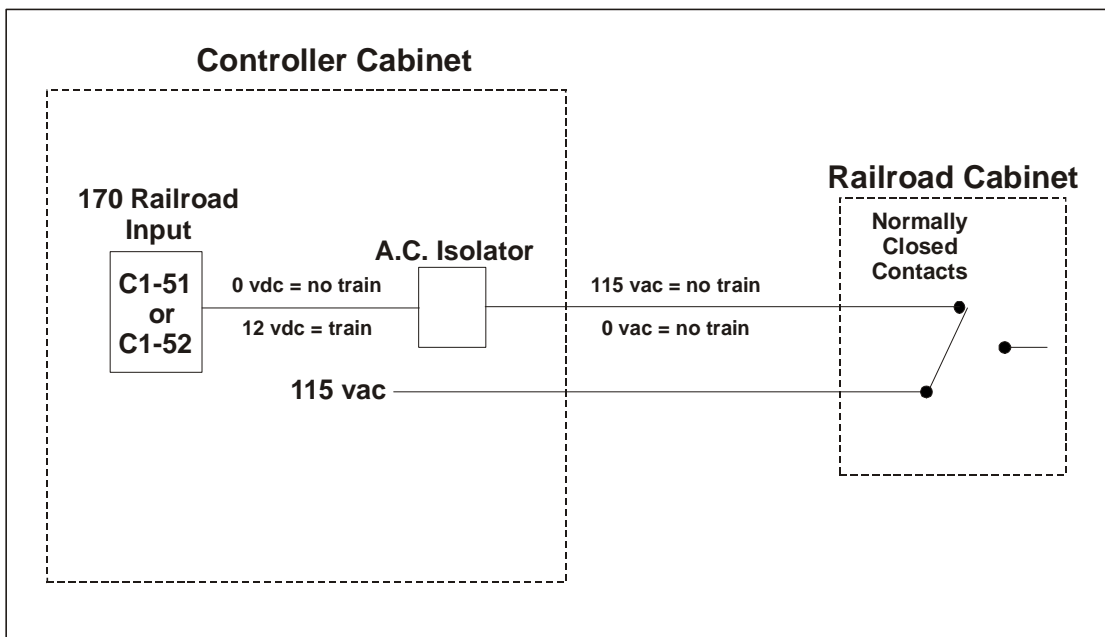
Mode 3 Operation

This mode uses both of the railroad inputs and can result in either Flashing operation, or Limited Service operation or both (sequentially) depending on the order of actuation. The RR A input has priority over the RR B input. Therefore, anytime the RR A input goes ON, the result will be Flashing operation. If the RR B input comes on first, Limited Service operation will result until a RR A input goes ON. At that point, Limited Service phases are terminated immediately and the result is Flashing operation. This mode is useful when multiple parallel tracks are present with trains of different speeds on different tracks (for example slow freight train and fast commuter line).

Railroad relay requirements

The program senses a Railroad input when the voltage at C1-51 or C1-52 is 12vdc. This means that the Railroad preempt circuit must be connected to the normally closed contracts of the railroad cabinet relay. An approaching train causes the railroad cabinet relay to energize, causing the normally closed contacts to become open. This removes the 115 vac from the A.C. isolator input and, if properly configured, the Railroad preempt sequence begins.

Typical Railroad Preempt Circuit



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SECTION 5 – OVERLAPS and PREEMPTION

Additional Points

- Entrapment monitoring is disabled when a RR Preempt sequence starts in order to expedite service of Track Clearance phases.
- Both Track Clearance time **and** Track Clearance phases must be set or the resulting operation will default to software Flash as soon as all phases have terminated.
- If a Railroad preempt occurs while coordination is active, the local coordinator will continue to run in the background (maintaining cycle position) but updating of the coordination function outputs will be suspended until the preemption sequence ends and the Free After Preempt timer (set at location 365) expires.
- A Railroad preempt will override Manual Control operation until the preemption sequence completes.
- A Railroad preempt will override Emergency Vehicle operation until the preempt sequence completes or until the Railroad preempt sequence begins Limited Service operation.
- Track Clearance phases will not start green until all **incompatible** overlaps have completely terminated.
- Turning on call light 3 at location 1DB delays the start of Track Clearance green until **all** overlaps, including compatible ones, have completely terminated.
- After an A.C. power failure, if power is restored to the 170E controller while the preempt input is active (and the controller is configured for RR preempt operation), the program will initiate a software Flash condition immediately on start up. The software Flash will remain in effect until the RR preempt input is removed, at which time a normal railroad exit sequence will take place.
- If a lead phase is flagged for both RR Limited Service and Protected Permissive operation, and its supplemental lag phase is not also flagged for RR Limited Service, a cross street phase must be placed on recall in order to service the lead phase call. An alternative to this is to use the programmable logic to generate a cross street call when the Protected Permissive phase is called during RR Limited Service.

EMERGENCY VEHICLE

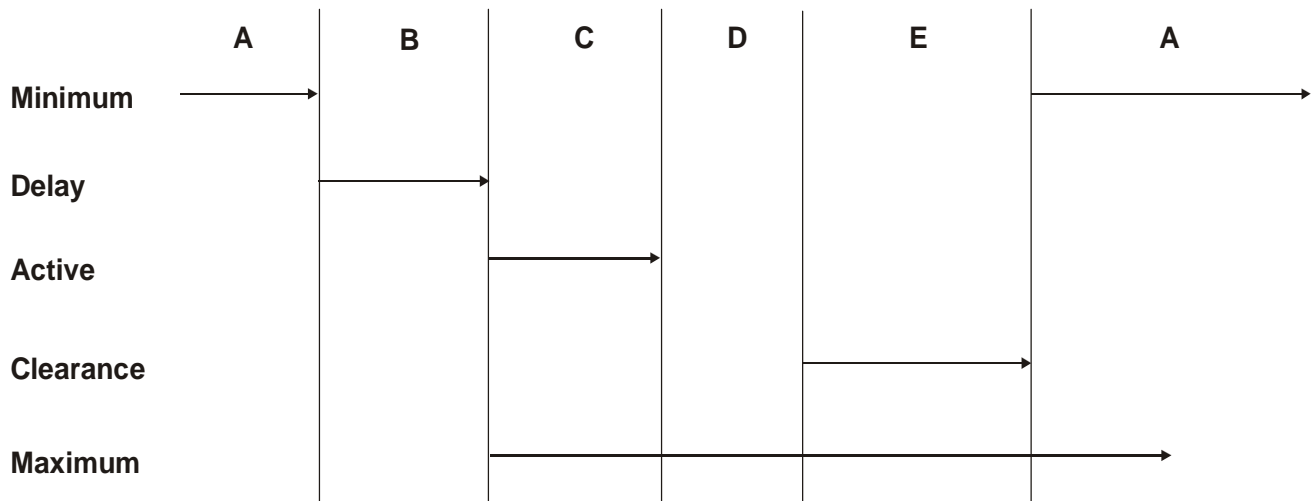
As with Railroad preemption, LACO-4E Emergency Vehicle (EV) preemption logic offers a variety of timers, and phase and control flags that give the user optimum control over EV operation. Minimum EV operation requires that both EV Clearance phases and EV Clearance time be set. If only Clearance phases are set and a preempt input goes ON, call light 9 will flash briefly to indicate that the preempt is insufficiently configured. All other parameters for that preempt will be ignored.

Assuming all parameters are utilized, an EV preempt operation is as follows (see the timing diagram on the next page):

- When an EV input first goes ON, its Minimum timer is checked. If the timer is active, the preempt is ignored.
- If the Minimum timer is zero, the preempt's Clearance phases are checked. If no Clearance phases are set, the preempt is ignored.
- If Clearance phases are set, the preempt's Clearance time is checked. If no Clearance time is set, call light 9 will flash briefly and the preempt will be ignored.
- If the Delay time is set, the preempt will do nothing except decrement the Delay timer until it expires. Call light 9 is illuminated during this time to indicate that a preempt input is active.
- When the Delay timer is zero, Ped Restricts are placed on all phases, and Holds and Calls are placed on all Clearance phases. All Walk intervals are terminated to Flashing Don't Walk immediately. If the EV is flagged to truncate Ped Clearance in EVFLAG (location 390), then all Flashing Don't Walk intervals will be terminated also. The Active timer is checked. While the Active timer is active, no other logic is performed. During this time, any Clearance phases that are Green or go Green will stay Green because of the Holds placed on them. Call light 9 is illuminated during this time to indicate that a preempt input is active.
- When the Active timer is zero, a Force Off is placed on all non-Clearance phases, causing them to terminate after satisfying minimum green intervals. When all Clearance phases are Green **and** all non-Clearance phases are out of service **and** the preempt input is no longer active, the Clearance interval begins. Green clearance, interval "9", will show in the Front Panel LED display.
- The normal Minimum Green interval times in the background during the Clearance interval. When the Clearance timer expires, if the Minimum Green timer has not expired, the phase will time out its remaining Minimum Green time and show interval "2" in the Front Panel LED display. If no Minimum Green time remains, the phase(s) will revert to Normal operation.
- If the Maximum time is set, its timer gets loaded when the Delay timer expires and times concurrently with the Active and Clearance timers. If the preempt sequence has not finished by the time the Maximum timer expires, that preempt sequence will end and the controller will return to Normal operation.

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SECTION 5 – OVERLAPS and PREEMPTION



The figure above shows the relationship between the various EV timers with details provided below.

- Interval A = Minimum timer active. All EV logic is ignored. This timer gets set at the beginning of the preempt sequence and also begins timing at the end of the preempt sequence.
- Interval B = Delay timer active. Call light 9 comes on to indicate an active preempt input. No other logic runs during this interval. Once this timer expires, an active preempt sequence is latched until either the Maximum timer expires, or the input goes OFF **and** the Clearance timer has expired.
- Interval C = Active timer active. Ped Restricts are placed on all phases, Hold and Call are placed on Clearance phases. Any Clearance phases already Green will show interval “6” (Hold) on the Front Panel display. Ped Clearance truncation takes place here.
- Interval D = Transition to Clearance phases. Adds a Force Off placed on all non-Clearance phases. Force Off honors phase minimums. If all Clearance phases are in service when the Active timer expires, this interval is skipped and Interval E begins. There is no EV-specific timer associated with this interval.
- Interval E = Clearance timer active. The Clearance timer will not start to decrement until the EV input goes OFF. Clearance phases show interval “9” (Preempt Clearance Green).
- The Maximum time, if set, will time concurrently with the Active and Clearance timers. If the Maximum timer expires before the Clearance timer expires, then the preempt logic will return the intersection to Normal operation until the next preempt input OFF -> ON transition occurs. If the Maximum time is not set (i.e. equals “000”), then this Maximum logic is ignored.

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SECTION 5 – OVERLAPS and PREEMPTION

Additional Points

- All four EV inputs have equal priority. If any EV is in service and another input goes ON, that input will be overridden until the existing EV finishes service. If multiple EV inputs go ON simultaneously, the lowest numbered input will be serviced.
- If an EV preempt occurs while coordination is active, the Local Coordinator will continue to run in the background (maintaining cycle position) but updating of the coordination function outputs will be suspended until the preemption sequence ends and the Free After Preempt timer expires.
- An EV preempt will override Manual Control operation until the preemption sequence completes.
- A Railroad preempt will override Emergency Vehicle operation until the preempt sequence completes or until the Railroad preempt sequence begins Limited Service operation.
- The Maximum time logic will be ignored if the Maximum timer is set to zero.
- Any EV may be set to link to any other EV.

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SECTION 5 – OVERLAPS and PREEMPTION

MANUAL CONTROL

The Manual Control feature allows on-site override of automatic operation of the intersection controller. Several conditions must be true before Manual Control logic can operate.

- No preemption can be active
- MANCON (location 309) must be set to “1”, “2” or “3”
- Both PedA and PedB must be disabled
- The Manual Control Enable input must be ON (Police panel pushbutton inserted in jack)

Once all of these conditions are satisfied, the local coordinator, if active, will be disabled. Depending on the value entered at MANCON, calls will be placed to the controller as follows:

MANCON value	Call logic
000	Manual Control logic disabled: No calls placed
001	Intersection is fully actuated (both vehicle and ped)
002	All permitted phases are placed on recall
003	All permitted phases and enabled peds are placed on recall
Any other value	Same as “003” above

When Manual Control begins, all phases currently green will have a Hold placed on them. Any phases concurrent to the green phases will start service (including ped service, if so configured) and have a Hold placed on them also. Any minimum greens will time out and the active phases will rest in green. The Interval display will show interval “6” indicating that the phases are being held. Whenever the Manual Advance input is set ON (Police panel pushbutton is pressed), all green phases that have timed their minimums will be terminated and the next calling phases in ring sequence will be served. All other normal phase logic applies including simultaneous termination at barrier crossings.

Phases can be omitted during Manual Control Operation by selecting the desired phases at location 3C1. The phases selected here will only apply when Manual Control logic is active. Also, lag phasing specific to Manual Control operation can be set at location 3C2. The phases set here will override any other lag-phasing configuration that was in effect at the start of Manual Control operation. This location is subject to the same constraints as Lag Phases Free (location 1FC) and coordination lag phases

When the Manual Control Enable input is OFF, the controller reverts immediately back to normal operation. Any remaining calls generated by the Manual Control logic will remain in place until serviced. If the local coordinator is still active, then it will time out the value entered in Free Time After Preempt (location 365, before updating the coordination function outputs.

If Manual Control is active and a railroad or emergency vehicle service starts, the Manual Control logic will be overridden.

If any phases are selected at either PedA (location 1E6) or PedB (location 1E7), the Manual Control logic will be overridden.

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SECTION 6 COORDINATION

GENERAL

LA COUNTY STANDARD COORDINATION

MASTER COORDINATOR

LOCAL COORDINATOR

COORDINATION OUTPUTS

COORDINATION FUNCTIONS

COORDINATION TABLES

ZIP COORDINATION

GENERAL

This coordination program provides timing and functions that enable the user to modify the operation of a fully (or semi-) traffic actuated, controlled intersection to time in harmony with system control of a background cycle. Traffic moving through a system of signals will usually be more concentrated in the early portion of the through Green band, while the flow during the later part of the band is usually relative to the demand on the system. For example, assume a system band of 36 seconds. In off-peak periods, perhaps only the first 8 or 10 seconds may have a flow of traffic that might be considered relevant to the system, but during peak periods the flow of traffic may frequently be heavy and continuous over the entire band time.

The coordination program can “guide” the controller into a condition that provides a period of assured Green during the initial portion of the band, leaving the remainder of the band to be self generated by vehicle actuations. If, after the assured Green period, traffic flow is insufficient to continue the Green, the controller will “gap out” and transfer to a conflicting call. In the case of peak traffic demand, the Green will be held following the assured Green period by vehicle actuations until either a gap appears or the phase Force Off is applied. The coordination functions can also be utilized to allow the controller to respond to conflicting phase calls late in the cycle and still return in time for the assured Green.

LA COUNTY STANDARD COORDINATION

In LACO-4E, both the Master and Local Coordinator functions run on all controllers. Controllers are physically configured as either stand-alone or interconnected. For stand-alone configurations, (essentially) there is no “Master” controller. All controllers are “slaves” and the Local Coordinator determines its operation directly from the “local” Master Coordinator (since both share the same memory). A controller that is connected to a Central System is also treated as a stand-alone controller.

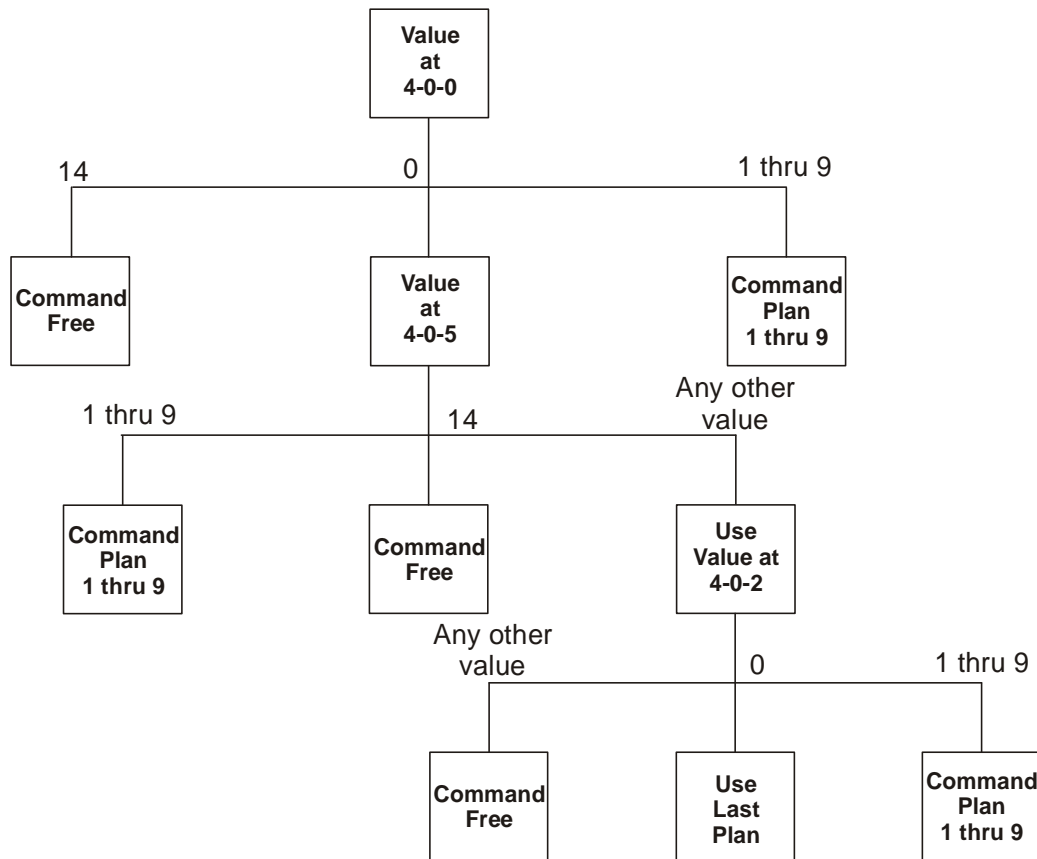
For interconnected configurations, the Local Coordinator determines its operation from data received from the “remote” Master Coordinator. This data is sent across twisted pair wire using the RS232 protocol or as a single wire pair that carries an event (start of a phase Green for instance) to trigger an Offset Timing cycle in the slave controller. See section 7 for more information on the wide variety of controller-to-controller communications available.

MASTER COORDINATOR

The Master Coordinator has two main functions.

- Determine which plan to command to the remote (slave) controller.
- Manage the Master Cycle Timer (the master clock for all of the coordination timers).

The LACO-4E Master Coordination Map below shows the hierarchy of options that the Master Coordinator uses to determine its plan choice. It can command any of nine plans, Free or Flash.



LACO-4E Master Coordination Map

LOCAL COORDINATOR

The Local coordinator has three main functions:

- Determine the appropriate plan, function or mode to process.
- Update the Local Cycle timer.
- Update the Plan (Dial) outputs.

The primary function of the Local Coordinator is to determine the plan with which to drive the coordination outputs. This plan depends on which of the three local modes of operation is active. The modes are, in order of priority, Local Manual Override mode, TMC Override mode and Time of Day (TOD) mode. There are five sub modes to Local Manual Override: Manual Plan, Slave, Offset Timing (Yield coordination), Free and Flash. Eight coordination tables are provided for fine-tuning of event driven operation; five Time of Day (TOD) tables and three Exception tables (Floating Holidays, Exception Days and Annual Events). Each of the Exception tables is searched once per minute on the minute to determine which TOD table is applicable for the current date. That TOD table is then searched for the most recent time and current Day of Week. Additionally, twelve coordination phase attribute flags (per plan) are available. These are described later in this section.

The Local Coordinator also maintains the Local Cycle timer which controls the setting and clearing of the coordination outputs. The Local Cycle timer lags the Master Cycle timer by the Offset value specified for each plan.

Once the Local Coordinator has determined its command source, it runs the commanded operation setting the coordination outputs (Force Offs, Holds, Ped Restricts and Coordination Calls) as specified in the Timing Sheets.

MODES OF OPERATION

Local Manual Override mode – In this mode, the Local Coordinator ignores what the local Master Coordinator is commanding and instead responds to the value that is entered at location 401. The four sub modes to this mode depend on the value entered here.

1 through 9 (Manual Plan sub mode) – As in TOD mode, the Local Coordinator receives its sync pulse from the local Master Coordinator based on the Plan number entered at location 401.

B (Slave sub mode) - The Local Coordinator receives sync and plan information from an external source via modem. If the master controller is running LACO-4E, then the slave controller should be configured to receive data via modem. If the master controller is running LACO-1R or LACO-3 (or any other vendor's program that sends "standard" 7-wire interconnect), then the data will be received via 7-wire interconnect and the cabinet input file must be configured accordingly. Slave sub mode operation is only available in Manual Override mode. If sync is lost for more than 4 seconds, the intersection will run Free until the next sync pulse is sensed. See section 7 for information regarding the format of data that is sent from a LACO-4E Master controller and received by a LACO-4E Slave controller. To remain compatible with pre-LACO-4E programs, only three Dials and one Offset (corresponding to Plans 1, 2 and 3) are supported when receiving 7-Wire information. If Slave sub mode is configured, then LACO-4E requires Plan and Sync pulse information from a source external to the controller.

C (Offset Timing sub mode) (or Yield Coordination) – This sub mode uses an event driven form of coordination instead of the familiar time based cycle. The event, which can be the start of (a selectable) phase Yellow or Green, is transmitted via modem. The slave controller checks its Comm Port options to see if any of them are configured. If only the master controller is running LACO-4E, then the event would be sent via the traditional hardwire interconnect (on a single pair) to the non-LACO-4E Slave controller. The user can select any of the nine plans (at location 7AA) to use but if none is selected it will default to plan 3. The selected plan is run to completion (one cycle) at which time the Local Coordinator is turned off (set Free) and the routine waits for the next event. This operation is available in both TOD and Manual Override modes. See section 7 for information on the data that gets passed from a LACO-4E Master controller to a LACO-4E Slave controller. If Offset Timing mode is configured, then the controller requires Sync pulse information from an external source.

E (Free sub mode) - The Local Coordinator releases all control of the intersection. Call light 0 is extinguished. In this mode the Local Cycle timer runs continuously to "060" and rolls over to "000" again.

TMC Override mode – In this mode, the Local Coordinator ignores the TOD Plan and runs the plan/function downloaded from Central. This can be plans 1-9, Free or Flash. "0" at this location means that Central has commanded the controller to run in TOD Mode. "99" at this location means that the controller has not received an AB341E *SetPattern* command from Central for more than 255 seconds. LACO-4E treats this the same as "0" and sets the Local Coordinator to TOD Mode

Time of Day (TOD) mode - The Local Coordinator receives sync and plan information internally from the local Master Coordinator. Depending on the current TOD table event, the Local Coordinator can run one of nine plans, turn on or off the TOD Output (for driving signs, etc), run in Slave Mode or Offset Timing mode (see below), output software flash or run Free.

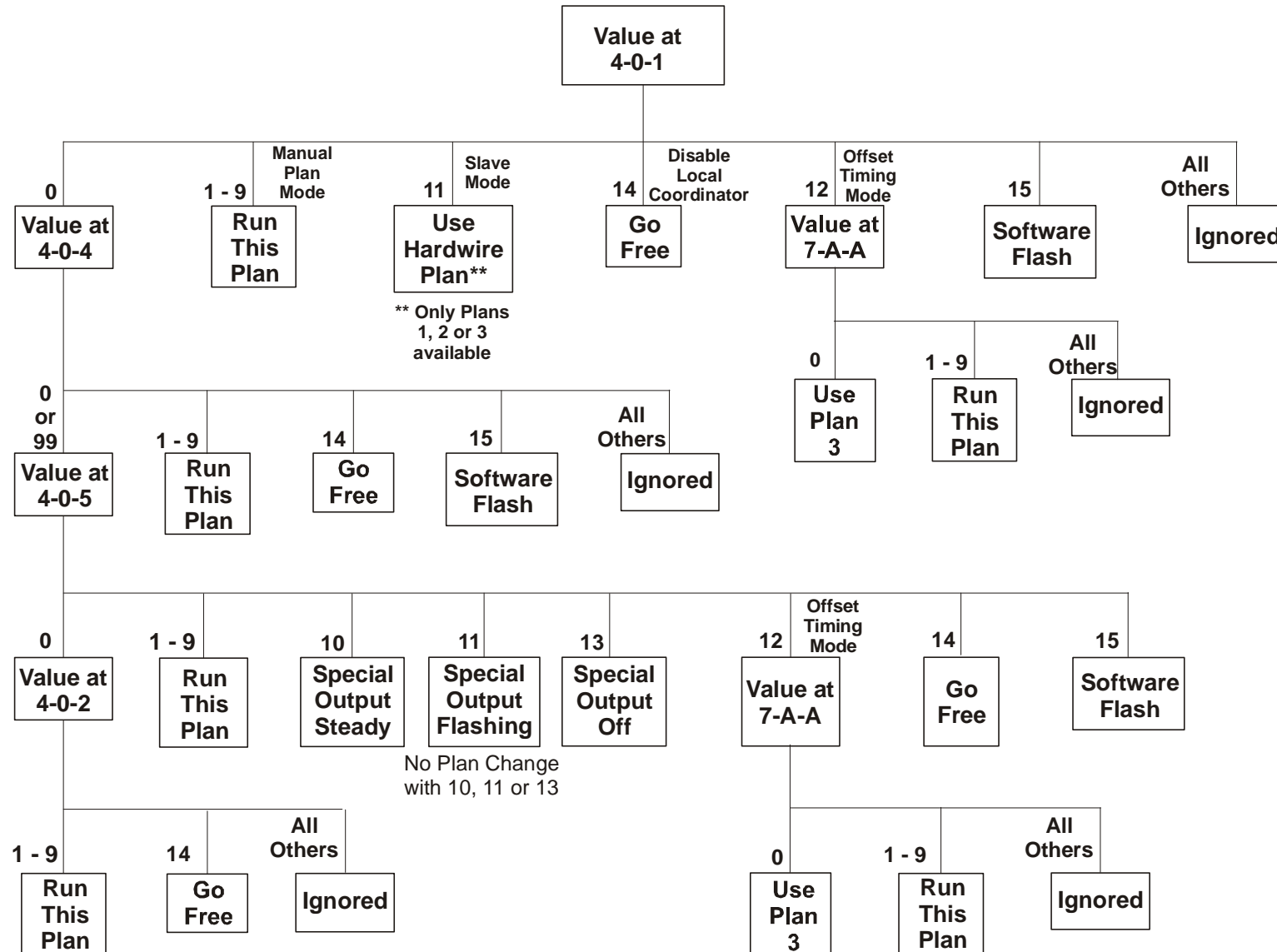
The local coordination routine will be overridden when preemption or manual control is in operation or while the "Free After Preempt" timer is active. This user set timer allows the intersection to run free after preemption for up to 255 seconds.

TRANSITION

One most useful features of the LACO-4E Coordination logic is its ability to transition quickly between plan changes. In most cases, the Local Coordination is back in sync within two Master cycles of a plan change. The Local Coordinator is considered to be in transition from the moment a new plan is selected until the dynamic offset time (CurOff, location 40C) equals the programmed offset time (NewOff, location 40D) of the new plan.

LOCAL COORDINATOR PLAN SELECTION HIERARCHY (see next page)

This figure illustrates the logic that the Local Coordinator uses to determine its operating mode and plan. The program first looks at the value in location 401 (Local Manual). If this is a non-zero value, then the Local Coordinator is in Manual Override Mode and that value determines which "sub mode" to run. If location 401 is "000", the Local Coordinator looks at the value in location 404 (TMC Override). If this is a non-zero value, other than "099", the Local Coordinator is in TMC Override Mode and that value determines whether to run a plan, Free or Flash. If this location is "000" or "099", the Local Coordinator looks at the value in location 405 (TOD Plan).



**Local Coordinator
Plan Selection Hierarchy**

COORDINATION OUTPUTS

Call light 0 is a Front Panel indication of the general status of the Local Coordinator. When this light is extinguished, the Local Coordinator is disabled and the intersection is running Free. This is can be confirmed by observing "014" at location 403 (Local Plan). When the Local Coordinator is in a valid coordination mode, call light 0 will be ON steady except for the last two seconds of the coordination cycle. During that period it will be extinguished. This represents the current plan's Sync pulse.

Auxiliary output file slot 3 (AUX 3) can be set to output coordination indications. AUX3 Red echoes the Sync pulse (for 7-wire communication to a Slave controller) and AUX3 Green is used for the TOD Special Function output. This is a time of day output from the event tables. It will be turned ON **steady** when a TOD table event occurs with an "A" in its Plan/Function column. It will be turned ON **flashing** when a TOD table event occurs with a "B" in its Plan/Function column. It will be turned OFF when a TOD table event occurs with a "D" in its Plan/Function column. This output will also be automatically echoed to the 4Ped Yellow output as long as no 2-color overlap or Ped A is in use.

Finally there is a Dynamic Coordination display (viewed at location 7FF), which provides the operator a composite status of all four of the coordination functions on the 170E controller Front Panel call lights at the same time. The four functions have a different flash rate to help distinguish them:

- Force Off = solid
- Hold = fast flash
- Ped Restrict = slow flash
- Cocall (Coordination calls) = pulsed

If, for instance, phases 2 and 6 have a (coordination) Hold applied and phases 4 and 8 have a Ped Restrict applied, then call lights 2 and 6 will be ON steady while call lights 4 and 8 will show a slow flashing indication.

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SECTION 6 – COORDINATION

COORDINATION FUNCTIONS

INTERVALS (in seconds)				PLAN 4			
	Plan 4	Plan 5	Plan 6	Force Off	Hold	Ped Restrict	Call
	1	2	3	4	5	6	7
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
A							
B							
C							
D							
E							
F							

Coordination functions consist of Force Offs, Holds, Ped Restricts and (coordination) Calls. With careful use of these four parameters and a proper cycle length/offset, the user can achieve the desired Green Band for each intersection. Each plan has an associated Cycle Length entered in row "0" of the respective Plan column (column 1, for Plan 4, in the example shown). Beneath the Cycle Length, time intervals for setting and clearing of the coordination functions are entered. Row zero is also considered "local cycle zero". The value of each row in this column must be greater than in the preceding row and no row may be greater than the Cycle Length (row "0").

Columns 4 through 7 (for Plan 4) are used for setting the desired phase flags for the coordination functions. Any phases may be flagged but only Allowed phases will be recognized. The coordinated phases should be flagged in row "0" of the Force Off column (column 4). At local cycle zero, which occurs at master cycle zero plus the plan's offset value, these phases will be forced off, if they are timing and have satisfied Minimum Greens. The Force Offs will remain in effect until the next interval (corresponding to the next row) is reached. Any phases flagged in this row of the Force Off column will have a Force Off applied to them. All phases not flagged will have the Force Off removed. The same operation is true of the Hold, Ped Restrict and Call functions.

COORDINATION TABLES

Coordination tables come in different varieties depending on what they specify and how they do it. Tables 0 through 4 are the Time of Day (TOD) tables and specify as their output a particular Plan (1 - 9) or Function (A - F) which is used by the Local Coordinator to decide what plan or functions to output. Tables 5 through 7 determine which of the TOD tables will be in effect.

TOD Tables (tables 0-4)

Each TOD table consists of a list of times of day and a chart of days of the week. The local coordinator uses this data to turn ON/OFF the coordination functions and/or the Special Function outputs. Every minute, on the minute, the LACO-4E program compares its internal clock to the times entered in the Hour:Min column of the table. If a match is found, and the current day of the week has been flagged for that time in the "Sun" through "Sat" columns to the right, then the action called for under the Plan column is taken. For example, it can command the intersection to output program flash (TOD Flash).

Entries in the Hour:Min column of TOD tables may appear redundant at times when actually they are not. For example, it may be desirable to go to Plan 2 at 05:30 if it is a Sunday but to Plan 6 at 05:30 if it is a Monday. Therefore, two lines will list 05:30. One will have an "X" in the Sunday column and will specify a "2" in the Plan column. The other will have an "X" in the Monday column and will list a "6" in the Plan column.

Another point worth noting is that the times listed in Tables 0-4 need not be in chronological order (even though that is the way they will usually be listed). The program merely scans the whole list for matches and will act on them without reference to where in the list they occurred. This eliminates the need to reenter the entire table in order to add an event in the middle of that table.

Annual Events Table (table 5)

Month/Day column are "starting" dates. Beginning on the date entered, the designated TOD table number will be put into effect each time a day of the week flagged on that line occurs. That table will continue to be implemented for each occurrence of the flagged days until changed by another later date with the same day(s) flagged, or until the end of that calendar year. Entries in Tables 5 through 7 change the "default" table for the flagged days of the week from table 0 to some other TOD table.

As an example, suppose that every Thursday and Friday, during June, July and August, a city sponsors a Farmers' Market that requires a modified traffic coordination, the specifics of which will be entered in table 3. That is, every Thursday and Friday during June, July and August, we want Table 3 to be in effect. On a line in Table 7 enter 06/01 in the Month/Day column; enter a "3" in the Table column; and flag columns 5 and 6 (Thursday and Friday) in the day-of-the-week columns. On each Thursday and Friday (until changed by another line), Table 3 will be in effect as the "default" table unless overridden on specific days by Tables 6 and 7.

On September 1, the city wishes to resume normal patterns of coordination for Thursdays and Fridays so another line is inserted in Table 5 with 09/01 in the Month/Day column, with a "0" in the Plan column, and with Thursday and Friday flagged in the day-of-week columns.

Floating Holidays Table (table 6)

This table has the same format as Table 5 but the operation is different. The dates listed in Table 6 are used for those holidays (or events) that don't fall on a fixed date every year or that cause a change in traffic patterns for a time period of more than one day. For example, Thanksgiving is defined as the fourth Thursday in November, but the Friday after Thanksgiving is generally treated as a holiday also (in terms of traffic patterns). To implement Table 1 on this holiday we would list under the Month/Day column, "11/04." We would next put a "1" in the Table column and flag Thursday on that line. The program automatically extends Table 1 operation through the Friday after Thanksgiving as well.

Control defaults to Table 0 unless otherwise directed by another event in Table 6. Events 6-0 through 6-4, listed on the Coordination Tables Timing Sheet, are those used by Los Angeles County. They may be changed to suit the individual agency's needs.

If the "Table" entry is set to "B" the BSP Priority logic will be ignored during that holiday period.

Exception Days Table (table 7)

Table 7 works in a similar manner to Table 6, but it allows other choices on specific days of specific months. If the date entered in the Month/Day column matches a flagged day of the week, control will be forced to the TOD table number listed in the Table column. At the end of that day, control defaults to table 0, unless otherwise directed by another event in Tables 5 through 7.

Events 7-0 through 7-9, listed on the Coordination Tables Timing Sheet, are those used by Los Angeles County. They may be changed to suit the individual agency's needs.

If the "Table" entry is set to "B" the BSP Priority logic will be ignored during that holiday period.

Conflicts Between or Within Tables

In the case when different tables command conflicting actions, the Exception Day Table (Table 7) takes priority over the Floating Holiday Table (Table 6) which takes priority over the Annual Event Table (Table 5). Within a given table, if two events direct different actions at the same time, the event closest to the bottom of the table will be implemented.

Additional points

- Table 8 is not used. Data entered in this table's events is ignored.
- Table 9, BSP Table, is described in section 8, Miscellaneous Features.
- Walk and Don't Walk intervals will not be abbreviated by coordination Force Off.
- All preemption modes (including Manual Control) will temporarily suspend Local coordinator control of the intersection. The Master cycle will continue to time in the background, allowing a seamless return to coordination after preemption.
- Queue Clearing Hold will not terminate to Max Extension but will end in the presence of a coordination or preemption Force Off.
- Yellow Clearance, Red Clearance and Red Revert intervals time as normal.

ZIP COORDINATION (ZIPCOORD)

ZipCoord is a user selectable alternative to the standard LACO-4E coordination function logic. Its name reflects the basic logic that ZipCoord provides. This basic logic is apparent on comparison of the ZipCoord timing (1 timing sheet) versus the standard coordination timing (4 timing sheets). It consists of nine plans where the user can only set a single force off point for each phase and the Hold Release point for the sync phase(s).

The sync phases' Force Off points must be set to the cycle length. These phases will be forced off at local cycle zero. After local cycle zero, a Hold will be placed on these phases until the next local cycle zero or until the Hold Release interval is reached, if set. If the Hold Release is set, it will end the Hold on the sync phases and let them operate off detector actuation so the side street can be serviced early. The side street phases, if called, will time until one of the following occurs:

- Their Max2 time is reached
- They are forced off
- They gap-out

When the sync phases go green again, they will hold in green until the next Hold Release point (local cycle zero). ZipCoord parameters are entered on a separate timing sheet from the standard coordination parameters.

ZipCoord timing occupies the same memory page (Page 4) as the first coordination timing sheet (Coordination 1) of the standard coordination timing. By default, the standard coordination timing is mapped into memory. To enable the ZipCoord memory map, enter any non-zero value at ZipCoord Enable (location 7AD). When this location is set to a non-zero value, all of the standard coordination timing is automatically erased. That is, the user set locations on memory Pages 4, 5, 6 and 7 will be set to "000". This corresponds to the Coordination 1, Coordination 2, Coordination 3 and Coordination Attributes timing sheets.

If a value of zero is entered at ZipCoord Enable, the standard coordination memory map will be re-enabled. At this point all user-set data will be erased from memory Page 4, which corresponds to the Zip Coordination timing sheet.

Other points to consider for ZipCoord usage:

- ZipCoord only affects how coordination functions are implemented
- Master and Local functionality do not change between ZipCoord and standard coordination
- Coordination Attributes are disabled for ZipCoord.
- Coordination Tables are not affected by changes made to ZipCoord Enable.

ZipCoord uses the Lag Phases (Free) set at location 1FC. If different Lag Phases are desired, then the user must switch to the Standard Coordination.

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SECTION 7 COMMUNICATIONS

PEER TO PEER

Transmit Time and Date

Receive Time and Date

Transmit 7-Wire Data (via modem)

Receive 7-Wire Data (via modem)

Transmit Time/Date (AB3418E Master)

Transmit Plan (Discontinued Option)

WWV/GPS

CENTRAL SYSTEMS INTERFACE (AB3418E SLAVE)

BUS SIGNAL PRIORITY (BSP)

PEER TO PEER (CONTROLLER TO CONTROLLER)

All controller-to-controller communications complies with the RS232 Serial Communications Specification.

Transmit Time and Date

LACO-4E provides two methods of sending one controller's local time and date to another controller. One uses an L.A. County proprietary message for transmission between County owned controllers. The other is the Caltrans specified AB3418E *SetTime* message.

Only one Comm Port may be configured for transmitting time and date using the County message. If more than one port is configured, the lowest numbered port will be used and the others will be ignored for this message. To use this LACO-4E proprietary message, determine which port to use and enter "4" followed by "E" at locations:

- 191 for the C2S connector
- 192 for the C20S connector
- 193 for the C30S connector
- 194 for the C40S connector

Once the 170E controller is configured, it will send its local time and date out of the configured Comm Port once per minute, on the minute. The time and date are sent in a six-byte string with the entire six-byte string being sent within 1 second. The six bytes sent are:

- Hour
- Minute (seconds are not sent)
- Day of Week
- Month
- Day of Month
- Year

This transmission is suspended whenever a WWV repoll operation is active. Selection of this comm method automatically configures the Comm Port with the following protocol:

- 8 bits
- No parity
- 1 Stop bit

The baud rate is set by software as determined by the port's comm settings. The sending and receiving controllers must be configured likewise for the received data to be recognized. The communications cable should have pins 2 and 3 of the transmitting controller connected to pins 3 and 2 (i.e. reversed) of the receiving controllers.

Receive Time and Date

As with transmitting Time and Date, LACO-4E controllers can receive Time and Date using both the AB3418E protocol and the L.A. County proprietary protocol.

Only one Comm Port may be configured for receiving time and date using the County message. If more than one port is configured, the lowest numbered port will be used and the others will be ignored for this message. To use this LACO-4E proprietary message, determine which port to use and enter "5" followed by "E" at locations:

- 191 for the C2S connector
- 192 for the C20S connector
- 193 for the C30S connector
- 194 for the C40S connector

Once the 170E controller is configured, it will poll the assigned Comm Port for any activity. This polling is suspended whenever a WWV repoll operation is active. When the 170E controller receives Time and Date data from the sending controller, it automatically updates its local time and date from the received data. The local Real Time Clock's "seconds" location is set to zero. The received data is expected in the following sequence:

- Hour
- Minute
- Day of Week
- Month
- Day of Month
- Year

Selection of this communication method automatically configures the Comm Port with the following protocol:

- 8 bits
- No parity
- 1 Stop bit

The baud rate is set by software as determined by the port's comm settings. The sending and receiving controllers must be configured likewise for the received data to be recognized. The communications cable should have pins 2 and 3 of the transmitting controller connected to pins 3 and 2 (i.e. reversed) of the receiving controllers.

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SECTION 7 – COMMUNICATIONS

Transmit 7-Wire Data (via modem)

Only one Comm Port may be configured for transmitting 7-wire data. If more than one port is configured, the lowest numbered port will be used and the others will be ignored for this message. To implement LACO-4E proprietary message, determine which port to use and enter “2” followed by “E” at locations:

- 191 for the C2S connector
- 192 for the C20S connector
- 193 for the C30S connector
- 194 for the C40S connector

This routine sends the controller's Master Coordinator data, once each second, in 7-Wire format but the data is transmitted via modem instead of the conventional seven conductors carrying 115 vac. First, the desired port must be setup for Comm Option 2. The coordination Master extracts the current plan number and its associated sync pulse status and encodes it into the first six bits of a single byte of data. In addition to this information, two more bits are encoded with Offset Timing pulse and Midnight Sync Pulse information. The Offset Timing pulse bit will be ON when either the phase(s) flagged in Green Offset Sync Pulse (location 1-D-C) are Green or the phases flagged in Yellow Offset Sync Pulse (location 1DD) are Yellow. This bit will be OFF at all other times.

The Midnight Sync Pulse bit will be ON when the 170E controller's Real Time Clock reaches the hour and minute set at MSP Hour (location 7AB) and MSP Minute (location 7AC). This pulse will be ON for only 1/10th of a second and OFF at all other times. If a value of “025” is entered at MSP Hour, then bit 7 will be ON for 1/10th of a second for **every** second. The data is transmitted in the following format:

	8	7	6	5	4	3	2	1	
MSB	Offset Timing	Midnight Sync Pulse	Free	Dial3 (Plan 3)	Dial2 (Plan 2)	unused	unused	Sync	LSB

Note that if the sending controller is in Local Manual Override mode and commanding the Slave sub mode (“B” at location 401), then only the Offset Timing and Midnight Sync Pulse data will be sent. Note also that, for compatibility with older LACO programs, only Plans 1, 2 or 3 should be configured in the Master Coordinator. The Sync pulse will represent Offset 1 in the receiving controller.

Receive 7-Wire Data (via modem)

Only one Comm Port may be configured for receiving 7-wire data. If more than one port is configured, the lowest numbered port will be used and the others will be ignored for this message. To implement LACO-4E proprietary message, determine which port to use and enter “3” followed by “E” at locations:

- 191 for the C2S connector
- 192 for the C20S connector
- 193 for the C30S connector
- 194 for the C40S connector

Once the 170E controller is configured, it will poll the assigned Comm Port for any activity. When it receives Time and Date data from the sending controller, it automatically updates its local time and date

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SECTION 7 – COMMUNICATIONS

from the received data. Selection of this communication method automatically configures the Comm Port with the following protocol:

- 8 bits
- 1 Stop bit

The baud rate and parity are set by software as determined by the port's comm settings. The sending and receiving controllers must be configured likewise for the received data to be recognized. The communications cable should have pins 2 and 3 of the transmitting controller connected to pins 3 and 2 (i.e. reversed) of the receiving controllers.

	8	7	6	5	4	3	2	1	
MSB	Offset Timing	Midnight Sync Pulse	Free	Dial3 (Plan 3)	Dial2 (Plan 2)	unused	unused	Sync	LSB

Note that if the sending controller is in Local Manual Override mode and commanding the Slave sub mode ("B" at location 401), then only the Offset Timing and Midnight Sync Pulse data will be sent. Note also that, for compatibility with older LACO programs, only Plans 1, 2 or 3 and Offset 1 should be configured in the Local Coordinator. The received Sync pulse will correspond to Offset 1.

Transmit Time/Date (AB3418E Master)

This option allows the 170E controller to send its Time and Date to any controller that supports the AB3418E protocol. Once per minute, the Time and Date are transmitted using the AB3418E **SetTime** message. This message comes in two variations, broadcast and addressed, but only the broadcast mode is used so that more than one connected controller can be updated with a single message. Data sent includes DOW, mm/dd/yy, hh/mm/ss, and tenths of second.

See the Central Systems Interface (AB3418E Slave) section for details on the **SetTime** message and AB3418E protocol.

Transmit Plan

This option has been discontinued.

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SECTION 7 – COMMUNICATIONS

WWV/GPS

NOTE: All references to WWV in the following section apply to GPS receivers as well.

In order to implement Time Based Coordination an accurate time source must be used to periodically update the 170E controller's Real Time Clock. The Radio Corrected Time Base (RCTB) WWV Clock used by Los Angeles County receives and decodes the WWV/WWVH radio broadcasts transmitted by NIST (National Institute of Standards and Technology, formerly the National Bureau of Standards). It automatically corrects for Leap Year and Daylight Savings Time and, in the event of a power failure, automatically locks on to the WWV broadcast when power is restored.

The 170E controller downloads this extremely accurate time in a number of ways:

- It automatically polls the WWV Clock after a power outage, either long or short.
- It automatically polls the WWV Clock every hour on the hour.
- It can manually poll the WWV Clock via the Front Panel keypad.

Disconnecting the WWV Clock or cable while performing a repoll will abort the repoll process. This is not recommended since it could possibly cause the controller to lock up, requiring a long power down.

Before the 170E controller can utilize the WWV Clock data, the following conditions must be satisfied:

- **The WWV Clock hardware must be properly configured**
- **The desired Comm Port must be configured for WWV** - Decide which Comm Port will be used for WWV. Comm Port 1, 2, 3 and 4 are configured at locations 191, 192, 193 and 194, respectively. Enter "1" at the desired location followed by "E". Any **one** Comm Port can be configured for WWV.
- **The WWV Clock cable must be connected to the configured Comm Port** - Viewing the 170E controller from the rear, the designations are Comm Port 1 (C2S), Comm Port 2 (C20S), Comm Port 3 (C30S, if installed) and Comm Port 4 (C40S, if installed).
- **The WWV Clock must be connected to the cable and have power available to it**
- **An antenna of the correct type must be connected to the WWV Clock**
- **The WWV Clock must be "locked on" to the WWV signal** - If the WWV Clock has not "locked on" to the WWV signal, then the LACO-4E program will not allow a download. This is to prevent erroneous time from being set.

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To manually poll the WWV Clock, access the Time display by pressing "A-C" or "C". Pressing the "E" key at this display will force a manual poll. A manual poll can also be initiated from TxMsg (location 200). At this location, enter "001" followed by the "E" key. If the display changes from "001" to "002" then to "000", then the poll attempt was successful. Any other indication means the poll was unsuccessful. Viewing the call lights at location 0A5 (WWV ERR) will provide a probable cause as follows:

1 = *Not Locked On* – Indicates that the WWV Clock has not locked on to the WWV radio signal transmitted by NIST, or the GPS receiver has not yet found at least one satellite to insure correct data, or has not received a usable signal for 5 days,

2 = *Cannot Override Central Time/Date* – The 170E controller has received a Time/Date update from Central within the last 5 hours. Central Time/Date overrides WWV/GPS Time/Date.

3 = *Received Timeout* – No data was received from the WWV Clock/GPS receiver within ½ second of the last poll.

4 = *Bad or unrecognized data received from Clock* – Indicates a probable bad ACIA on the 170E controller CPU board. Reconfiguring WWV operation for an unused Comm Port will verify this.

5 = *Unused*

6 = *Unused*

7 = *No Port Configured* – No port has been configured for WWV/GPS operation.

8 = *Bad or disconnected cable* – Indicates that the WWV Clock/GPS cable is not connected to the assigned Comm Port or the cable is faulty.

If the display retains the "001" but changes to "000" briefly every 2 seconds, then the 170E controller is not receiving valid data (call lights "4" or "5"), or the WWV Clock is not "locked on" (call light "1"). In this situation, the 170E controller will continually repoll until either valid data is received from the WWV Clock or the WWV function is removed from the Comm Port option.

If the display retains the "001" but changes to "000" within 1 second, the WWV/GPS logic has not received any data from the WWV/GPS receiver since the last poll. The WWV/GPS receiver should be tested for proper operation (call light "3").

The display changing immediately from "001" to "000" can be caused by one of three conditions:

- An invalid value was entered at TxMsg (location 200). Only "001" or "002" are valid values.
- No Comm Port is configured for WWV/GPS operation (call light "7").
- The WWV/GPS cable is either faulty or not connected (call light "8").

NOTE: WWV/GPS Time and Date updates will override any Time and Date update from Central as long as the WWV/GPS unit is functional and no errors occur on polling.

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CENTRAL SYSTEMS INTERFACE (AB3418E SLAVE)

More detailed information on the AB3418E protocol can be found in “Standard Communications Protocol for Traffic Signals in California, Specification and Implementation Requirements” available from the California Dept of Transportation. All AB3418E messages consist of an Opening Flag, Header, Data and Closing Flag. The Opening and Closing Flags are always “0x7E”. The Header includes:

- Address byte – This must be in the range of 0-127
- Control byte – 0x03, 0x13 or 0x33 depending on message
- IPI (Initial Protocol Identifier) byte – This is always 0xC0
- Command byte – Depends on message

LACO-4E checks the Control byte of the incoming message from Central. If it is “0x03”, then the message is treated as a broadcast message. If it is “0x13”, then the message is treated as an addressed message.

When the selected port is configured as an AB3418E Slave, LACO-4E automatically sets the controller’s Comm Port protocol to 8 data bits, 1 stop bit and No parity. Any of the controller’s Comm Ports may be set to transmit and receive AB3418E protocol but only the first port detected as such will be used. First go to location 190 (System ID) and enter a unique address, from 1 to 63, for this controller. This identifies the 170E controller to the polling system. To configure the controller’s Comm Port 1 to *receive* AB3418E communication (controller responds to commands from polling system) go to location 191 (Comm Port 1) and enter “8” followed by “E”. Follow the same steps to configure Comm Port 2 (at location 192), Comm Port 3 (location 193) or Comm Port 4 (location 194).

The following table summarizes the messages currently supported by LACO-4E.

Command			Response				Message Name
Control	Type	Bytes	Control	Type	Error	Bytes	
33	81	8	33	C1	E1	28	GETCONTROLLERID ¹
13/03	92/A2	16	13/03	D2	F2	8/0	SETTIME ¹
13/03	93/A3	9	13/03	D3	F3	8/0	SETPATTERN ¹
33	84	8	33	C4	E4	11	GETSHORTSTATUS ¹
33	85	8	33	C5	E5	68	GETSYSTEMDETECTORDATA ¹
33	86	8	33	C6	E6	23	GETSTATUS8 ²
33	89	11	33	C9	E9	varies	GETCONTROLLERTIMINGDATA ²
13	99	varies	13	D9	F9	8	SETCONTROLLERTIMINGDATA ²
33	8A	8	33	CA	EA	28	GETSTATUS16 ²
33	8C	8	33	CC	EC	40	GETLONGSTATUS8 ²
33	87	8	33	C7	E7	12	GETSHORTSTATUSEXTENDED ³

¹ Caltrans AB3418E

² Caltrans AB3418E

³ L.A. County Specific

AB3418E Standard Messages –

GetControllerID – Provides information that identifies the controller to the polling system. Causes the 170E controller to respond to the polling system with the following information:

- Number of data bytes in message response = **19**
- Number of bytes in Manufacturer's ID = **4**
- Manufacturer's ID = **LACO** (Los Angeles County)
- Number of bytes in Model Number = **2**
- Model Number = **4E** (LACO-4E)
- Number of bytes in protocol version = **10**
- Protocol Version = **AB3418E V1**

SetTime – This message causes the 170E controller's time and date to change to the time and date sent from the polling system. Data sent includes DOW, mm/dd/yy, hh/mm/ss, and tenths of second. This message comes in two variations, addressed and broadcast. The broadcast variation does not generate a response while the addressed variation does. The broadcast variation is used to update multiple controllers with a single message and its Address byte is ignored.

NOTE: WWV/GPS Time and Date updates will override any Time and Date update from Central as long as the WWV/GPS unit is functional and no errors occur on polling.

SetPattern – This message tells the 170E controller to implement the coordination plan sent from the polling system. This can be plans "1" through "9", "254" for Flashing Red operation or "255" for Free operation. The commanded plan can be observed at location 404 (TMCPLN) and will take affect at the start of the next Master Cycle. This message also comes in two variations, addressed and broadcast. The broadcast variation does not generate a response while the addressed variation does. The broadcast variation is used to update multiple controllers with a single message and its Address byte is ignored.

GetShortStatus – Provides three byte status of the intersection. Causes the 170E controller to respond to the polling system with the following information:

- Current green phases
- Status as follows:
 - If any preempt input is ON
 - If the Flash Sense input is ON
 - If the Local Cycle timer has rolled over since the last poll
 - If the Manual Control Enable input is ON (pushbutton switch inserted in Police Panel jack)
 - If location 401 has any non-zero value (Local coordinator is in Manual Override mode)
 - If any system detector is in an error condition
 - If any non-critical alarm exists (There are currently no non-critical alarms configured)
 - If any critical alarm exists
- Current plan

GetSystemDetectorData – This message requests system detector data including:

- Sequence number
- Sample period length
- Number of System Detectors (this is always "28" for LACO-4E)
- Volume/Occupancy/Error Status for each System Detector.

GetStatus8 – Provides fifteen bytes status of the intersection. Causes the 170E controller to respond to the polling system with the same information as *GetShortStatus* above plus additional status bytes that provide the following information:

- Current green or yellow overlaps (overlaps A through D).
- Active railroad or EV preemption service
- Coordinator-in-transition status
- Ring A and B calling phases
- Ring A and B calling peds
- Ring A and B current phases in service
- Ring A and B current intervals as follows:

0x00 = Walk	0x01 = Don't Walk	0x02 = Min Green
0x03 = Queue Green	0x04 = Added Initial	0x05 = Passage/Green Rest
0x06 = Hold	0x07 = Reducing Gap	0x08 = Red Rest
0x09 = Preempt Green	0x0A = not used	0x0B = Red Revert
0x0C = Gap Termination	0x0D = Max Termination	0x0E = Force Off
0x0F = Red Clearance		
- Presence status for all 28 detectors
- Master Cycle timer
- Local Cycle timer

GetControllerTiming – This message provides the capability of uploading memory locations to Central (or a laptop running Central Systems software). The message specifies a two byte starting address in memory and the number of bytes to upload. Up to 32 bytes of contiguous memory can be retrieved with each message. The 170E controller responds with the requested data. Any location(s) within the 170E controller's memory map, not just Timing, can be retrieved with this message.

SetControllerTiming – This message provides the capability to modify memory locations from Central (or a laptop running Central Systems software). The message specifies a two byte starting address in memory, the number of bytes to modify and the actual data that will replace the 170E controller's data. Up to 16 bytes of contiguous memory can be downloaded from Central. Any location(s) within the 170E controller's memory map, not just Timing, can be modified with this message. This message causes the 170E controller to respond with an "acknowledgement" message only. Extreme care should be used in the Central System software to ensure that no program critical memory is modified.

GetStatus16 – Provides twenty byte status of the intersection. Causes the 170E controller to respond to the polling system with the same information as *GetStatus8* above plus additional status bytes that provide the following information:

- Green overlaps (overlaps A through H)
- Yellow overlaps (overlaps A through H)
- Ring C and D calling phases
- Ring C and D calling peds
- Ring C and D current phases in service
- Ring C and D current intervals as follows

GetLongStatus8 – Provides thirty two byte status of the intersection. Causes the 170E controller to respond to the polling system with the same information as *GetStatus8* above plus additional status bytes that provide the sample sequence number and Volume/Occupancy/Error status for System Detectors 1-8.

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GetExtShortStatus – Provides four byte status of the intersection. Causes the 170E controller to respond to the polling system with the same information as *GetShortStatus* above plus an additional status byte that provides the following information:

- | | |
|---------------------------|--|
| 1. BADA/BADE flash | 5. Controller key press detected |
| 2. Cabinet door open | 6. Controller requesting timing download |
| 3. Stuck all red flash | 7. Front panel stop time switch ON |
| 4. Police panel door open | 8. External stop time input ON |

Any LACO-4E memory location is retrievable from the 170E Controller using the **GetControllerTiming**. Following are several useful examples:

1) Get Input, Output and Coordination Status

Send **GetControllerTiming** Message as follows:

7E 05 33 C0 89 03 EF 1F 27 C0 7E

Returns 31 bytes of data from the controller as follows:

03EFh - Echo of Input Port 1 (In1)
03F0h - Echo of Input Port 2 (In2)
03F1h - Echo of Input Port 3 (In3)
03F2h - Echo of Input Port 4 (In4)
03F3h - Echo of Input Port 5 (In5)
03F4h - Echo of Input Port 6 (In6)
03F5h - Echo of Output Port 1 (Out1)
03F6h - Echo of Output Port 2 (Out2)
03F7h - Echo of Output Port 3 (Out3)
03F8h - Echo of Output Port 4 (Out4)
03F9h - Echo of Output Port 5 (Out5)
03FAh - Echo of Output Port 6 (Out6)
03FBh - Echo of Output Port 7 (Out7)
03FCh - Coordination Calls (CoCall)
03FDh - Coordination Ped Restricts (PedRst)
03FEh - Coordination Holds (Hold)
03FFh - Coordination Force Offs (Force1)
0400h - System Manual Plan Override (SysMan)
0401h - Local Manual Plan Override (LocMan)
0402h - Commanded Master Plan (MasPln)
0403h - Commanded Local Plan (LocPln)
0404h - Central Master Plan Override (TMCPIn)
0405h - Current Time of Day Table Plan (TODPln)
0406h - Current Time of Day Special Function Command (TODSpf)
0407h - Current Time of Day Table (TODTbl)
0408h - Minimum Cycle Length (MinCyc) (discard this)
0409h - Maximum Cycle Length (MaxCyc) (discard this)
040Ah - Current Master Cycle Timer (MasCyc)
040Bh - Current Local Cycle Timer (LocCyc)
040Ch - New Offset Time (NewOff)
040Dh - Current Offset Time (CurOff)

2) Get Coordination MOE Data

Send **GetControllerTiming** Message as follows:

7E 05 33 C0 89 1A 0C 14 27 C0 7E

Returns 20 bytes of data from the controller as follows:

- 1A0Ch – Permitted phases (Permit)
- 1A0Dh – Local plan (LocPln)
- 1A0Eh – Last Master Cycle length (LMster)
- 1A0Fh – Coordination Status Sequence Number
- 1A10h – Last cycle Coordination split for phase 1
- 1A11h – Last cycle Coordination split for phase 2
- 1A12h – Last cycle Coordination split for phase 3
- 1A13h – Last cycle Coordination split for phase 4
- 1A14h – Last cycle Coordination split for phase 5
- 1A15h – Last cycle Coordination split for phase 6
- 1A16h – Last cycle Coordination split for phase 7
- 1A17h – Last cycle Coordination split for phase 8
- 1A18h – Last cycle Coordination green delay for phase 1
- 1A19h – Last cycle Coordination green delay for phase 2
- 1A1Ah – Last cycle Coordination green delay for phase 3
- 1A1Bh – Last cycle Coordination green delay for phase 4
- 1A1Ch – Last cycle Coordination green delay for phase 5
- 1A1Dh – Last cycle Coordination green delay for phase 6
- 1A1Eh – Last cycle Coordination green delay for phase 7
- 1A1Fh – Last cycle Coordination green delay for phase 8

3) Get Timing Sheet Checksum Data

Send **GetControllerTiming** Message as follows:

7E 05 33 C0 89 19 60 16 27 C0 7E

Returns 22 bytes of data from the controller as follows:

- 1960h – Page 0100 Checksum
- 1962h – Page 0200 Checksum
- 1964h – Page 0300 Checksum
- 1966h – Page 0400 Checksum
- 1968h – Page 0500 Checksum
- 196Ah – Page 0600 Checksum
- 196Ch – Page 0700 Checksum
- 196Eh – Page 1000 Checksum
- 1970h – Page 1100 Checksum
- 1972h – Page 1200 Checksum
- 1974h – Page 1E00 Checksum

4) Get Embedded Date of LACO-4E EPROM

Send **GetControllerTiming** Message as follows:

7E 05 33 C0 89 8005 03 27 C0 7E

Returns 3 bytes of data from the controller as follows:

- 8005h – Month of LACO-4E program
- 8006h – Day of LACO-4E program
- 8007h – Year of LACO-4E program

Use of the AB3418E **GetControllerTiming** message in conjunction with a working knowledge of the LACO-4E memory maps can provide a wealth of useful information to Central.

Bus Signal Priority (BSP)

(See section 8 for information on BSP operation)

The BSP protocol format and usage is detailed in “Bus to Intersection Message Format” published by the Los Angeles County Metropolitan Transportation Authority (Metro). The BSP protocol is based on the AB3418E protocol specification. More detailed information on the AB3418E protocol can be found in “Standard Communications Protocol for Traffic Signals in California, Specification and Implementation Requirements” available from the California Dept of Transportation.

When the selected port is configured for Bus Signal Priority, LACO-4E automatically sets the 170E controller’s Comm Port protocol to 8 data bits, 1 stop bit and No parity. Any of the 170E controller’s Comm Ports may be set to transmit and receive Bus Signal Priority but only the first port detected as such will be used. To configure the 170E controller’s Comm Port 1 for Bus Signal Priority, go to location 191 (Comm Port 1) and enter “9” followed by “E”. Follow the same steps to configure Comm Port 2 (at location 192), Comm Port 3 (location 193) or Comm Port 4 (location 194).

The BSP system has two modes of operation:

Mode 1 Schedule Based: As the bus approaches the intersection three messages are sent to the traffic controller: the first for checking in, the second five seconds later as a position update or confirmation message, and then the third for the check-out message as the bus enters the intersection. The bus to intersection message format conforms to the Revision 1 Pilot Project Protocol. The traffic controller determines if priority can be granted based on the status of the traffic signal and rules established for granting priority.

Mode 2 Headway Based: The bus sends the check-in, position update, and check-out messages using the Revision 2 Metro Rapid Protocol. The traffic controller tracks the headway between buses checking in on the same route and direction, and makes a decision to grant priority based on the status of the traffic signal and the rules established for granting priority.

The BSP signal priority message format:

<u>Field</u>	<u>Data</u>	<u>Description</u>
1	0x7E	Start Flag
2*		Address bytes (1-3 bytes)
3	0x03	Control (send data no response)
4	0xC3	Initial Protocol Identifier (IPI)
5	0x85, 0x88	Command (0x85 for Pilot Project Protocol, 0x88 for Metro Rapid Protocol)
6	0x01, 0x02	Revision (0x01 for Pilot Project Protocol, 0x02 for Metro Rapid Protocol)
7		Data, Bus Identifier (Two bytes, MSB followed by LSB)
8*		Data, Bus Status (Priority request/Direction/Status)
9		Data, Bus ETA (in seconds 0-255)
10*		DTGP Action (Only in outbound response message)
11*		Scheduled Headway (One byte, Metro Rapid Protocol only)
12*		Bus Route (Two bytes, Metro Rapid Protocol only)
13		CRC (Two bytes, MSB followed by LSB)
14	0x7E	End Flag

Definition of Data Fields:

Field	Contents
2 Address	<p>A two or three byte field:</p> <p>Byte 1: Address low order byte</p> <p>Byte 2: Address high order byte (if needed) or Secondary Address</p> <p>Byte 2 or 3: City code (up to 127 codes)</p> <p>The address bytes are formatted as an HDLC address per AB3418E:</p> <p>Byte 1: A6 A5 A4 A3 A2 A1 G E=0</p> <p>Byte 2: A13 A12 A11 A10 A9 A8 A7 E=0</p> <p>Byte 3: C7 C6 C5 C4 C3 C2 C1 E=1</p> <p>Where: A(nth) = Address C(nth) = City Code</p> <p style="padding-left: 40px;">G = Group (always zero) E = Extension</p>
8 Bus Status	<p>Bits are set in the priority request to indicate:</p> <p>1 N/B Bus direction or Bus A</p> <p>2 S/B Bus direction or Bus B</p> <p>3 E/B Bus direction or Bus C</p> <p>4 W/B Bus direction or Bus D</p> <p>5 Position Update</p> <p>6 Check-out</p> <p>7 Check-in</p> <p>8 Priority Request</p>
10 DTGP	<p>Bits are set in the priority response to indicate:</p> <p>1 Hold the Green Phase (Bus arrives during green)</p> <p>2 Early Green Return (Bus arrives when not green)</p> <p>3 Special Operation (Future; queue jump or skip phase)</p> <p>4 Demand Override</p> <p>5 Manual Override</p> <p>6 Table Override</p> <p>7 Priority Override</p> <p>8 Preempt Override</p>
11 Headway	<p>Scheduled Headway 1-255 minutes, zero indicates not being used or data not available. In Metro Rapid Protocol packets only.</p>
12 Bus Route	<p>Bus Route Number 1-65535 (two bytes, MSB followed by LSB)</p> <p>In Metro Rapid Protocol packets only.</p>

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Example packets:

Request to address 1, city 1, Pilot Project Protocol, Bus ID 1, Priority Check-In for NB bus, ETA 30 seconds

Start	Addr	City	Ctl	IPI	Cmd	Rev	Bus ID		Status	ETA	CRC		End
0x7E	0x04	0x03	0x03	0xC3	0x85	0x01	0x00	0x01	0xC1	0x1E	0x76	0x0C	0x7E

Response with DTGP = Hold Green

Start	Addr	City	Ctl	IPI	Cmd	Rev	Bus ID		Status	ETA	DTGP	CRC		End
0x7E	0x04	0x03	0x03	0xC3	0x85	0x01	0x00	0x01	0xC1	0x1E	0x01	0x4C	0xF7	0x7E

Request to address 5, city 3, Metro Rapid Protocol, Bus ID 35, Priority Check-In for bus A, ETA 50 seconds, headway 10 minutes, bus route 12

Start	Addr	City	Ctl	IPI	Cmd	Rev	Bus ID		Status	ETA	Hdwy	Route		CRC		End
0x7E	0x14	0x07	0x03	0xC3	0x88	0x02	00	0x23	0xC1	0x32	0x0A	00	0x0C	0x8E	0xCD	0x7E

Response with DTGP = Early Green

Start	Addr	City	Ctl	IPI	Cmd	Rev	Bus ID		Status	ETA	DTGP	Hdwy	Route		CRC		End
0x7E	0x14	0x07	0x03	0xC3	0x88	0x02	00	0x23	0xC1	0x32	0x02	0x0A	00	0x0C	0xAD	0x68	0x7E

See Appendix E13 for information on cabling requirements for AB3418E and BSP communications.

SECTION 8 MISCELLANEOUS FEATURES

BUS SIGNAL PRIORITY (BSP)

USER DATA VALIDATION

PROGRAMMABLE LOGIC

MID-BLOCK PED CROSSING

FREEWAY OFF-RAMP RELEASE LOGIC

OUTPUT FILE EDITING

FLASHOUT PROGRAM

REINITIALIZATION

MEMORY MANAGEMENT

TIMING COPYING

BUS SIGNAL PRIORITY (BSP)

The Bus Signal Priority logic provides transit buses a priority service over normal vehicular flow when passing through a signalized corridor. In order to accomplish this task, LACO-4E incorporates the AB3418E communications specification and priority logic functions necessary for a transit priority system. While the logic routines in this system give a priority to the transit vehicles, they only aid in the progression of the vehicle and do not guarantee its passage. The purpose of the system is to reduce "Red Time" or the amount of time a bus sits at a red light. See section 7, Communications for information on the BSP protocol.

Highlights of the LACO-4E Bus Signal Priority feature:

- Receives Priority request from the transit bus
- Extracts bus direction information
- Extracts bus Estimated Time of Arrival (ETA)
- Extracts Check-in, Check-out and Position update requests
- Provides a Manual Override
- Provides a Demand Override
- Provides a Time of Day Table Override
- Provides a Priority Override
- Provides a Preempt Override
- Maintains a running average of the queue length on the priority phase per ring
- Maintains the average demand (Green) time for all eight phases
- Determines whether to hold the green or force-off for an early green return
- Sends the "Action Taken" Status to the MTA bus logger
- Works under free and coordinated operation
- Maintains the coordinated cycle
- Aids, but does not guarantee, the passage of the transit vehicle

The BSP logic routine determines what action to take when it receives a transit priority request. The logic can hold the green for the priority phase. However, how long to hold the green must be calculated so as not to overrun the coordinated cycle. The logic can also force a side street termination for an early return to green but the logic must determine how much time can be reduced on the side street without seriously affecting congestion levels. The average queue build up on the priority phase is looked at and affects the side street green time reduction calculation; the larger the queue the more time needs to be subtracted from the side street. The ETA Timer tells the logic when to start the priority action and when to end it if the Checkout message is late or never arrives.

The Override logic disables the BSP logic with any one of the five parameters failing the test. The five parameters are Demand override, Table override, Manual override, Preempt override and Priority routine active override. See section 7 for BSP Protocol definition.

The operator will have a series of locations to set to optimize the performance of the priority routine for each signal location. All user set locations are in the first column of the BSP RAM page (PAGE-1E). Shaded areas on the timing sheet represent observation-only memory locations. Because the BSP RAM page is located in extended memory, the data can be set or read in decimal or binary format making it easier on the user. The decimal data is shown in the Timing window of the display and the binary data is represented in the call active lights. To switch from one mode to the other, simply toggle the Stop Time switch and observe the decimal point in the Timing window. If it is on, the display is in decimal mode. If it is off, the display is in binary mode.

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SECTION 8 – MISCELLANEOUS FEATURES

Operational Procedures

The operator must enter the user set locations for the BSP routines to run. The operator must first select the BSP manual control mode 1E00. Manual control manages the BSP logic in operation. Then enter the low order address of the controller at location 1E01. The address can be unique to the BSP communications, as it will not interfere with an existing system. Next, enter the high order address if necessary at location 1E02 (for single bus only). Enter the City code, which is actually part of the addressing scheme although it is treated as a separate location. Each city has a unique code assigned by Metro.

The next locations have different meanings for Single Bus vs. Multi Bus mode.

For Single Bus, if the user is using the hardwired mode of operation (mode 7) the ETA time must be set in the HWETA location 1E04. This number is an estimate of the time it will take the Bus to arrive once it crosses the check in loop. The next location 1E05 is the Trip Point, the minimum time in seconds that the ETA timer can count down to and still perform the priority service. Next at 1E08 are the priority phases, which will be hosting the priority service calls. At the next location, enter any Demand phases the operator wishes to remove from the Split modification logic if their congestion level reaches max. Then enter the priority phases in locations 1E0A-1E0D. These four locations tell the logic the association between phase and direction of the Bus. Only two phases should be selected, one for each direction.

For Multi Bus, location 1E04 is Early Green Time which is the time in seconds that a phase's Max Green 1 timer or coordination split interval can be shortened. Location 1E05 is Bus Green Extension which is the time in seconds that is added to the bus's ETA time. The priority phase green may be extended by this time to accommodate a priority request. Location 1E08 is No Early Green, which are phases that will not have their Max Green 1 timers reduced during free operation or selected phases will not have their green split shortened during coordination. If there are three or four priority phases, all priority phases will need to be toggled for No Early Green.

Demand phases, location 1E09, enables the demand override logic which monitors max outs and force offs, determining if corresponding phases for Max Green 1 or coordination split may be reduced. Locations 1E0A – 1E0D identifies the bus priority phases and their associated direction. Each bus direction should have only one phase assigned. However, different directions can have the same assignable phase.

The BSP logic can be turned off, "Overridden", by three tables. The Floating Holiday table (table 6) and Fixed Holiday table (table 7) are the coordination tables used for Holiday plan selection in LACO-4E. The code of "B" for Bus will set the BSPFLT or BSPFIX locations and tell the logic to ignore all priority requests. The BSP table (table 9) for the BSP is used to configure Table Override. The Hours, Minutes, Day of Week and Direction(s) to override will need to be entered to inhibit the priority request for any given direction when the Local Coordinator is active. Press "9" to set table data entry mode then "9" to access event 0 of the BSP table. Data for this table is entered in the same format as for the other coordination tables.

Observe Locations

The operator can observe several status locations to aid in trouble shooting or simply to watch the logic routine work. The first location is called BSPMsgErr (location 1E3F) which holds the test results of the incoming BSP message. All of the locations are checked by this logic routine to make sure the message is complete and for the intended controller. This location updates each time a new message is received.

ETATMR (location 1E10) is set at the beginning of the priority service. The Estimated Time of Arrival of the bus to the intersection can be updated by the bus in a position update message. The ETA information is used by the logic code to determine the time to start priority service. The count down runs to completion or until receipt of the check-out message. This timer displayed in Single Bus only. Set the display to decimal to observe the timer.

DTGP (Decision To Grant Priority) (location 1E11) - This location is the heart of the decision making system for both Single and Multi Bus Priority.. The operator can see what the logic wants the

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controller to do and observe the action. This location contains eight bits of action code. Set the display for binary mode to view this location.

The first two DTGP bits tell the operator which action the logic has selected for this priority request. Bit one is for HOLD the green and Bit two is for an Early Green Return. These bits may change as the BSP logic continuously selects the best action to take while the ETA Timer counts down or is updated by the Bus en route to the bus stop. If the decision of “hold the green phase” or “early green return” request cannot be serviced, these bits will both remain zero. The other six bits provide the override status. If any of these bits are set, the priority request was denied and the routine resets and waits for the next check in message. The data bits are:

1. Hold the Green Phase (Bus arrives during priority phase green)
2. Early Green Return (Bus arrives when priority phase is not green)
3. Special Operation (Not used)
4. Demand Override (SLOP < Trip Point. All BSPDFaz are set)
5. Manual Override (Manual control = 0 or 1. No priority phase set. Message packet errors.)
6. Table Override
7. Priority Override (Priority request for a different direction, check out message for non-active bus, in transition between coordination plans, headway > ETA)
8. Preempt Override

Priority Flag (location 1E12) - Contains the bus direction information of the priority request and tells the logic that a priority request is being serviced and to ignore any additional requests. Set the display for binary mode.

Priority Phase (location 1E13) - Contains the phase information of the priority request and is used in the logic routines for priority phase consideration. Set the display for binary mode.

BSP TOD (location 1E14) - The search result of the BSP Table (table 9). The priority request will be ignored for this direction while the table is active.

BSPFIX (location 1E15) - The search result of the Fixed Holiday Table. This table can inhibit the priority logic for all directions for a given date. The Fixed holiday table is the same one used for coordination and is table 7.

BSPFloat (location 1E16) - The search result of the Floating Holiday Table. This table can inhibit the priority logic for all directions for a date that is not fixed on the calendar. An example of a floating holiday is Labor Day, which is the first Monday in September. The Floating holiday table is the same one used for coordination and is table 6.

BSPDFaz (location 1E17) - The Demand Phase location contains any phases in demand override. It is the sum of all eight demand phase locations **BSPFaz1** - **BSPFaz8** and is used by the override logic to exclude any green time modifications for the congested phases. Only phases selected in the user location **DemPhz** 1E09 may appear in this location and be excluded from having their green times modified. Observe the data in binary mode.

BSPFaz1-8 (location 1E18 through 1E1F) - The demand phase working locations. The data contained in these locations is dynamic. The demand phase logic looks at how the phase was terminated. If the override flag count reaches three, the demand phase override flag is set in BSPFaz above. The flag is cleared at BSPFaz when the override flag count reaches zero. The flag being set tells the logic that the demand is very heavy for this phase and to not reduce any green time from it. Observe these locations in binary mode.

Slop (location 1E20) - A program calculated number which tells the logic how much time could be adjusted in the cycle without seriously affecting coordination. This number has no meaning when the controller is operating in the Free mode. The Slop for each ring is the programmed green time minus the average green time for the coordinated phases. (PAGrn 1E5C minus AGAVG 1E21, PBGrn 1E5F minus BGAVG 1E22). This value is the smaller non-zero for the two rings. Observe this data in decimal mode. Slop is used in Single Bus Priority mode.

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AGAVG (location 1E21) – The running average green time of Ring A priority phases over the last two cycles. Used to calculate the Ring A Slop and used in Single Bus Priority mode.

BGAVG (location 1E22) - The running average green time of Ring B priority phases over the last two cycles. Used to calculate the Ring B Slop and used in Single Bus Priority mode.

BSPRAG (location 1E23) - Timer for the actual green time of the Ring A priority phases. The value is used to calculate the Ring A Slop.

BSPRBG (location 1E24) - Timer for the actual green time of the Ring B priority phases. The value is used to calculate the Ring B Slop.

AGFlag (Location 1e25)

BGFlag (Location 1E26)

BSPFTB (location 1E27) - Floating Holiday storage for the “Day after” bit. This allows, for example, the day after Thanksgiving to run in the holiday mode. The display can be in either mode for this location.

BSPDONE (location 1E28) - Contains the phases that had their timing modified by the logic routine. Timing modification can only be done one time for each phase green. If, in the next cycle, the bus has not reached the bus stop and the ETA timer is still running the phase greens can be modified again.

BSPMAX (location 1E29) - Holds the max recall flags for the build call routine. It is used by the logic when the coordination is running free to hold the priority phase green.

CYCNT (location 1E2A) – The projected number of cycles before the bus arrives.

BAICP (location 1E2B) – “Bus Arrival in Cycle Position.” The projected arrival time of the bus with respect to the local cycle timer.

BSPMsgErr (location 1E3F) is an observe location that stores the last message status. There are eight bits that will aid the operator in checking the communication system in the field. Maintenance groups may observe this location and note any errors then clear all flags for the next maintenance cycle. This will aid in finding intermittent problems with the communications system. This location should be observed in the binary display mode.

Bits		Definition
1	Bad Opening/Closing Flag	Missing start or end flag
2	Bad Address1	1st Address byte does not match Timing Sheet Primary Address
3	Bad Address 2	2nd Address byte does not match Timing Sheet Secondary Address
4	Bad City	City byte does not match Timing Sheet City Code
5	Bad Control Byte/IPI/Command	Control byte is not equal to 0x03 or IPI byte is not equal to 0xC3 or Message Number byte is not equal to 0x85
6	Bad Revision	Revision Number byte is not equal to 0x01 or 0x02
7	Future use	
8	Bad Checksum	Computed checksum of message does not match transmitted checksum

Locations 1E51 – 1E5F are used during Single Bus Mode while in coordination:

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PASTART (location 1E5A) – Start of the Ring A priority phase green in the local cycle = start of the programmed split (preceding force off +3 seconds)

PAEND (location 1E5B) – End of Ring A priority phase green in the local cycle = programmed force off point

PAGRN (location 1E5C) – Length of the Ring A programmed split green = PAEND - PASTART

PBSTART, PBEND, PBGRN (1E5D -1E5F) – Same values for Ring B

The **PSTART** and **PEND** locations are temporary storage used while calculating the PA and PB values and while processing each ring, and are not useful externally.

LoArvA – LoArvD (locations 1E9B – 1E9E) – The ETA countdown timers per bus direction. These locations used in Multi Bus Priority only.

Locations 1E90 – 1E9A: The incoming data bit characters sent from the bus are stored here.

Locations 1EC0 – 1EDF: The outgoing data bit characters sent to the bus are stored here.

BusHdwy (Locations 1E00 – 1EFF): Historical bus headway stored here.

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USER DATA VALIDATION

LACO-4E provides automatic validation of all the critical data in the program. This data falls into four general categories:

1. Phase Time Parameters

- Minimum Green – If a phase is selected for Permit or Railroad Limited Service, its Minimum Green time will be automatically set to 10 seconds if no other time is set there.
- Yellow Clearance – Yellow Clearance time for all phases must be between 3.0 seconds and 5.0 seconds. If it is less than 3.0 seconds, it will be automatically set to 3.0 seconds. If it is greater than 5.0 seconds, it will automatically be set to 5.0 seconds. If a phase is selected for Yellow Ranging, then its Yellow Clearance time can be set to any value between .0 second and 25.5 seconds.
- Red Revert times – The default time for Red Revert is 2.0 seconds. Any value other than zero can be entered for Red Revert. If zero is entered, it will automatically be changed to 2.0 seconds.
- Main Street phases – At least one phase must be selected as a Main Street phase. If no phase is selected, then phases 1, 2, 5 and 6 will automatically be selected.
- Side Street phases – Side street phases are automatically set to the opposite of Main Street phases.
- First phases – First phases must also be selected in Permit phases. All First phases must be able to time concurrently with regards to ring, street, Exclusive phasing and Restricted phasing.
- Yellow Startup phases – Same as First phases.
- Ped phases – Only one phase may be selected for each ped. If more than one phase is selected, only the last selected phase will be saved. If Overlap A/B have parent phases selected, then Ped A/B are disabled. Phases selected will be erased. Only configured peds (i.e. peds with phases assigned) can be selected as STA Mode, Ped Recall or Railroad-Only peds (RRPED).
- Exclusive phases – Only lead phases or lag phases may be selected as Exclusive phases.
- Restricted phases – Restricted phases can only be set for standard quad configurations. Only lead phases or lag phases may be selected as Restricted phases. Restricted phases cannot be selected on the same street with Exclusive phases. If Restricted phases are selected, they will be erased.
- Free Lag phases – If no phases are selected for a quadrant or multiple phases are selected for a quadrant, then only the quadrant's barrier phase will be saved.
- Manual Control Lag phases – Same as Free Lag phases, above

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2. Preempt Parameters

- Railroad Mode Select – Only “01”, “02”, or “03” are recognized as valid Railroad modes. Any other value will be changed to “00”.
- All Red time after RR Flash – The default value is 5.0 seconds. Any value other than zero can be entered. If no value is set, it will automatically be changed to 5.0 seconds.
- EV Clearance phases – EV Clearance phases must also be selected as either Permitted phases or Railroad Limited Service phases (RRBLIM). They must also be able to time concurrently as in First phases, above.
- RR Track Clearance phases – Same as EV Clearance phases, above.
- RR Exit phases – Railroad Exit phases must also be selected as Permitted phases and be able to time concurrently as in First phases, above.
- EV Link – An EV will not be permitted to link to itself. If, for example, EV A Link is set to “001” (for EV A), the location will automatically be changed to “000”. Also, any value other than “001”, “002”, “003” or “004” will be treated as zero.

3. Overlap Parameters

- Yellow Clearance time – Same as phase Yellow Clearance.
- Load Switch assignments – Only 3-color overlaps (C, D, E and F) can have their outputs redirected. A value entered for overlaps A or B will be erased. Only phase load switches (“1” through “8”) or ped load switches (“13” through “16”) can be entered here. Any other value will be erased.
- Yellow Ranging overlaps/Driveway Flash overlaps/Yellow Startup overlaps – Only overlaps A through F (call lights 1 through 6) can be selected. Any other selection (7 or 8) will be erased.

4. Coordination Parameters

- Cycle lengths – Default Cycle lengths for plans 1 through 9 are set to 60 seconds. If zero is entered for any plan’s Cycle length, it will be automatically changed to 60 seconds. Any value (other than zero) may be entered here. However, if the Cycle length is less than 10 seconds, the plan will use 60 seconds instead and the value entered here will remain unchanged.
- Max Cycle Length – The Max Cycle length cannot be zero and it must be greater than the Min Cycle length. If either of these two conditions is not met, the value will automatically be changed to 255 seconds.
- Plan Lag phases – Same as Free Lag phases, above.

PROGRAMMABLE LOGIC

Refer to Appendices A15 (Programmable Logic worksheet), E1 (Input Function Map) and E2 (Output Function Map) for this discussion. This feature is very powerful in that it almost completely eliminates the need for external wiring to achieve special logic operation. Programmable Logic provides the following logic gates and operations:

- Four each 2-input/2-output AND gates
- Four each 2-input/2-output OR gates
- Four each 2-input/2-output Exclusive OR (XOR) gates
- Four each 2-input/2-output Set/Reset (S/R) Latches
- Four each Relay with switched input, and coil controls
- Four each Multifunction Timers
- The bottom output of all gates except the Timer are the complement of the top output

Programmable Logic is implemented in very straightforward manner. Users already familiar with logic operations and basic electrical devices will adapt to this feature very quickly. The key to facilitating this feature is in understanding the mechanism used to connect the 170E controller inputs and outputs to the logic devices. Every input and output in the 170E controller is mapped to a “port”. There are eight input ports (Appendix E1) and seven output ports (Appendix E2). Each port is further broken down into bits. A port is one byte long and therefore has eight bits. Appendices E1 and E2 show this port/bit relationship and associate three pieces of information with each one:

1. The LACO-4E default (and, in some cases optional) functions
2. The C1 pin assignment based on the Caltrans 170E controller specification
3. The “logic” pin associated with the port/bit which is used on the Programmable Logic Timing Sheet

Notice that input logic pins are 2-digit numbers and output logic pins are 3-digit numbers. This is a convenient way to separate the inputs from the outputs for both the users and the controller program. For those who may be interested, the logic pin is defined thusly:

$$\text{Logic pin} = ((\text{port number}-1) * 10) + \text{bit position}$$

For instance, the EV B input is located in *input* port 5 (“5005” in the hardware address column of Appendix E1) at bit position 6. Hence its logic pin number is:

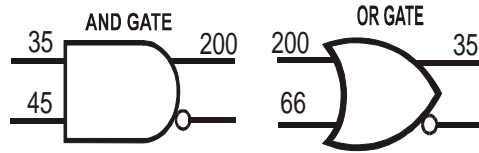
$$((5-1) * 10) + 6 = 46$$

Note that the AUX3 Yellow output, which is located in *output* port 5 at bit position 6 has the same logic pin number as the EV A input except that it is preceded with a “1”, (146).

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Dummy pins are used as a connection mechanism between logic devices. These pins are not used in the 170E controller and have no input or output function. Any pin with a number greater than “199” will be treated as a dummy pin. A dummy pin (pin 200 below) must be specified twice. First, it will be used to identify the *output* of logic device X (the AND gate below) and then it will be used to identify the *input* of logic device Y (the OR gate below) that is connected to logic device X.



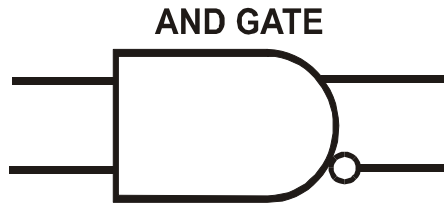
Note: The above is explained in Example A, following the logic gate descriptions.

Gates can be linked together by wrapping an output of one gate to the input of any other gate “below” it (higher memory address). Gates in a column can be linked to any gate in any column, which is to the right of it (higher address). This means that (viewing the Programmable Logic timing sheet) the AND1 outputs *can* be used as inputs to any other gate on the timing. By contrast, the TIMER4 outputs *cannot* be used as inputs to any other gate. An output that feeds back to the input of the same gate will be processed in the next 10th sec.

The logic and simplicity of this numbering system will become apparent to the user upon examination of Appendices E1 and E2. Additionally, a real world example is provided on the Programmable Logic Worksheet (Appendix A15). This example and others are explained in detail following the logic device descriptions.

LOGIC DEVICES

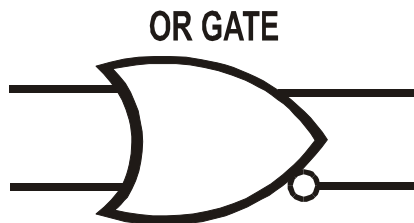
AND Gate



In 1	In 2	Out 1	Out 2
0	0	0	1
1	0	0	1
0	1	0	1
1	1	1	0

As long as both inputs are ON, Out1 will be ON and Out2 will be OFF. If either input is OFF, Out1 will be OFF and Out2 will be ON.

OR Gate



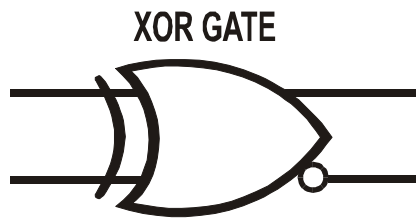
In 1	In 2	Out 1	Out 2
0	0	0	1
1	0	1	0
0	1	1	0
1	1	1	0

As long as either input is ON, Out1 will be ON and Out2 will be OFF. When both of the inputs are OFF, Out1 will be OFF and Out2 will be ON.

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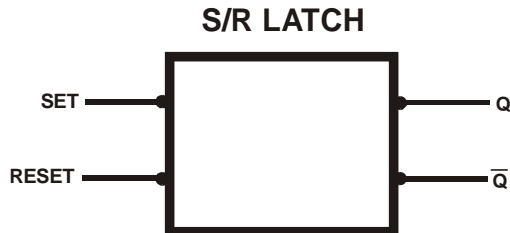
XOR (Exclusive Or) Gate



In 1	In 2	Out 1	Out 2
0	0	0	1
1	0	1	0
0	1	1	0
1	1	0	1

As long as both inputs are different (one ON and one OFF), Out1 will be ON and Out2 will be OFF. When both of the inputs are the same (both ON or both OFF), Out1 will be OFF and Out2 will be ON.

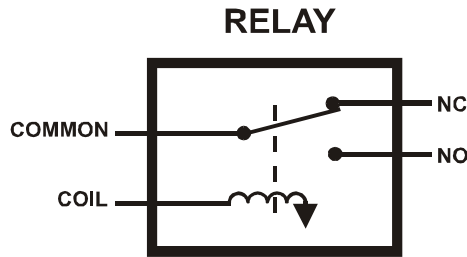
Set/Reset Latch



There is no truth tale associated with this device. The two outputs are always in the opposite state from one another. The default state for this device has the Q output = 1 (set). Each .1-second the SET and RESET inputs are monitored for change. If both of the inputs are ON together or the RESET input is ON by itself, then the Latch is reset and the Q output = 0 (clear) while the other output = 1. If only the SET input is ON, then the Latch will be set. Four entries need to be defined for each S/R Latch block:

- Set – The logic pin of the input or output used to toggle the Latch to its SET state.
- Reset – The logic pin of the input or output used to toggle the Latch to its RESET state.
- Q – The logic pin of the input that is desired to be latched.
- \overline{Q} – The logic pin of the input that is required to always be in the opposite state as the Q pin.

Relay



There is no truth table associated with this device. The default state for this device has the normally closed (NC) output connected to the COMMON input. Each .1-second the COIL input is monitored for change. If the COIL input is ON, then the COMMON input will be connected to the normally open (NO) output. There are four entries for each Relay block:

- Common – The logic pin of the input to be switched.
- NC – The logic pin of the Normally Closed contact. This would normally be the same as the Common logic pin number but is not restricted to that. This must be an input logic pin.
- NO – The logic pin of the Normally Open contact. This could be, for instance, the input to one of the logic gates (e.g. a Dummy pin) that might invert the Common input state.
- Coil – The logic pin of the input or output which, when ON connects the Common to the Normally Open contact.

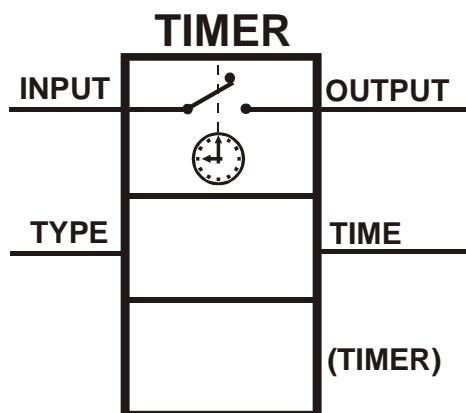
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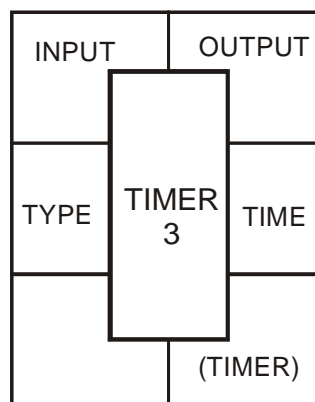
Timer

There is no truth table associated with this device. This logic block is a multipurpose timer that acts as an extension, delay or one-shot timer, which counts in either whole second or .1 second increments. There are four entries for each Timer block:

- Input – The logic pin of the input to be modified by the timer.
- Output – The logic pin of the timer modified input. This would normally be the same as the Input logic pin number but is not restricted to that.
- Type – One of six combinations of as indicated below
- “01” = .1 second Delay timer. Delays input logic until timer expires.
- “02” = .1 second Extension timer. Extends input logic until timer expires.
- “03” = .1 second One Shot timer. Enables input logic until timer expires at which time the input logic is disabled until the input is reactivated.
- “10” = 1 second Delay timer. Delays input logic until timer expires.
- “20” = 1 second Extension timer. Extends input logic until timer expires.
- “30” = 1 second One Shot timer. Enables input logic until timer expires at which time the input logic is disabled until the input is reactivated.
- Time – The duration of the timer. To implement a 6.0 second timer using Types 01,02 or 03, enter “60” at this location (60 times .1 second = 6.0 seconds). To implement a 6 second timer using Types 10, 20 or 30, enter “6” at this location.



Functional Diagram



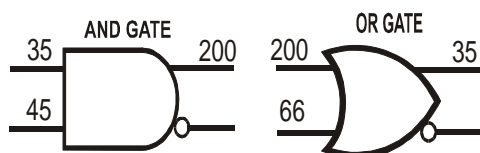
Timing Sheet Equivalent

The figures above depict the Timer block. When the controller starts up, the (Timer) location is initialized with the value entered in the Time location. Depending on the value entered in the Type location, the Timer block operates as follows:

- Types 01 and 10 (Delay) – The switch controlled by the (Timer) location will remain open until the timer reaches zero.
- Types 02 and 20 (Extension) – The switch will remain closed until the timer reaches zero.
- Types 03 and 30 (One Shot) – The switch will remain closed until the timer reaches zero and will remain closed until the Input logic pin goes OFF then back ON.

Examples

Example A - General



This example takes the I3 Upper detector slot input (logic pin 35) and AND's it with the EV A input (logic pin 45). The output of the AND gate is linked to input1 of the OR gate (via dummy pin 71) and is OR'd with the Front Panel Stop Time switch. OR gate output1 then replaces the original I3 Upper detector slot input. Logically, this means that the detector I3U input will only place a call to its assigned phase if:

((detector I3U is actuated) AND (the EV A input is ON))

OR

(The Front Panel Stop Time switch is ON))

Functionally, this means that phase 2 (the default phase for detector I3U) will be called whenever:

1. The Front Panel Stop Time switch is placed ON **OR**
2. Detector I3U is actuated **AND** EV A input in ON (even if EV A is not configured!)

This is admittedly an example with limited application, but it serves to illustrate that the only limitation to this logic feature is the user's imagination. Users are urged to replicate this and the following examples to familiarize themselves with the power of the Programmable Logic feature. To implement the above example, enter the following data:

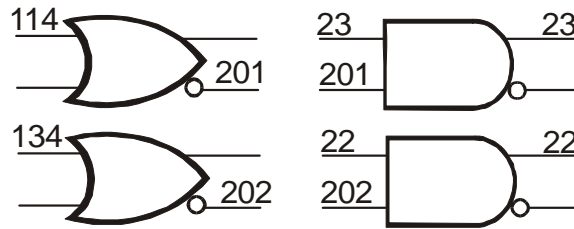
Location	1280	1281	1290	1282	1283	1292
Data	35	45	200	200	66	35
Function	Det I3U	EV A	Dummy	Dummy	F.P Stop Time	Det I3U

REMINDER – When accessing memory locations with 4 digits, the first key press must be “8”.

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Example B – Anti-Backup logic: Phase 1 detector actuation only places a call when phase 6 is not yellow and phase 5 detector actuation only places a call when phase 2 is not yellow

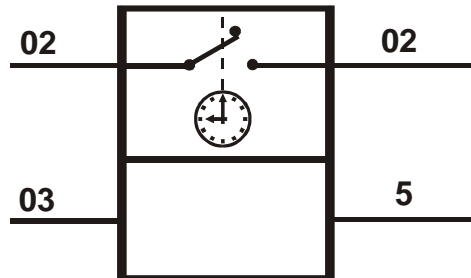


Location	12A2	12B3	12C0	12C1	12D0
Data	114	201	23	201	23
Function	Phase 2 Yellow	Dummy	Det J5	Dummy	Det J5

Location	12C2	12D3	12E0	12E1	12F0
Data	134	202	22	202	22
Function	Phase 6 Yellow	Dummy	Det I1	Dummy	Det I1

REMINDER – When accessing memory locations with 4 digits, the first key press must be “8”.

Example C - Pulsed Detector Call: One Shot operation turns constant J2 Upper detector actuation into a .5 second pulsed actuation. The actual .5-second timer can be observed at location 1-2-9-C.



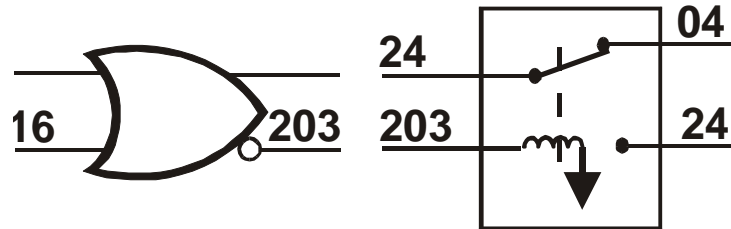
Location	128A	128B	129A	129B
Data	02	03	02	05
Function	Det J2U	.1sec One Shot	Det J2U	.5 sec

REMINDER – When accessing memory locations with 4 digits, the first key press must be “8”.

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Example D – Left Turn Arrow comes on (Protected movement of Protected/Permissive Left Turn gets called) **only** during Railroad preempt. An actuation on input I5 (phase 3 detector) gets transferred to the J6 Upper input (phase 8 detector) during normal operation. When the Railroad B input is active, the I5 actuation gets transferred to I5 (itself) and phase 3 gets called resulting in a Protected left turn arrow. Notice that the Railroad B input is inverted before being used as the Relay coil control. This is because LACO-4E uses negative logic when monitoring the Railroad inputs. That is, when the input goes OFF, the preemptor logic sees it as a TRUE input and begins a preemption sequence. However, this logic translation is accomplished within the preemption module. The Programmable Logic module only knows input ON or OFF so the inverter is added to compensate for that fact.



Location	12C3	12D3	12E8	12E9	12F8	12F9
Data	16	203	24	203	04	24
Function	RRB	Dummy	Det I5	Dummy	Det J6U	Det I5

REMINDER – When accessing memory locations with 4 digits, the first key press must be “8”.

MID-BLOCK PED CROSSING

As the name implies, this feature sets up field indications for a Pedestrian crossing that is not located at an intersection. To implement this feature, turn on call light 1 at User Flag (location 1DB). This feature requires that phase 2 and/or 6 be used to drive the vehicle indication and phase 4 is used to drive the ped indication. Operation is the same as a normal intersection except that the vehicle head flashes its Red ball when the ped is timing its Flashing Don't Walk and/or its Yellow Clearance intervals. It is common to select phase 4 as Yellow Ranging (location 1DE) so that the phase 4 Yellow Clearance can be set to 0 seconds. This way, only the ped intervals will time. An additional all-Red time may be added, between the end of Flashing Don't Walk and the start of the vehicle phase Green, by setting the desired time in the phase 4 Red Clearance.

FREEWAY OFF-RAMP RELEASE LOGIC

One of the primary reasons that state agencies cite for not relinquishing control of a freeway off-ramp to a local agency is that there is no provision in the local agency's controller firmware to prevent the off-ramp from backing up onto the freeway. LACO-4E has a user selectable feature that does just that. When enabled, the off-ramp's advance detector is continuously monitored for actuation. When this occurs, if the off-ramp phase is red, and either of phase 2 and phase 6 are in service, the program clears all coordination holds and zeros out both rings' Max Green timers. This will cause phases 2 and 6 to terminate (max out) which allows the off-ramp phase to service sooner than it would without the logic.

Configure for Freeway Off-ramp Anti-Backup logic as follows:

- Set location 1DB (User Flags) call light 7 to ON. This enables the logic.
- Select the desired off-ramp phase in location 2BB (detector I8). The default is phase 4.
- Set selected detector's delay time (location 21B). This should be set to a value that will reduce false "backup" indications.

OUTPUT FILE EDITING

(See figure on next page)

This feature is ideal for performing a Conflict Monitor test while the controller is installed in a cabinet or in a shop/lab environment. It allows the technician to turn ON or OFF (in any combination) each of the fifty-six 170E controller outputs (36 output file, 18 aux file, Detector Reset and the WatchDog Timer). The table on the next page provides information that maps the field outputs to the editable buffers. The 170E controller's output buffers are located on RAM page 00. This RAM page is write protected to protect the integrity of the program, therefore the RAM page 00 buffers are copied to RAM page 19 whenever the Front Panel (FP) Stop Time switch is placed ON, and the output modification takes place on that page only. The RAM page 00 buffers are never modified.

Use of this feature requires that data be displayed in Flag Display mode of the Extended Memory Display (See section 2). In this display, every time the FP Stop Time switch is set to ON, the display mode toggles between Decimal Display mode and Flag Display mode. When the extended memory location is first accessed, the display mode defaults to Flag Display mode and data is indicated in the call lights (in hexadecimal format). To avoid confusion, when using this feature, always set the FP Stop Time switch to ON *first*. Then access the desired editable output buffer. This way the FP display will always be in the correct display mode.

Output states should not be tampered with during normal operation, so this feature requires some deliberate action in order to avoid accidental activation:

1. The Front Panel (FP) Stop Time switch must be ON
2. The LED Display must be showing locations 1980 through 1986

While both of these conditions are TRUE, the field indications are controlled by the Front Panel keypad. If either condition is False, field indications are driven by the LACO-4E Signals logic.

First set the FP Stop Time switch to ON. Then access the desired editable output buffer (locations 1980 through 1986) by pressing 8-1-9-8-x, where "x" corresponds to buffers (ports) 0 through 6. Next, using the table on the following page as a reference, press any of keys "1" through "8" to toggle the state of that call light (bit). The corresponding indication wired to that port/bit combination will go ON/OFF each time the key is pressed. The WatchDog timer can be turned ON/OFF but it is updated every .1 second by the program logic to prevent the CMU (if connected) from triggering a WatchDog failure.

LACO-4E USERS MANUAL

SECTION 8 – MISCELLANEOUS FEATURES

Location (Output Port)	Call/Active Light (Bit)	Function	Location (Output Port)	Call/Active Light (Bit)	Function
1980 (OUT1)	1	4Ped Don't Walk	1981 (OUT2)	1	2Ped Don't Walk
	2	4Ped Walk		2	2Ped Walk
	3	Phase 4 Red		3	Phase 2 Red
	4	Phase 4 Yel		4	Phase 2 Yel
	5	Phase 4 Grn		5	Phase 2 Grn
	6	Phase 3 Red		6	Phase 1 Red
	7	Phase 3 Yel		7	Phase 1 Yel
	8	Phase 3 Grn		8	Phase 1 Grn
1982 (OUT3)	1	8Ped Don't Walk	1983 (OUT4)	1	6Ped Don't Walk
	2	8Ped Walk		2	6Ped Walk
	3	Phase 8 Red		3	Phase 6 Red
	4	Phase 8 Yel		4	Phase 6 Yel
	5	Phase 8 Grn		5	Phase 6 Grn
	6	Phase 7 Red		6	Phase 5 Red
	7	Phase 7 Yel		7	Phase 5 Yel
	8	Phase 7 Grn		8	Phase 5 Grn
1984 (OUT5)	1	Overlap A Grn	1985 (OUT6)	1	Aux 6 Red (Free)
	2	Overlap B Grn		2	Aux 6 Grn (Plan3)
	3	Overlap A Yel		3	Aux 5 Red (Olp F Red)
	4	Overlap B Yel		4	Aux 5 Yel (Olp F Yel)
	5	Aux 6 Yel (Plan2)		5	Aux 5 Grn (Olp F Grn)
	6	Aux 3 Yel (Preempt)		6	Aux 4 Red (Olp E Red)
	7	Detector Reset		7	Aux 4 Yel (Olp E Yel)
	8	Watch Dog Timer		8	Aux 4 Grn (Olp E Grn)
1986 (OUT7)	1	Aux 3 Red (Sync)			
	2	Aux 3 Grn (SpecFunc)			
	3	Aux 2 Red (Olp D Red)			
	4	Aux 2 Yel (Olp D Yel)			
	5	Aux 2 Grn (Olp D Grn)			
	6	Aux 1 Red (Olp C Red)			
	7	Aux 1 Yel (Olp C Yel)			
	8	Aux 1 Grn (Olp C Grn)			

Output Editing Map

LACO-4E USERS MANUAL

SECTION 8 – MISCELLANEOUS FEATURES

FLASHOUT PROGRAM

LACO-4E comes with an integrated Intersection Flashout Routine. This routine allows maintenance personnel to verify cabinet-to-field wiring by turning on individual load switch outputs.

To run the Flashout program, the 170E controller must be restarted. The cabinet should be in maintenance flash prior to starting the controller. Place the Front Panel Stop Time switch to the ON position and, while holding down the "F" key, turn the 170E controller power switch ON. The Flashout program starts up in Flash mode (software flash) and the 170E controller Front Panel displays the following:

- Call lights 0-4 count to 1 second in .1 second intervals
- Call lights 5-9 are extinguished
- Phase digit of the LED display shows 0
- Interval digit of the LED display shows "F" alternating with "b" every half second
- Timing digits of the LED display show "1010" alternating with "0101" every half second
- Output File phase load switches showing Red flash
- Output File ped load switches Dark
- Aux Output File load switches 1, 2, 4 and 5 (Overlaps C, D, E and F) showing Red Flash
- Aux Output File load switches 3 and 6 Dark

The Front Panel Stop Time switch toggles the Red flash operation. In the ON position, the "vehicle" load switch Red outputs flash once per second while all other outputs, except the one under test, remain dark. In the OFF position, all outputs except the one under test are. The keyboard is used to select the phase (signal head) and interval (color). Press "1" through "8" to select the signal heads wired to phases 1 through 8 and observe that the Phase digit on the Front Panel display changes to the selected phase. Press "A" for Red, "B" for Yellow, "C" for Green, "D" for ped Don't Walk, or "E" for ped Walk. Observe that the interval digit on the Front Panel display changes to the selected interval. Pressing the "F" key toggles the output state of the selected phase and interval, either solid ON or .1 second ON followed by 1.9 seconds OFF. If a Red output is selected while in Red flash operation, that Red output will be either be solid ON or 1.5 seconds ON followed by .5 seconds OFF.

Pressing "9" enables testing of the unused ped Yellow outputs which normally drive the 2-color overlap indications. Press "C" to test 2Ped Yellow (overlap A Green), "E" to test 4Ped Yellow (overlap B green), "B" to test 6Ped Yellow or "D" to test 8Ped Yellow.

The Flash mode is used for testing the intersection indications when the intersection must be in flashing operation (for instance if traffic is present). This mode allows the operator to momentarily display an output for .1 second every two seconds, which would be too fast to confuse motorists but slow enough for the technician to see. To toggle the Flash mode, press the "F" key. Observe that the interval digit is either solid (indicating non-flash mode) or alternating between the color selection ("A" through "E") and "F" (indicating Flash mode).

To test the auxiliary output file, hold down the "A" key and perform a short power down restart while in the Flashout program. The phase digit will alternate between the selected aux file slot and "A". The aux file slots are numbered 1 through 6. As with the output file above, select the slot to be tested then select the output to test (Red, Yellow or Green) by pressing the "A", "B" or "C" key. All other operation is identical to the output file operation described above except the "D" and "E" keys extinguish all outputs.

To change back to testing the output file, simply perform another short power down. To exit out of the Flashout program, perform a long power down of the 170E controller. It will restart in LACO-4E with the last timing that was entered.

LACO-4E USERS MANUAL

SECTION 8 – MISCELLANEOUS FEATURES

REINITIALIZATION

Method 1

Set location 10A = "888". CAUTION: THIS MUST NOT BE DONE WHILE THE INTERSECTION IS ON AUTOMATIC! This will cause the program to clear all memory locations and load default timing from the EPROM. The program will set the outputs all Red and the 170E controller display will show "0808". Backup Timing is reset with the same data. Permitted Phases (location 1F0) is set to 0, as are all Phase Intervals. The default timing is as follows.

Location	Function	Value
1E0	Main Street Phases	1, 2, 5, 6
1E1	Side Street Phases	3, 4, 7, 8
10E	Stuck All Red Fail Delay Time	03.0 seconds
10F	Red Revert Time	02.0 seconds
11E	Phase 1 Yellow Clearance	05.0 seconds
12E	Phase 2 Yellow Clearance	05.0 seconds
13E	Phase 3 Yellow Clearance	05.0 seconds
14E	Phase 4 Yellow Clearance	05.0 seconds
15E	Phase 5 Yellow Clearance	05.0 seconds
16E	Phase 6 Yellow Clearance	05.0 seconds
17E	Phase 7 Yellow Clearance	05.0 seconds
18E	Phase 8 Yellow Clearance	05.0 seconds
400	System Manual	014
401	Local Manual	014
409	Maximum Cycle Length	255 seconds
104	Program Number	004
All other Timing Sheet locations are set to 000.		

Timing can now be reentered from scratch.

Note: Communications parameters are **not** affected by reinitialization. This allows continuous connection to Central during the operation while still maintaining communications with the 170E controller.

Method 2

Set location 104 to "000." This method can be used safely while the signal is in automatic. The program will Force Off all phases and peds, allowing Minimums (Walk, Flashing Don't Walk, Minimum Green) to time out. When the intersection is all red, the 170E controller will output software flash, the Base Display will show "BADA," and the WatchDog output will be disabled causing CMU hardware flash. At this point, the cabinet Maintenance Flash switch should be placed "ON".

Placing the Front Panel Stop Time switch to "ON" will cause the 170E controller to attempt to reinitialize from Backup memory. If the Backup timing is for a LACO-4E program, (and the data checksum is correct) the data will be downloaded and the 170E controller will restart with all phases and peds on a one-time recall. If the Backup timing is for a non-LACO-4E program, the 170E controller will load EPROM default data as in Method 1. If it is LACO-4E timing data, but the data checksum is wrong, the 170E controller will show "BADD" and continue in software flash. At this point the operator can set location 10A to "171" to force a download from Backup Timing. In this case, all timing should be verified since the checksum mismatch indicates that some data corruption has probably occurred. A successful download will be indicated by a Long Power Down startup.

LACO-4E USERS MANUAL

SECTION 8 – MISCELLANEOUS FEATURES

MEMORY MANAGEMENT

LACO-4E offers a variety of “memory management shortcuts” that fall into two categories; Memory erasure/initialization and Signal Timing saving/restoration. These functions are initiated from location 10A. The different codes that can be entered at location 10A and the resulting operations are as follows:

- **111 - All user-entered data on RAM Page 01 is cleared.** All data entered on the Phase Timing and Configuration timing sheets will be set to zero (erased).
- **222 - All user-entered data on RAM Page 02 is cleared.** All data entered on the Detector timing sheet will be set to zero (erased).
- **333 - All user-entered data on RAM Page 03 is cleared.** All data entered on the Overlap and Preemption timing sheets will be set to zero (erased).
- **444 - All user-entered data on RAM Page 04 is cleared.** All data entered on Zip Coordination and Coordination 1 timing sheets will be set to zero (erased).
- **555 - All user-entered data on RAM Page 05 is cleared.** All data entered on the Coordination 2 timing sheet will be set to zero (erased).
- **666 - All user-entered data on RAM Page 06 is cleared.** All data entered on the Coordination 3 timing sheet will be set to zero (erased).
- **777 - All user-entered data on RAM Page 07 is cleared.** All data entered on the Coordination Attributes timing sheet will be set to zero (erased).
- **888 - All user-entered data (except Coordination tables) is cleared.** Signal timing is reinitialized from EPROM defaults. This data is also copied to Backup memory.
- **999 - All Coordination tables are cleared.** Tables 6 and 7 are initialized to L.A. County defaults.
- **255 – Clears All Programmable Logic.**
- **071 - Copies all user-entered data to the 7000h NOVRAM.**
- **170 - Restores signal timing that was saved to 7000h NOVRAM back to CPU RAM.** Assumes that the saved data checksum is valid. If checksum is not valid, display shows “BADD” (BAD Data). Use “171” (see below) to override the “BADD” result.
- **171 - Overrides 7000h data checksum test and restores signal timing that was saved to 7000h NOVRAM back to CPU RAM.** USE WITH CAUTION! An invalid data checksum indicates possible corrupted data. Signal timing should be thoroughly checked after this option is invoked. The stored data must be from LACO-4E timing for this operation to be successful.
- **123 - Initializes signal timing from 7000h NOVRAM unconditionally.** USE WITH EXTREME CAUTION! Program module may contain timing from a non-LACO-4E program!
- **321 - Requests full timing sheet database download from Central.** This causes the Central System to initiate a full timing download to the 170E Controller’s Backup memory. After the last timing data is sent, Central sends a “commit” byte (0xAA to location 10A) to force a transfer of Backup memory to Dynamic memory.

LACO-4E USERS MANUAL

SECTION 8 – MISCELLANEOUS FEATURES

TIMING COPYING

LACO-4E allows the user to copy both phase timing (from phase to phase) and coordination timing (from plan to plan). Both operations use the same two memory locations to initiate the data transfer. The Source phase/plan should be entered at CPYFRM (location 100) and the Destination phase/plan is entered at CPYTO (location 101). These are both decimal type data and the “E” key must be pressed after each entry. For phase copying, simply enter the Source and Destination phase numbers (1 through 8). For plan copying, enter the plan number preceded by a “1” for both the Source and Destination plan numbers (1 through 9). That is, Plan1 = 11, Plan2 = 12, etc. The program knows whether Zip Coord or Standard coordination is being used and copies the appropriate data automatically. Both Source and Destination locations must be valid and compatible. The program will not allow a phase-to-plan copy or vice versa. A successful copy is indicated by the Destination location being reset to zero.

When the phase copy operation is invoked, all sixteen rows of the Source phase timing column are copied to the Destination phase timing column. When the plan copy operation is invoked, one of two sequences takes place depending on the type of coordination in effect.

1. For Zip Coord, all eleven rows of the Source plan column are copied to the Destination plan column.
2. For Standard Coordination, all sixteen rows of six columns of data are copied:
 - The Interval column of the Destination plan
 - The four Coordination Function Flag columns of the Destination plan
 - The Coordination Attributes column of the Destination plan

For most intersections, all of the even phase numbers have similar if not identical data as do all of the odd phases. With this feature, one would first enter the timing for Phase 1, and then set location 100 to “001”. Next, set location 101 to “003” and press “E”. This will copy the phase 1 data to the phase 3 column. Then set location 101 to “005” followed by “E”, and then “007” followed by “E” to copy the remaining odd phases. Repeat that process, first setting the phase 2 timing and then copying that data to phases 4, 6 and 8.

This feature is even more of a convenience when entering Standard coordination data since six columns worth of data must be entered for each plan. By first setting the plan with the most common data, the remaining plans, as many as 768 locations (6 columns for each of 8 plans) can be populated quickly with approximate timing and then individual locations can be modified as needed.

- Appendix A – Timing Sheets
- Appendix B – Feedback Forms
- Appendix C – Glossary of Terms and Acronyms
- Appendix D – Timing Sheet Conversions
- Appendix E – I/O Mappings
- Appendix F – RAM Maps
- Appendix G – Checksum Maps
- Appendix H – Troubleshooting Guide

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Timing Sheets

- A1. Phase Timing
- A2. Configuration
- A3. Detectors
- A4. System Detectors
- A5. Overlaps
- A6. Preemption
- A7. Bus Signal Priority (BSP)
- A8. Zip Coordination
- A9. Coordination 1
- A10. Coordination 2
- A11. Coordination 3
- A12. Coordination Attributes
- A13. Coordination Tables
- A14. Programmable Logic

Information Sheets

- A15. Programmable Logic Worksheet
- A16. Setting The Real Time Clock
- A17. Maintenance Information Sheets 1-5

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PHASE TIMING
INTERSECTION: _____ **Date Prepared:** _____ **By:** _____

T.S. No.: _____ **Date Implemented:** _____ **By:** _____

Keystroke: 1 + Phase + Interval

		Phase							
Interval		1	2	3	4	5	6	7	8
Walk	0								
Flashing Don't Walk	1								
Minimum Green	2								
Queue Maximum	3								
Added Green/Actuation	4								
Vehicle Extension	5								
Time Before Reduction	6								
Minimum Gap	7								
Max Green 1 (Free)	8								
Max Green 2 (Coord.)	9								
Max Added Green	A								
Unused	B								
Unused	C								
Time to Reduce	D								
Yellow Clearance	E								
Red Clearance	F								

True North	1	2	3	4
Phase North	5	6	7	8

MISCELLANEOUS TIMERS		
Timer	Location	
Red Rest Delay Time	106	
Green Rest Delay Time	107	
Stuck All Red Fail Delay Time	10E	
Red Revert Time	10F	

Comments:

INTERSECTION: _____ Date Prepared: _____ By: _____
T.S. No.: _____ Date Implemented: _____ By: _____

PHASE FUNCTION FLAGS									
Keystrokes: 1 + F + row		1	2	3	4	5	6	7	8
Permitted Phases	0								
Red Lock	1								
Red & Yellow Lock	2								
Minimum Vehicle Recall	3								
Maximum Vehicle Recall	4								
Rest In Green	5								
Rest in Red	6								
Barrier Recall	7								
Double Entry	8								
Exclusive Phases	9								
Restricted Phases	A								
Prot/Perm Left Turn	B								
Lag Phases (Free)	C								
First Phases After Start-Up	D								
Yellow Start-Up Phases	E								
Yellow Start-Up Overlaps	F	A	B	C	D	E	F		

STREET CONFIGURATION FLAGS									
Keystrokes: 1 + E + row		1	2	3	4	5	6	7	8
Main Street Phases	0								
Side Street Phases	1								
2 Ped Load Switch	2								
4 Ped Load Switch	3								
6 Ped Load Switch	4								
8 Ped Load Switch	5								
Ped A Load Switch	6								
Ped B Load Switch	7								
Ped Recall - Rest in Walk	8								
STA Mode Phases	9								
Unused	A								
Unused	B								
Unused	C								
Driveway Flash	D								
2 Head Driveway Flash	E								
Overlap Driveway Flash	F	A	B	C	D	E	F		

MISCELLANEOUS FLAGS									
Keystrokes: 1 + D + row		1	2	3	4	5	6	7	8
Unused	0								
Assoc. Phase Recall - 1	1								
Assoc. Phase Recall - 2	2								
Assoc. Phase Recall - 3	3								
Assoc. Phase Recall - 4	4								
Assoc. Phase Recall - 5	5								
Assoc. Phase Recall - 6	6								
Assoc. Phase Recall - 7	7								
Assoc. Phase Recall - 8	8								
Yellow Calling Phases	9								
Yellow Phases Called	A								
User Flags (See Options Box)	B								
Green Offset Sync Pulse	C								
Yellow Offset Sync Pulse	D								
Yellow Ranging Phase	E								
Yellow Ranging Overlap	F	A	B	C	D	E	F		

Controller (Card) IP Address : _____

Subnet Mask IP Address : _____

Default Gateway IP Address : _____

Local/Remote Port Number : _____

Remote Host (Server) IP Address : _____

COMMUNICATIONS OPTIONS										
Systems ID (1 to 63)	190		Port Mode Options 1 = W W V 2 = Transmit 7 Wire 3 = Receive 7 Wire 4 = Transmit Time/Date 5 = Receive Time/Date 6 = Transmit Plan 7 = AB3418 Master 8 = AB3418 Slave 9 = Bus Signal Priority							
Port 1 Mode	191									
Port 2 Mode	192									
Port 3 Mode	193									
Port 4 Mode	194									
			1	2	3	4	5	6	7	8
Port 1 Baud	1C0									
Port 2 Baud	1C1									
Port 3 Baud	1C2									
Port 4 Baud	1C3									
Baud Rate: 1 - 115.2 K 4 - 19.2 K 7 - 2400 2 - 57.6 K 5 - 9600 8 - 1200 3 - 38.4 K 6 - 4800										
			1	2	Parity: 0 - No Parity 1 - Odd Parity 2 - Even Parity					
Port 1 Parity	1C4									
Port 2 Parity	1C5									
Port 3 Parity	1C6									
Port 4 Parity	1C7									

MANUAL CONTROL CONFIGURATIONS									
Option	Location	1	2	3	4	5	6	7	8
Omit Phases	3C1								
Lag Phases	3C2								
Recall Type	309								
Recall Type Options (309) 00 = Manual Control Disabled 02 = Vehicle Recall Only 01 = Fully Actuated 03 = Ped and Vehicle Recall									

User Flag Options (1DB)
 1 = Enable Mid-Block Ped Crossing Logic.
 2 = Modify Main Street Phases at Location (1E0).
 3 = Delay RR/EV Clearance Until All Overlaps Finish Terminating.
 4 = Modified Barrier Crossing (Ignore True Max).
 5 = Disable Daylight Savings Time Update.
 6 = Disable Ped Recycle Logic For STA Mode & Ped Recall Phases.
 7 = Enable Freeway Off-Ramp Anti-Backup Logic.
 8 = Ignore Stuck-All-Red Failure.

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

App	Lanes	Description	File/Slot/ Channel	Delay		Extended Call		Phase Flags								Attribute Flags									
				Code	Sec	Code	Sec	Code	1	2	3	4	5	6	7	8	Code	1	2	3	4	5	6	7	8
			I1U	210		230		2B0									2D0								
			I1L																						
			I2U	211		231		2B1									2D1								
			I2L	212		232		2B2									2D2								
			I3U	213		233		2B3									2D3								
			I3L	214		234		2B4									2D4								
			I4U	215		235		2B5									2D5								
			I4L																						
			I5U	216		236		2B6									2D6								
			I5L																						
			I6U	217		237		2B7									2D7								
			I6L	218		238		2B8									2D8								
			I7U	219		239		2B9									2D9								
			I7L	21A		23A		2BA									2DA								
			I8U	21B		23B		2BB									2DB								
			I8L																						
			I9U	21C		23C		2BC									2DC								
			I9L	21D		23D		2BD									2DD								

App	Lanes	Description	File/Slot/ Channel	Delay		Extended Call		Phase Flags								Attribute Flags								
				Code	Sec	Code	Sec	Code	1	2	3	4	5	6	7	8	Code	1	2	3	4	5	6	7
			J1U	220		240		2C0									2E0							
			J1L																					
			J2U	221		241		2C1									2E1							
			J2L	222		242		2C2									2E2							
			J3U	223		243		2C3									2E3							
			J3L	224		244		2C4									2E4							
			J4U	225		245		2C5									2E5							
			J4L																					
			J5U	226		246		2C6									2E6							
			J5L																					
			J6U	227		247		2C7									2E7							
			J6L	228		248		2C8									2E8							
			J7U	229		249		2C9									2E9							
			J7L	22A		24A		2CA									2EA							
			J8U	22B		24B		2CB									2EB							
			J8L																					
			J9U	22C		24C		2CC									2EC							
			J9L	22D		24D		2CD									2ED							

Comments:

DETECTOR ATTRIBUTES

Flag 1 - Non-Calling	Flag 5 - Queue Clearing
Flag 2 - Red & Yellow Lock	Flag 6 - Non-Counting
Flag 3 - Yellow Disconnect	Flag 7 - Special Delay Option 1
Flag 4 - Red Calling Only	Flag 8 - Special Delay Option 2

Note: Shaded Phase Flags call by default.

SPECIAL DETECTOR DELAY ASSIGNMENTS											PHASE							
All Options: Delay Timer resets during detector phase yellow.										Code	1	2	3	4	5	6	7	8
Special Delay Option 1 (Attribute Bit 7) - Bypasses delay while flagged phases are timing.										2F8								
Special Delay Option 2 (Attribute Bit 8) - Bypasses delay while flagged phases are timing.										2F9								

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

Parameter	Location	Data	Units
Stuck ON Threshold ¹	21F		Minutes
Stuck OFF Threshold ¹	22F		Minutes
Chatter Threshold ¹	23F		Actuations
Period ²	24F		Seconds

1 - Set Data to "0" to disable Error Checking

2 - Default = 60 seconds

Approach	Lanes	Description	System Detector	C1 Pin	File/Slot/Channel
			Det 1	39	I2U
			Det 2	40	J2U
			Det 3	41	I6U
			Det 4	42	J6U
			Det 5	43	I2L
			Det 6	44	J2L
			Det 7	45	I6L
			Det 8	46	J6L
			Det 9	47	I4U/L
			Det 10	48	J4U/L
			Det 11	49	I8U/L
			Det 12	50	J8U/L
			Det 13	55	J1U/L
			Det 14	56	I1U/L
			Det 15	57	J5U/L
			Det 16	58	I5U/L
			Det 17	59	J9U
			Det 18	60	I9U
			Det 19	61	J9L
			Det 20	62	I9L
			Det 21	63	I3U
			Det 22	64	J3U
			Det 23	65	I7U
			Det 24	66	J7U
			Det 25	76	I3L
			Det 26	77	J3L
			Det 27	78	I7L
			Det 28	79	J7L

Memory Locations of Interest

(Press "8" key first)

1503 - Set to non-zero value to reset all System Detector Logic.

150F - Collection Period Timer

15FF - Data Collection Sequence Counter

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

OVERLAP A									
Keystrokes: 3 + row + A	1	2	3	4	5	6	7	8	
Normal Parents	A								
Green Omit Parents	B								
RR Preempt Parents	C								
EV Preempt Parents	D								
Unused	0								
Delay Time	1								
Green Extension Time	2								
Yellow Clearance Time	3								
Red Clearance Time	4								

OVERLAP B									
Keystrokes: 3 + row + B	1	2	3	4	5	6	7	8	
Normal Parents	A								
Green Omit Parents	B								
RR Preempt Parents	C								
EV Preempt Parents	D								
Unused	0								
Delay Time	1								
Green Extension Time	2								
Yellow Clearance Time	3								
Red Clearance Time	4								

OVERLAP C									
Keystrokes: 3 + row + C	1	2	3	4	5	6	7	8	
Normal Parents	A								
Green Omit Parents	B								
RR Preempt Parents	C								
EV Preempt Parents	D								
Load Switch Assignment	0								
Delay Time	1								
Green Extension Time	2								
Yellow Clearance Time	3								
Red Clearance Time	4								

OVERLAP D									
Keystrokes: 3 + row + D	1	2	3	4	5	6	7	8	
Normal Parents	A								
Green Omit Parents	B								
RR Preempt Parents	C								
EV Preempt Parents	D								
Load Switch Assignment	0								
Delay Time	1								
Green Extension Time	2								
Yellow Clearance Time	3								
Red Clearance Time	4								

OVERLAP E									
Keystrokes: 3 + row + E	1	2	3	4	5	6	7	8	
Normal Parents	A								
Green Omit Parents	B								
RR Preempt Parents	C								
EV Preempt Parents	D								
Load Switch Assignment	0								
Delay Time	1								
Green Extension Time	2								
Yellow Clearance Time	3								
Red Clearance Time	4								

OVERLAP F									
Keystrokes: 3 + row + F	1	2	3	4	5	6	7	8	
Normal Parents	A								
Green Omit Parents	B								
RR Preempt Parents	C								
EV Preempt Parents	D								
Load Switch Assignment	0								
Delay Time	1								
Green Extension Time	2								
Yellow Clearance Time	3								
Red Clearance Time	4								

Comments:

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

RAILROAD CONFIGURATION		
Railroad Select (1, 2 or 3)	360	
All Red Time After Railroad Flash	361	
Railroad Track Clearance Time	362	
Limited Service Max Time	363	
Railroad Link to EV (See EV Setup Note # 5)	364	
Free Time After Preemption	365	
Free Time After Preemption (Timer)	366	
Max Timer (Minutes)	367	
Max Timer (Seconds)	368	

Observation Only ☐

RAILROAD PHASES		1	2	3	4	5	6	7	8
Track Clearance	3A0								
Railroad Exit	3A1								
Railroad Ped Only	3A2								
Limited Service	3A3								

Comments:

EV CONFIGURATION		1	2	3	4	5	6	7	8
EV Flags (See Notes to the Right)	390								
EV-A Clearance Phases	391								
EV-B Clearance Phases	392								
EV-C Clearance Phases	393								
EV-D Clearance Phases	394								

EV FLAGS

- 1 = Not Used
- 2 = Not Used
- 3 = Not Used
- 4 = Not Used
- 5 = EV-A Truncates Ped Flashing Don't Walk Interval
- 6 = EV-B Truncates Ped Flashing Don't Walk Interval
- 7 = EV-C Truncates Ped Flashing Don't Walk Interval
- 8 = EV-D Truncates Ped Flashing Don't Walk Interval

EV-A SETUP		
Delay (1)	310	
Active (2)	311	
Clearance (3)	312	
Maximum (4)	313	
Link to EV (5)	314	
Minimum (6)	315	

EV-B SETUP		
Delay (1)	320	
Active (2)	321	
Clearance (3)	322	
Maximum (4)	323	
Link to EV (5)	324	
Minimum (6)	325	

EV SETUP NOTES

- (1). The length of time before the controller responds to EV input. HOLD, CALL, ALLOW & Coordination Functions are not affected during this time.
- (2). The length of time that HOLD & CALL are set. Coordination functions are suspended during this time.
- (3). The length of Green Clearance time. HOLD, CALL & FORCE OFF are set by preemption logic during this time.
- (4). The maximum time (in seconds) that the preempt will remain in control of the intersection.
- (5). Causes the selected EV to time after the current EV times out.
- (6). Minimum time (in seconds) allowed from the end of one EV until the start of another EV.

EV-C SETUP		
Delay (1)	330	
Active (2)	331	
Clearance (3)	332	
Maximum (4)	333	
Link to EV (5)	334	
Minimum (6)	335	

EV-D SETUP		
Delay (1)	340	
Active (2)	341	
Clearance (3)	342	
Maximum (4)	343	
Link to EV (5)	344	
Minimum (6)	345	

AUX 3 YELLOW OUTPUT CONTROL (Keystrokes: 3 + C + 0)

1	Railroad A
2	Railroad B
3	Emergency Vehicle A
4	Emergency Vehicle B
5	Emergency Vehicle C
6	Emergency Vehicle D
7	Manual Control
8	Unused

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

NOTE: All data is located in the Extended Memory and must be accessed with "8" followed by the 4 digit address.

BSP data can be set/read in decimal or binary format. To switch from one mode to the other, simply toggle the Stop Time switch and observe whether or not the decimal point in the Timing window is displayed. Decimal point is not part of the Timing value.

BUS PRIORITY CONTROL			
SINGLE BUS	MULTI BUS		
* Manual Control	* Manual Control	1E00	
Primary Addr.	Bus Address	1E01	
Secondary Addr.	Unused	1E02	
City Code	City Code	1E03	
Hardwired ETA	Early Green Time	1E04	
Trip Point	Bus Green Ext.	1E05	

BUS PHASES			1	2	3	4	5	6	7	8
SINGLE	MULTI									
Priority	No Early Grn	1E08								
Demand	Demand	1E09								
NB - Bus A		1E0A								
SB - Bus B		1E0B								
EB - Bus C		1E0C								
WB - Bus D		1E0D								

* Manual Control (1E00) Options

Selection inputted at Location 1E00 will indicate if program is operating in Single or Multi Bus Priority Mode.

Single Bus Priority

0 = Auto
1 = Logic OFF
2 = Logic ON / No Comm
4 = Headway / No Comm
7 = Hardwire
14 = BSP OFF

Multi Bus Priority

14 = Disabled
11 = Enabled

Single Bus Priority - up to 2 directions within same barrier.
Multi Bus Priority- up to 4 directions.

Both Single Bus Priority and Multi Bus Priority have unique parameters to one another and their corresponding memory locations. Upon determining which bus priority will be used, input appropriate parameters per corresponding column.

BSP OVERRIDE TABLE									
	Hour : Min	Dir / Bus	S	M	T	W	T	F	S
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

BSP Override Table Instructions

Note: All busses defaulted on.

1. "9" + "9" sets the controller to Table Entry mode pointing to the BSP Override Table, Event 0.

2. Press "A" or "D" key to move to desired Event.

3. Enter 4 digit Time of Day.

4a. For **Single Bus**, enter Direction (Dir.) turned off.

1 = N 3 = N+S A = S+W D = N+S+W

2 = S 5 = N+E C = E+W E = S+E+W

4 = E 6 = S+E 7 = N+S+E F = ALL

8 = W 9 = N+W B = N+E+W 0 = NONE (Default)

4b. For **Multi Bus**, enter Bus Priority Operation:

1 = Bus A on 2 = Bus B on 3 = Bus C on 4 = Bus D on

A = Bus A off B = Bus B off C = Bus C off

D = Bus D off F = ALL off 0 = ALL on (Default)

Then press "E" to select the Days of Week.

5. Select Day(s) of Week.

6. Press "A" or "D" to move to next Event.

7. Repeat steps 3 through 6 for each event.

Comments:

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

KEYSTROKE: 4 + Plan # + Parameter

TIME OF DAY OPERATIONS SUMMARY					
PLAN 1		PLAN 4		PLAN 7	
PLAN 2		PLAN 5		PLAN 8	
PLAN 3		PLAN 6		PLAN 9	
FREE					

OFFSET TIMES		
PLAN	Location	Offset
1	7-A-1	
2	7-A-2	
3	7-A-3	
4	7-A-4	
5	7-A-5	
6	7-A-6	
7	7-A-7	
8	7-A-8	
9	7-A-9	

Midnight Sync Pulse					
7-A-B	Hour		7-A-C	Minute	

** ZIP Coordination Enable	7-A-D	
----------------------------	-------	--

** Set to "000" to **DISABLE** Zip Coordination

Observation Only Location

	Parameters		Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8	Plan 9
0			1	2	3	4	5	6	7	8	9
System Manual	Cycle Length	0									
Local Manual	Force Off Phase 1	1									
Master Plan	Force Off Phase 2	2									
Local Plan	Force Off Phase 3	3									
TMC Override	Force Off Phase 4	4									
Time Of Day Plan	Force Off Phase 5	5									
Special Function	Force Off Phase 6	6									
Current Table	Force Off Phase 7	7									
Min Cycle Length	Force Off Phase 8	8									
Max Cycle Length	Hold Release	9									

Master Cycle Timer	COMMENTS:
Local Cycle Timer	
New Offset	
Current Offset Time	
Last Master Cycle	
Last Local Cycle	

Date Implemented: _____ **By:** _____

[illegible]

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

KEYSTROKE: 5 + column + row

	INTERVALS (In Seconds)			COORDINATION FUNCTION FLAGS											
				PLAN 4				PLAN 5				PLAN 6			
	Plan 4	Plan 5	Plan 6	Force Off	Hold	Ped Restrict	Call	Force Off	Hold	Ped Restrict	Call	Force Off	Hold	Ped Restrict	Call
	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0															
1															
2															
3															
4															
5															
6															
7															
8															
9															
A															
B															
C															
D															
E															
F															

COMMENTS:

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

KEYSTROKE: 6 + column + row

	INTERVALS (In Seconds)			COORDINATION FUNCTION FLAGS											
				PLAN 7				PLAN 8				PLAN 9			
	Plan 7	Plan 8	Plan 9	Force Off	Hold	Ped Restrict	Call	Force Off	Hold	Ped Restrict	Call	Force Off	Hold	Ped Restrict	Call
	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0															
1															
2															
3															
4															
5															
6															
7															
8															
9															
A															
B															
C															
D															
E															
F															

COMMENTS:

[illegible]

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

KEYSTROKE: 9 + Table Number to access Event 0, then A or D to move up or down the table.

TABLE 0 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

TABLE 3 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

TABLE 5 - Annual Events

Event	Month / Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	/								
1	/								
2	/								
3	/								
4	/								
5	/								
6	/								
7	/								
8	/								
9	/								
A	/								
B	/								
C	/								
D	/								
E	/								
F	/								

TABLE 1 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

TABLE 4 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

TABLE 6 - Floating Holidays

Event	Month / Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	/								
1	/								
2	/								
3	/								
4	/								
5	/								
6	/								
7	/								
8	/								
9	/								
A	/								
B	/								
C	/								
D	/								
E	/								
F	/								

TABLE 2 - Time Of Day

Event	Hour : Min	Plan or Function	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	:								
1	:								
2	:								
3	:								
4	:								
5	:								
6	:								
7	:								
8	:								
9	:								
A	:								
B	:								
C	:								
D	:								
E	:								
F	:								

Plan = Plan Number 1 through 9

Function:

- A = Special Function Output - ON Steady
- B = Special Function Output - ON Flashing
- C = Offset Timing Mode
- D = Special Function Output - OFF
- E = FREE
- F = Time of Day Flash

Floating Holiday Table:

"Day" refers to the nth occurrence of the DOW flagged. For example, 01/03 indicates the 3rd occurrence of the flagged DOW in January. "0" or greater than "5" is treated as the last occurrence.





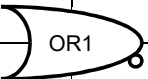
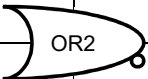
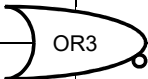
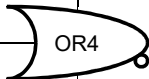


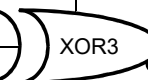









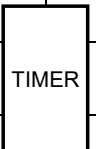
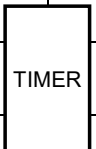
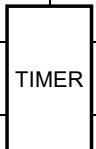
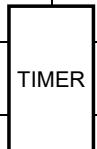
TABLE 7 - Exception Days

Event	Month / Day	Table	Sun 1	Mon 2	Tue 3	Wed 4	Thu 5	Fri 6	Sat 7
0	/								
1	/								
2	/								
3	/								
4	/								
5	/								
6	/								
7	/								
8	/								
9	/								
A	/								
B	/								
C	/								
D	/								
E	/								
F	/								

INTERSECTION: _____ Date Prepared: _____ By: _____

T.S. No.: _____ Date Implemented: _____ By: _____

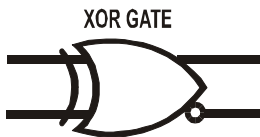
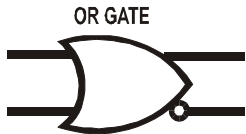
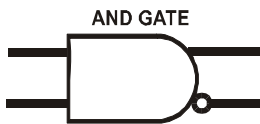
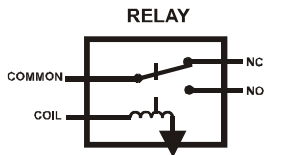
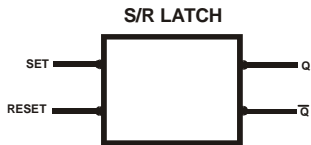
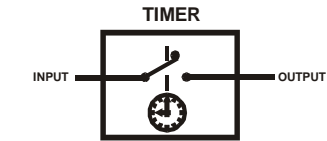
KEYSTROKE: 8 + column + row

	128	129	12A	12B	12C	12D	12E	12F
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
A								
B								

Comments:

LACO-4E

PROGRAMMABLE LOGIC WORKSHEET



332 INPUT FILE

I1 22	I2U 01	I3U 35	I4 11	15 24	I6U 03	I7U 37	I8 13	I9U 26	I11U 56	I12U 41	I13U 42	I14U 57
	I2L 05	I3L 52			I6L 07	I7L 54		I9L 28	I11L 17	I12L 43	I13L 44	I14L 58

J1 21	J2U 02	J3U 36	J4 12	J5 23	J6U 04	J7U 38	J8 14	J9U 25	J11U 18	J12U 45	J13U 47	J14U 15
	J2L 06	J3L 53			J6L 08	J7L 55		J9L 31	J11L 51	J12L 46	J13L 48	J14L 16

336 INPUT FILE

I1 22	I2U 01	I5 24	I6U 03	J1 21	J2U 02	J5 23	J6U 04	J14U 15	J12U 45	J13U 47	I12U 41	I13U 42	I14U 57
I4 11	I2L 05	I8 13	I6L 07	J4 12	J2L 06	J8 14	J6L 08	J14L 16	J12L 46	J13L 48	I12L 43	I13L 44	I14L 58

332/336 OUTPUT FILE

Ø1		Ø2		Ø2 PED		Ø3		Ø4		Ø4 PED	
116	R	113	R	111	R	106	R	103	R	101	R
117	Y	114	Y	141	Y	107	Y	104	Y	143	Y
118	G	115	G	112	G	108	G	105	G	102	G
Ø5		Ø6		Ø6 PED		Ø7		Ø8		Ø8 PED	
136	R	133	R	131	R	126	R	123	R	121	R
137	Y	134	Y	142	Y	127	Y	124	Y	144	Y
138	G	135	G	132	G	128	G	126	G	122	G

AUX FILE

AUX1		AUX2		AUX3		AUX4		AUX5		AUX6	
166	R	163	R	161	R	156	R	153	R	151	R
167	Y	164	Y	146	Y	157	Y	154	Y	145	Y
168	G	165	G	162	G	158	G	155	G	152	G

337 INPUT FILE

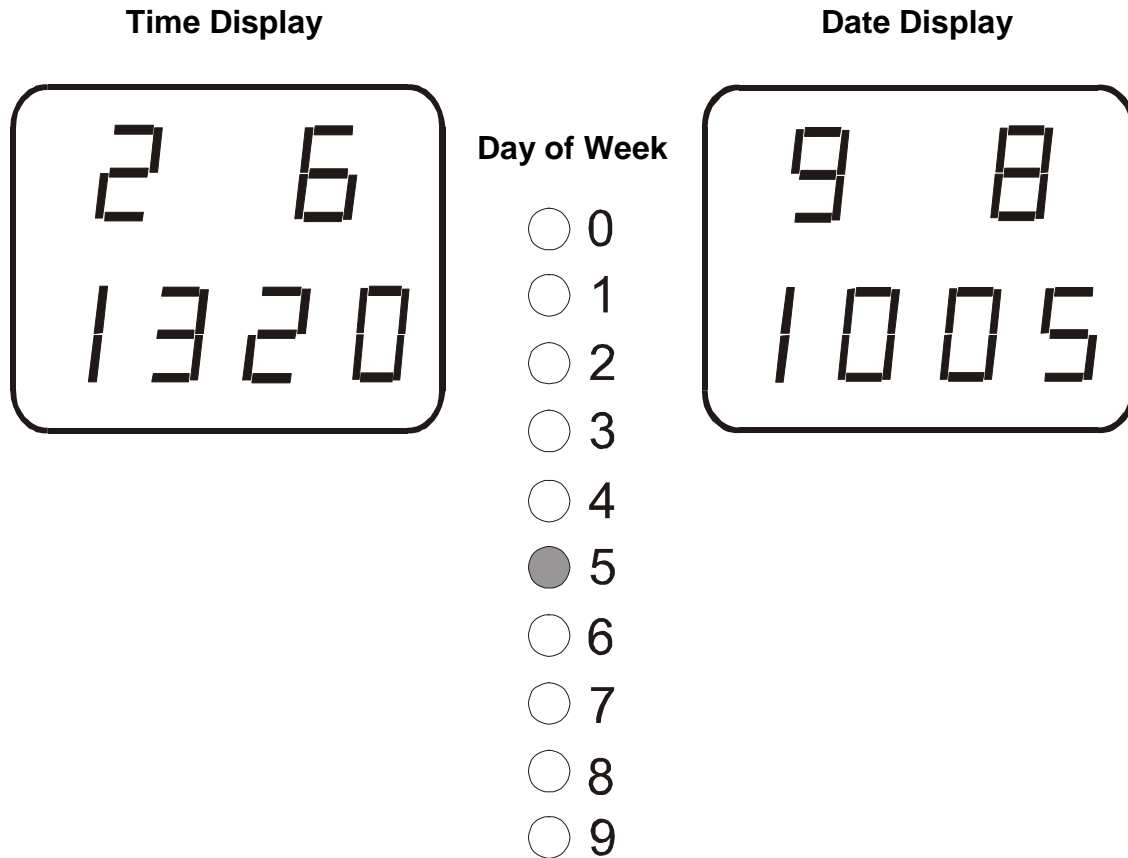
I2U 01	I3U 35	I6U 03	I7U 37	J2U 02	J3U 36	I12U 41	I13U 42	I14U 57	I11U 56	J11U 18
I2L 05	I4 11	I6L 07	I8 13	J2L 06	J4 12	I12L 43	I13L 44	J14U 15	I11L 17	J11L 51

337 OUTPUT FILE

ØA1		Ø2		Ø4		Ø6		Ø2PED		Ø4 PED	
166	R	113	R	103	R	133	R	111	R	101	R
167	Y	114	Y	104	Y	134	Y	131	Y	132	Y
168	G	115	G	105	G	135	G	112	G	102	G

LACO-4E

Setting the Real Time Clock



The LACO-4E Clock Display mode consists of two displays, Time and Date. To enter the Clock Display mode, from the Base Display, press “C” or “A-C” to bring up the Time display. To show the Date display, from the Base Display, press “A-D”. Pressing “A” or “D” from either display will toggle to the other display.

To set the time and date first access the Time display. If a WWV Clock is installed and configured, pressing the “E” key will cause the 170 to repoll the WWV Clock and update the time and date automatically.

The example above shows, from left to right, the Time display, Day of Week call lights (which is the same for both displays so is only shown once) and Date display. To manually set this time, first access the Time display and enter the time, 13:20.26, in HH/MM/SS format. Press “E” to save then press any number from 1 through 7 (for Sunday through Saturday) to set the Day of Week in the call lights (this also sets the Day of Week in the Date display).

Pressing “A” or “D” from here causes the Date display to appear (pressing any other key returns to the Base display). Enter the date, October 5, 1998, in MM/DD/YY format. Press “E” to save. The Day of Week can be modified or set here, as in the Time display. Press any key other than “A” or “D” to return to the Base display from here.

LACO-4E

Maintenance Information Sheets 1-5

STATUS FLAGS

RRCNTL (Railroad Mode Status) 3-B-3

- 1 Mode 1 active – RR A Flash, Single Input
- 2 Mode 2 active – RR B Limited Service, Single Input
- 3 Mode 3 active – RR A Flash, Dual Input
- 4 Mode 4 active – RR B Limited Service, Dual Input
- 6
- 7
- 8

FLSFLG (Software Flash Status) 0-B-3

- 1 Railroad Preempt active at Startup
- 2 TOD (Time of Day) Flash
- 3
- 4 Railroad Flash
- 5
- 6 BADA Flash
- 7 BADE Flash
- 8 Stuck all Red Failure

RRSTAT (Railroad State Status) 3-B-4

- 1 In transition to RR Track Clearance
- 2 Timing RR Track Clearance
- 3 In transition to RR Limited Service
- 4 Timing RR Limited Service
- 5 In transition to RR Flash
- 6 Timing RR Flash
- 7 Ending preempt
- 8 In transition to 1, 3 or 5 above

CRDFLG (Coordination Status) 0-B-5

- 1 Local coordinator disabled
- 2 MasCyc not rolled over since last new plan
- 3 Received new plan override from TMC
- 4 In Slave mode
- 5 In Offset Timing mode
- 6 Using Zip Coord
- 7 In TOD Flash
- 8 Using LAG0 to set Lag phases

EVSTAT (Emergency Vehicle Status) 3-B-6

- 1 EV A in service
- 2 EV B in service
- 3 EV C in service
- 4 EV D in service
- 5 All Ped protection disabled
- 6 Timing EV Delay
- 7 Timing EV Active
- 8 Timing EV Clearance

CLKFLG (Real Time Clock Status) 0-B-6

- 1 Setting time/date from WWV
- 2 Setting time/date from AB3418E message
- 3
- 4 Receiving time/date from LACO-xx 170E
- 5 Okay to override WWV/GPS Time and Date
- 6 Sending time/date to LACO-xx 170E
- 7 Entering time/date via keyboard
- 8 Daylight Savings Time status updated

RNGFLG (Ring Status) 0-B-D

- 1 Ring A ready to terminate cross barrier
- 2 Ring B ready to terminate cross barrier
- 3 Ring A terminating to Lagging phase
- 4 Ring B terminating to Lagging phase
- 5 Ring A terminating to Leading phase
- 6 Ring B terminating to Leading phase
- 7 Ring A terminating to Cross Street phase
- 8 Ring B terminating to Cross Street phase

PREFLG (Preempt Input Status) 0-B-C

- 1 Railroad A active
- 2 Railroad B active
- 3 EV A active
- 4 EV B active
- 5 EV C active
- 6 EV D active
- 7 Manual Control active
- 8 Any preempt input active

OLPFLG (Overlap Termination Status) 0-B-E

- 1 Overlap A terminating
- 2 Overlap B terminating
- 3 Overlap C terminating
- 4 Overlap D terminating
- 5 Overlap E terminating
- 6 Overlap F terminating
- 7
- 8 At least one overlap terminating

ERROR FLAGS

MEMERR (Memory Errors) 0-A-1

- 1 BADA error at power up
- 2
- 3
- 4 Timing download error: Non LACO-4E data
- 5 Timing download error: bad checksum
- 6 Corrupted Base RAM
- 7 Stack overflow
- 8 Bad EPROM

WWVERR (WWV Clock Errors) 0-A-5

- 1 Not locked on
- 2
- 3 Receiver timed out
- 4 Bad or unrecognized data
- 5
- 6
- 7 No comm port configured for WWV/GPS
- 8 Bad or disconnected cable

BMsgErr (BSP Received Message Errors) 1-E-4-F

- 1 Bad Opening or Closing flag
- 2 Incorrect Address 1 byte
- 3 Incorrect Address 2 byte
- 4 Incorrect City Code byte
- 5 Incorrect Control, IPI and/or Command byte
- 6 Incorrect BSP Revision byte
- 7 future use
- 8 Bad Checksum

USEFUL MEMORY LOCATIONS

These four pages provide useful information about program status and operation. The memory locations are arranged by major functionality. Each location (or group of locations) provides the data type; (D) for decimal data and (F) for flag data, the mnemonic, the memory location and a brief description of what the data is used for. Note that 4 digit memory locations require the first key press to be "8". Note also that these locations can be viewed as either flag data or decimal data by toggling the Front Panel Stop Time switch.

PREEMPTION

Input Actuation Counters

- (D) **RRACNT** (3-8-0) Number of Railroad A input actuations – Increments each time C1-pin 51 transitions to ON for more than .5 seconds.
- (D) **RRBCNT** (3-8-1) Number of Railroad B input actuations – Increments each time C1-pin 52 transitions to ON for more than .5 seconds.
- (D) **EVACNT** (3-8-2) Number of EV A input actuations – Increments each time C1-pin 52 transitions to ON for more than .5 seconds.
- (D) **EVBCNT** (3-8-3) Number of EV B input actuations – Increments each time C1-pin 52 transitions to ON for more than .5 seconds.
- (D) **EVCCNT** (3-8-4) Number of EV C input actuations – Increments each time C1-pin 52 transitions to ON for more than .5 seconds.
- (D) **EVDcnt** (3-8-5) Number of EV D input actuations – Increments each time C1-pin 52 transitions to ON for more than .5 seconds.
- (D) **MANCNT** (3-8-6) Number of Manual Control Enable input actuations – Increments each time C1-pin 52 transitions to ON for more than .5 seconds.

Active Preempt Timers

- (D) **DELAY** (3-0-0) Remaining Delay time for current EV
- (D) **ACTIVE** (3-0-1) Remaining Active time for current EV
- (D) **CLEAR** (3-0-2) Remaining Track Clearance time
- (D) **MAX** (3-0-3) Remaining max time for current EV
- (D) **LINK** (3-0-4) Next EV to link to
- (D) **EVCLR** (3-0-5) Timing sheet Clearance time for current EV
- (D) **MRKTMR** (3-6-6) Time remaining to stay Free after preemption/manual control
- (D) **RRMIN** (3-6-7) Remaining minutes in Railroad max timer
- (D) **RRSEC** (3-6-8) Remaining seconds in Railroad max timer

COORDINATION

- (D) **MASPLN** (4-0-2) Currently commanded plan by Master Coordinator
- (D) **LOCPLN** (4-0-3) Current plan being run by Local Coordinator
- (D) **TMCPLN** (4-0-4) Current TMC Override Plan sent from Central
- (D) **TODPLN** (4-0-5) Current plan scheduled by Time Of Day operation
- (D) **TODSPF** (4-0-6) Current state of Special Function Output
- (D) **TODTBL** (4-0-7) Current Time of Day table selected by Exception tables
- (D) **MASCYC** (4-0-A) Master Cycle timer
- (D) **LOCCYC** (4-0-B) Local Cycle timer
- (D) **NEWOFF** (4-0-C) Current Active Offset parameter
- (D) **CUROFF** (4-0-D) Current offset value
- (D) **LMSTER** (4-0-E) Last Master Cycle time
- (D) **LLOCAL** (4-0-F) Last Local Cycle time
- (D) **CYCLEN** (7-B-0) Current cycle length
- (D) **MSYNC** (7-B-1) Coordination sync pulse timer
- (F) **SICBIT** (7-E-0) Standard Interconnect bits
- (F) **CORDM** (7-E-1) Received 7-wire modem data buffer
- (F) **CORDO** (7-E-3) Offset timing in progress indicator
- (F) **CORDF** (7-E-4) Offset timing input status
- (F) **MAX2** (7-E-7) Phases to time Max2 green
- (F) **CRDDIS** (7-B-0) Composite coordination function status

USEFUL MEMORY LOCATIONS

PHASE

(F) DYNOFZ	(0-0-B)	Phases served since last barrier crossing
(F) CalFlg	(0-1-0)	Intersection Call Status flags
(F) LAG	(0-2-D)	Current lag phases (last phases before barrier crossing)
(F) LEAD	(0-9-A)	Current lead phases (first phases after barrier crossing)
(F) PED	(0-5-D)	Current enabled ped phases
(F) ALLOW	(0-5-F)	Current allowed phases
(F) DYNXCL	(0-6-0)	Current Exclusive phases
(F) DYNRST	(0-6-1)	Current Restricted phases
(F) QUEACT	(0-6-3)	Active Queue phases
(F) QHOLD	(0-6-9)	Current phases with Queue hold applied
(F) FORCE2	(0-6-E)	Phases with unconditional Force Off applied
(F) ADVAN	(0-6-F)	Phases being advanced
(F) GFAZE	(0-7-0)	Current green phases
(F) WFAZE	(0-7-1)	Current walk phases
(F) DWFAZE	(0-7-2)	Current Flashing Don't walk phases
(F) YFAZE	(0-7-3)	Current yellow phases
(F) RFAZE	(0-7-4)	Current red phases
(F) FAZIN	(0-7-5)	Current phases in service
(F) FAZNXT	(0-7-6)	Next phases to be served
(F) FAZLST	(0-7-7)	Last phases served
(F) IRCALL	(0-7-B)	Phases with internal recall applied
(F) DCALL	(0-7-C)	Phases being called by vehicle detection
(F) VCALL	(0-7-D)	Composite Vehicle calls
(F) PCALL	(0-7-E)	Composite Ped calls
(F) CALL	(0-7-F)	Composite calls
(F) DETLOK	(0-A-B)	Phases with current detector red or yellow locked call
(F) RESLOK	(0-A-C)	Phases with restricted phasing locked call
(F) XCLLOK	(0-A-D)	Phases with exclusive phasing locked call
(F) OLOCK	(0-A-E)	Phases with locked call due to overlap termination
(D) ALLRED	(1-0-9)	Stuck all red delay timer
(D) GRSTMR	(1-9-A)	Ring A Green Rest delay timer
(D) GRSTMR	(1-9-B)	Ring B Green Rest delay timer
(F) COCALL	(3-F-C)	Phases being called by coordinator
(F) PEDRST	(3-F-D)	Phases with ped restrict applied
(F) HOLD	(3-F-E)	Current phases with coordination/preempt hold applied
(F) FORCE1	(3-F-F)	Phases with conditional (requires opposing call) Force Off applied

OVERLAP

(F) CNTINU	(0-9-F)	Overlaps continuing green through parent phase termination
(F) OGFAZE	(0-7-8)	Current green overlaps
(F) OYFAZE	(0-7-9)	Current yellow overlaps
(F) ORFAZE	(0-7-A)	Current red overlaps

USEFUL MEMORY LOCATIONS

COMMUNICATIONS – AB3418E Slave

(F) AB8RxBuf	(1-4-0-0 to 1-4-3-F)	Last Received Message Buffer – Raw data
(F) AB8StBuf	(1-4-4-0 to 1-4-7-F)	Last Received Message Buffer – Unstuffed data
(F) AB8TxBuf	(1-4-8-0 to 1-4-C-F)	Last Transmitted Message Buffer – Unstuffed data
(F) AB8FCS	(1-4-E-0)	CRC Error Status of last received message
(F) AB8RxTx	(1-4-D-9 to 1-4-D-A)	Base address of AB3418E Slave communications port
(D) no name	(1-4-F-7)	Number of received messages with CRC error

COMMUNICATIONS – AB3418E Master

(F) AB7TxBuf	(1-6-C-0 to 1-6-D-F)	Last Transmitted Message Buffer – Unstuffed data
(F) AB7Tx	(1-6-F-C to 1-6-F-D)	Base address of AB3418E Master communications port
(F) ABTime	(1-6-F-F)	Transmit trigger for AB3418E <i>SetTime</i> message

COMMUNICATIONS – Bus Signal Priority

(F) BSPRxBuf	(1-E-C-0 to 1-E-D-F)	Last received and transmitted BSP message – Unstuffed
(F) BSPFCS	(1-E-4-0 to 1-E-5-7)	Buffer for calculating CRC of BSP message
(F) BRxAddr	(1-E-9-0)	Received BSP Address 1 byte
(F) BRxAddr2	(1-E-9-1)	Received BSP Address 2 byte
(F) BRxCity	(1-E-9-2)	Received BSP City byte
(F) BRxCtrl	(1-E-9-3)	Received BSP Control byte
(F) BRxIPI	(1-E-9-4)	Received BSP IPI byte
(F) BRxCMD	(1-E-9-5)	Received BSP Command byte
(F) BRxRev	(1-E-9-6)	Received BSP Revision byte
(F) BRXBusID	(1-E-9-7)	Received BSP Bus ID MSB byte
(F) no name	(1-E-9-8)	Received BSP Bus ID LSB byte
(F) BRxStat	(1-E-9-9)	Received BSP Status byte
(F) BRxETA	(1-E-9-A)	Received BSP ETA byte
(F) RAPTM	(1-E-B-A)	Received headway time
(F) MSRte	(1-E-B-B)	Received bus route number MSB
(F) LSRte	(1-E-B-C)	Received bus route number LSB
(F) BSPMsgErr	(1-E-3-F)	Error Status of last received message

COMMUNICATIONS – WWV/GPS

(F) WWVErr	(0-A-5)	WWV/GPS Error status flags
(D) TxMsg	(2-0-0)	WWV/GPS Poll Message
(D) WHour	(2-0-1)	WWV/GPS Last polled Hour
(D) WMin	(2-0-2)	WWV/GPS Last polled Minute
(D) WSec	(2-0-3)	WWV/GPS Last polled Second
(D) WMonth	(2-0-4)	WWV/GPS Last polled Month
(D) WDay	(2-0-5)	WWV/GPS Last polled Day
(D) WYear	(2-0-6)	WWV/GPS Last polled Year
(D) WDOW	(2-0-7)	WWV/GPS Last polled Day Of Week
(F) WWVFlag	(3-D-0)	WWV/GPS Control Flags
(F) WWVTxRx	(3-D-5 to 3-D-6)	Base address of WWV/GPS communications port
(F) WWVRxBuf	(1-9-D-0 to 1-9-D-F)	Last Received Message buffer

USEFUL MEMORY LOCATIONS

MISCELLANEOUS

(F) IN1	(0-8-0)	Buffered Inputs from Port 7401 (see Appendix E1 for bit descriptions)
(F) IN2	(0-8-1)	Buffered Inputs from Port 7402 (see Appendix E1 for bit descriptions)
(F) IN3	(0-8-2)	Buffered Inputs from Port 7403 (see Appendix E1 for bit descriptions)
(F) IN4	(0-8-3)	Buffered Inputs from Port 7404 (see Appendix E1 for bit descriptions)
(F) IN5	(0-8-4)	Buffered Inputs from Port 7405 (see Appendix E1 for bit descriptions)
(F) IN6	(0-8-5)	Buffered Inputs from Port 7406 (see Appendix E1 for bit descriptions)
(F) IN7	(0-8-6)	Buffered Inputs from Port 7407 (see Appendix E1 for bit descriptions)
(F) OUT1	(0-9-0)	Buffered Outputs to Port 7401 (see Appendix E2 for bit descriptions)
(F) OUT2	(0-9-1)	Buffered Outputs to Port 7402 (see Appendix E2 for bit descriptions)
(F) OUT3	(0-9-2)	Buffered Outputs to Port 7403 (see Appendix E2 for bit descriptions)
(F) OUT4	(0-9-3)	Buffered Outputs to Port 7404 (see Appendix E2 for bit descriptions)
(F) OUT5	(0-9-4)	Buffered Outputs to Port 7405 (see Appendix E2 for bit descriptions)
(F) OUT6	(0-9-5)	Buffered Outputs to Port 7406 (see Appendix E2 for bit descriptions)
(F) OUT7	(0-9-6)	Buffered Outputs to Port 7407 (see Appendix E2 for bit descriptions)
(D) PLONG	(1-0-C)	Number of controller long power downs
(D) PSHORT	(1-0-D)	Number of controller short power downs
(D) DWNMIN	(1-9-2-C)	Number of minutes in last power down
(D) DWNSEC	(1-9-2-D)	Number of seconds in last power down
(D) NOVRED	(1-9-2-E)	Checksum of data being copied from NOVRAM
(D) NOVRIT	(1-9-2-F)	Checksum of data being copied to NOVRAM
(D) DWNTIM	(1-9-2-0 to 1-9-2-5)	Time/Date of last power down
(D) UPTIME	(1-9-2-6 to 1-9-2-B)	Time/Date of last power up
(D) RRTIM	(1-9-3-0 to 1-9-3-5)	Time/Date of last Railroad preempt sequence
(D) EVTIME	(1-9-3-6 to 1-9-3-B)	Time/Date of last EV preempt sequence
(D) STPTIM	(1-9-4-0 to 1-9-4-5)	Time/Date of last Ext Stop Time (Cabinet/CMU Flash)

System Detector Dynamic Data Collection storage

(D) SDPerTmr	(1-5-0-F)	Collection Period Timer
(D) SDIChCtr	(1-5-1-0 to 1-5-1-F)	I-File Detectors Chatter Accumulators
(D) SDJChCtr	(1-5-2-0 to 1-5-2-F)	J-File Detectors Chatter Accumulators
(D) SDIONCtr	(1-5-3-0 to 1-5-3-F)	I-File Detectors Stuck ON Accumulators
(D) SDJONCtr	(1-5-4-0 to 1-5-4-F)	I-File Detectors Stuck ON Accumulators
(D) SDIOFCtr	(1-5-5-0 to 1-5-5-F)	I-File Detectors Stuck OFF Accumulators
(D) SDJOFctr	(1-5-6-0 to 1-5-6-F)	J-File Detectors Stuck OFF Accumulators
(D) SDIVCtr	(1-5-7-0 to 1-5-7-F)	I-File Detectors Volume Accumulators
(D) SDJVCtr	(1-5-8-0 to 1-5-8-F)	J-File Detectors Volume Accumulators
(D) SDIOccH	(1-5-9-0 to 1-5-A-F)	I-File Detectors Occupancy Accumulators
(D) SDJOccH	(1-5-B-0 to 1-5-C-F)	J-File Detectors Occupancy Accumulators
(D) SDSeqNum	(1-5-F-F)	Data Collection Sequence Number

AB3418E Message Data Buffers (reported in AB3418E GetSystemDetectorData Message)

(D) SDIVol	(1-6-0-0 to 1-6-0-F)	I-File Detector Volumes
(D) SDJVol	(1-6-1-0 to 1-6-1-F)	J-File Detector Volumes
(D) SDIOStat	(1-6-2-0 to 1-6-2-F)	I-File Detector Occupancy/Status
(D) SDJOSat	(1-6-3-0 to 1-6-3-F)	J-File Detector Occupancy/Status

B1. LACO-4E User Comment Form

B2. LACO-4E Trouble Report Form

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LACO-4E USERS MANUAL
APPENDIX B – FEEDBACK REPORTS

LACO-4E User Comment Form

User Information

Organization: _____ Name _____
Phone _____ Fax _____
Email _____
Do you wish to be contacted by a Los Angeles County representative regarding this feedback?
(Yes) (No) (Optional)

Equipment Information

LACO-4E Version _____
Controller Manufacturer and Model _____
Cabinet Type: _____
Conflict Monitor: _____ Modem: _____
Other: _____

Comments

Please circle one: (Problem Report) (Feature Request) (General Comment)
Place comments below. Attach additional pages or information as needed:

Please mail or fax this form to the Los Angeles County DPW office listed below. Thank you.

Los Angeles County – DPW
Operational Services Division
P.O. Box 1460
Alhambra, CA 91802

(626) 458-1700 (voice)
(323) 223-4152 (fax)

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LACO-4E USERS MANUAL

APPENDIX B – FEEDBACK REPORTS

LACO-4E Trouble Report Form

Agency _____ Reporting Person _____
Phone _____ Date/Time _____
Trouble Location _____
Trouble Description _____

LACO-4E Version: _____

Controller Manufacturer/Model _____ Cabinet Type: _____

Date and Time Problem was reported _____

Estimated time of problem occurrence _____

Are LED's on load switches illuminated normally? (Yes) (No)

Has the conflict monitor tripped? (Yes) (No)

If Yes:

What is the failure indication? _____

What are the channel indications? _____

What does the controller front panel display show?

Does the controller respond to the keypad key entries? (Yes) (No)

If Yes, what does the Ring A display show?

If Yes, what does the Ring B display show?

Is the phase timing status still being updated on any of the displays? (Yes) (No)

Is the controller connected to central systems communications? (Yes) (No)

If Yes:

Do lights on controller modem appear to be acting normally? (Yes) (No)

If No (modem does not look normal):

What looks abnormal? _____

Please fax this form to (323) 223-4152 as soon as possible. Attach additional pages as needed for other information or comments. You may also wish to telephone or page a Los Angeles County DPW representative to report this event. Thank you.

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C1. TERMS

C2. ACRONYMS

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LACO-4E USERS MANUAL

APPENDIX C – GLOSSARY OF TERMS AND ACRONYMS

C1. TERMS

Ø - see Phase.

Added Green Per Actuation - Typically used for Advance loops where no First Vehicle loops exist. Each actuation of the Advance loops during Phase Red increments a counter which is used in place of Minimum Green if its value exceeds that parameter

Advance - Cause immediate termination of a Phase in service at the beginning of a Railroad preempt. see also Manual Advance.

Advance Loop - Position of loops typically between 200 and 300 feet ahead of an intersection.

Allowed Phases - The phases that the Program is currently recognizing as valid. These may change with a Railroad or EV preempt.

Alternate Phase - see Supplemental Phase

Artery - A primary route with a moderately high traffic volume. A Main street as opposed to a Side street.

Associated Phase Recall - A feature that assures that if a particular Phase goes Green, one or more other flagged phases will receive a locked call.

Asynchronous Communications Input Adapter (ACIA)- Serial data port. Allows communications between the 170E controller and external hardware.

BADA - An indication on the Function display that shows during reinitialization or when the program detects corrupted data in the CPU Base RAM. Toggling the Front Panel Stop Time switch clears the RAM and restarts the program.

BADD - An indication that invalid data was detected prior to a download of data from the Timing Saver Module (7000h NOVRAM) and CPU RAM.

BADE - An indication on the Function display that shows when the program detects corrupted data on the EPROM chip itself. In this case the EPROM must be replaced.

Barrier - The imaginary line that separates Main street phases/movements from Side street phases/movements.

Call - see Demand

Call/Active light - One of eleven red LED's located on the Front Panel of the 170E controller used to indicate various conditions, flags or data.

Caltrans - California Department of Transportation.

Central - see as Central System.

Central System -

Clearance - In the most general sense, any phase or interval intended to empty an intersection in preparation for another phase or condition (such as flash). Examples include Railroad clearance, EV clearance, Yellow clearance, Ped clearance and Exit clearance. In a narrower context, the term is often used to denote those intervals from the beginning of Yellow to the beginning of Green of the next conflicting phase.

Clearance phases - In EV preempt, those phases that must serve in order to permit the emergency vehicle to pass through an intersection as quickly as possible.

Concurrent phases - Phases that may safely time together.

Conflict - Condition where 2 or more non-concurrent phases erroneously time together.

Conflict Monitor Unit (CMU) - Safety device whose primary function is to detect a Conflict condition and set hardware Flash.

Coordination - A system for synchronizing the operation of successive intersections to assure uninterrupted traffic flow.

Counts - A total of Vehicle actuations for any particular detector input occurring during Phase Red.

Cycle - The time allotted for one complete Coordination sequence.

Day of Week (DOW) - Sunday, Monday, Tuesday, Wednesday, Thursday, Friday or Saturday. Used in Time of Day tables and Real Time Clock displays.

Default - A value set by the Program in the absence of user set data.

Delay - The postponement of program action for a programmable time interval following some event such as a Vehicle detector call.

Demand - A request for service by a Ped/Vehicle movement.

Density - A measure of how many vehicles per second are passing a particular point in a street lane.

Detection - The sensed presence of a vehicle or the equipment assigned to this task.

LACO-4E USERS MANUAL

APPENDIX C – GLOSSARY OF TERMS AND ACRONYMS

Detector (amplifier) - The electronic module responsible for sensing the presence of a vehicle over a loop at a particular position in a lane and placing a call to the controller.

Dial (see also Plan) - An imaginary clock (in analogy to older mechanical units) with user- defined time markers used to toggle on and off Coordination Functions (Call, Hold, Force Off, Ped Restrict). It runs continuously in the background and makes one revolution in one cycle before repeating.

Diamond Interchange Program - A program developed by Caltrans for freeway ramp monitoring.

Don't walk - see Ped Clearance

Down Time Accumulator (DTA) - A timer inside the 170E controller, which keeps track of the duration of any A. C. power failures up to a total of 255 minutes. It is used by the program to correct the 170E controller Real Time clock when power is restored.

Driveway Flash - A phase so flagged will flash its Green output when timing its normal Green intervals. Other intervals and outputs for that phase are unaffected.

Emergency Vehicle (EV) - A preempt routine intended to clear an intersection and give right-of-way to certain phases being used by emergency vehicles.

Entrapment - A situation where a vehicle may legally turn left on a Yellow ball indication but is prevented from safely completing the turn because the opposite through Phase remains Green. If the Yellow interval expires, the vehicle may be trapped in the middle of the intersection facing a Red indication but unable to turn.

Erasable Programmable Read Only Memory (EPROM) - A data memory device in the 170E controller that can be read but not written to by the controller.

EV clearance - That portion of an EV preempt where the intersection rests in the phases devoted to giving right-of-way to emergency vehicles.

EV delay - A timer which postpones the Forcing off of non-EV clearance Phases.

Event - A programmable time marker used to initiate or disable Coordination functions.

Event table - A listing of specific times (Months, Days, Hours, Minutes) defining Coordination events and selecting the action to be taken at that time.

Exception days - Special calendar days that depart from normal Coordination.

Exclusive Phase - A Phase that has no concurrent phases, i.e. a phase that can only time by itself.

Exit Clearance - A Vehicle Phase or movement devoted to moving vehicles out of an intersection. Typically used at very wide intersections to extend the Green in order to clear out the intersection after the normal through Phase terminates.

Exit phases - The first regular Phases served upon leaving a RR1 Flash preempt.

Extension - The amount of time a vehicle actuation (call) prolongs the green time for a particular Phase.

First Vehicle Detection - Vehicle detection (i.e. a cut loop in the pavement) that is located at the stop line or back of the crosswalk.

Flag - A User settable indication of the ON/OFF status of any of a number of program parameters. Generally it indicates one or more of eight items which, when selected, light up LED's on the 170E controller Front Panel.

Flash - A condition of the signals where the Yellow and Green indications are dark and all Red indications alternate ON and OFF at approximately 1 Hz.

Flashing Don't Walk - The interval during which the Pedestrian signals flash Red ("DON'T WALK" or "HAND" symbol).

Floating holidays - Those holidays that fall on different calendar days from year to year.

Force Off - To cause termination of the Phase presently timing. Effective only if there is an opposing call and the "Minimum" intervals (Minimum Green, Added Initial, Walk and Flashing Don't Walk) have expired.

Free - Not coordinated.

Fully Traffic Actuated (FTA) Signal - An intersection that has detection for all vehicle and pedestrian movements. This type of operation assigns the right-of-way on the basis of actual traffic demand within given limitations.

Gap - A space between moving vehicles or the time interval between sequential detector actuations caused by that spacing.

Gap Out - The termination of a phase, in the presence of a conflicting call, caused by a gap of sufficient duration.

Gap Reduction - A programmed diminishing of the Gap time required to allow termination of a Phase.

Gap Termination - Same as "Gap Out"

LACO-4E USERS MANUAL

APPENDIX C – GLOSSARY OF TERMS AND ACRONYMS

Green band - An interval of guaranteed Green time on a Time-Space diagram that progresses from one intersection to the next along with an assumed platoon of vehicles to assure that they can continue through adjacent intersections uninterrupted.

Green Extension - An interval that delays the Green to Yellow transition of an Overlap beyond the Green to Yellow transition of its parent Phase when the two would otherwise occur simultaneously.

Green Omit - A flag to omit the Green interval from an overlap of one or more of its parent Phases. Typically used with two-color right turn Overlaps to turn off the Green arrow during the through phase Ped and Green intervals.

Hardware Flash - A flash condition wherein the Red signal indications are removed from program control by switching them with mechanical relays to be driven by separate dedicated flasher units. The CMU initiates flash by utilizing this capability. (Compare with Software Flash)

Hold-To - extend the duration of the Green interval beyond its normal timing constraints. Typically implemented by Coordination timing but also used for Queue timing and preemption.

Holding loop - Typically, a loop in a left turn pocket that extends or "holds" the through phase.

Holiday Table - A list of special days that depart from normal Coordination.

I file - In a Model 332 controller cabinet, the upper of two racks for plug-in electronic detector modules that comprise the Input file. (see also J file)

Initialization - The process of loading CPU RAM with EPROM default timing on initial power up of the 170E controller running under LACO-4E.

In service - Timing some interval (Green, Yellow or Red Clearance) of a Phase.

Interconnect - A means of coordinating adjacent intersections by synchronizing signals transmitted between them, typically on wires. Sometimes used as a generic term to refer to any kind of Coordination scheme.

Intersection - The crossing (or meeting) place of two or more streets.

Interval - In general, the time devoted to any particular condition of operation wherein the signal indications do not change. Specifically, any of 16 defined controller conditions or states of operation such as Minimum Green, Walk, Flashing Don't Walk, Vehicle Extension, Yellow, etc.

Isolator - A plug-in electronic module that allows the 170E controller to receive a field input while preventing any electrical continuity between the controller and field circuits.

J file - In a Model 332 controller cabinet, the lower of two racks for plug-in electronic detector modules that comprise the Input file. (see I file)

Lag - To follow in time sequence.

Lag Phase - The phase of a quadrant pair that follows (lags) the Lead Phase. The last phase of a quadrant pair to be served before crossing the barrier (assuming both phases calling).

Lead - To precede in a time sequence.

Lead Phase - The phase of a quadrant pair that would be served first when crossing the barrier (assuming both phases calling).

Leading Green Arrow - same as Leading Left Turn

Leading Left Turn (LLT) - A Protected/Permissive left turn or any other left turn where anti-backup operation is desired, see Protective/Permissive Left Turn.

Leading Left turn Arrow (LLA) - same as Leading Left Turn.

Load switch - A plug-in module that switches A. C. current to the signal lamps at the command of the 170E controller. Also referred to as "switch pack".

Local Cycle Timer - Timer used by the Local controller to output its coordination functions. Lags the Master cycle timer by a programmable offset time.

Lock - To latch and remember a call until it is serviced.

Long power down - A power outage lasting 2 or more seconds.

Loop - Specifically, a coil of wire embedded in the pavement for the purpose of sensing the presence of vehicles. Loosely, the detector or detector channel associated with a particular loop or set of loops.

Ltd. - Limited, as in Railroad Limited Service

Manual advance - A 170E controller input which, when in Manual Operation, allows a push-button to Force Off the Phase presently timing in order to advance service to the next phase.

Manual enable - A 170E controller input which must be held "TRUE" in order for the "Manual Advance" input to be effective.

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APPENDIX C – GLOSSARY OF TERMS AND ACRONYMS

Master - In a Coordination system, the controller serving as a reference for the relative offsets of the other intersections in the system.

Master Cycle Timer - The main Coordination timer, which all other Coordination functions are slaved to.

Max - Maximum

Max Extension 1 - In uncoordinated (Free) operation, the maximum time vehicles can extend the Green, beginning with the first opposing call after Minimum Green.

Max Extension 2 - In coordinated operation, the maximum time vehicles can extend the Green, beginning with the first opposing call after Minimum Green.

Maximum Gap - A Phase timing parameter that sets the upper value for a calculated ramp used in the Gap Reduction routine.

Max Out - see "Max Termination"

Max Termination - The termination of a Phase in the presence of an opposing call because the Max Extension timer has expired (not because of a gap in traffic).

Min - Minimum

Minimums - The portions of the Green interval that are guaranteed to time (except when overridden by a Railroad preempt). Any combination of Walk, Flashing Don't Walk, Minimum Green and Variable Initial Green.

Minimum Gap - The lowest value the Vehicle Extension may achieve during Gap Reduction.

Minimum Green - An interval, which guarantees the minimum amount of time a Vehicle Phase, will show Green under normal (no preempt) conditions. The first vehicle Green interval to time.

Minimums - The portion of the Green interval made up of Walk, Flashing Don't Walk, Minimum Green and Variable Initial Green.

ML2 format - A type of serial communications protocol used by Caltrans.

Modem - MODulator/DEModulator. A plug-in electronic module that enables serial communication between intersections by means of coded audio tone bursts on dedicated wires.

Non-Volatile Random Access Memory (NOVRAM) - A read-write memory in the 170E controller not subject to data loss during power failures.

Offset - Amount of time that the local controller lags behind the system master.

Offset Timing - A method of Coordination based on an "event" rather than time-of-day.

Opposing call - A call to non-concurrent (conflicting) Phase.

Overlap - An auxiliary Vehicle Phase defined to time concurrently with one or more regular Vehicle Phases designated as "parent" phases. If one parent phase terminates and the next phase is also a parent phase of that Overlap, then the Overlap will remain Green during the transition. The Overlap will only terminate when a parent phase transitions to a non-parent phase.

Parent Phase - A Vehicle Phase from which an Overlap is derived. If Overlap A is defined as "8 + 1", then 8 and 1 are parent Phases.

Ped - Pedestrian

Ped clearance - The time during which the flashing "DON'T WALK" or flashing hand symbol is displayed.

Ped protection - The total time from the beginning of Flashing Don't Walk to the beginning of a conflicting Phase. Generally, the sum of the Flashing Don't Walk, Yellow and Red Clearance intervals for a Phase.

Ped push button (PPB) - Actuating device that causes a Ped Call to be placed.

Ped Recall (Rest in Walk) - A mechanism whereby ped calls are generated internally every phase sequence cycle.

Ped Restrict - A coordination function, which stores a Ped call but delays its service until the end of Ped Restriction.

Phase - 1) A particular traffic movement.

2) The direction associated with a traffic movement.

3) A time interval associated with a traffic movement.

Phase flag - A flag that selects one of eight possible phases and turns on the associated Call light.

Phase North - The direction parallel to that leg or approach of an intersection defined to be north for purposes of assigning unambiguous loop designations.

Plan (see also Dial) - One of the 9 possible combinations of cycle lengths and offsets.

Port - A serial port provided in the 170E controller. Same as Comm Port or Communications Port.

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APPENDIX C – GLOSSARY OF TERMS AND ACRONYMS

Pre-timed Signal - The right-of-way at an intersection is assigned according to a predetermined schedule. The length of the time interval for each signal indication in the cycle is fixed.

Preempt - An interruption of normal intersection operation to provide special right-of-way for emergency vehicles or railroad trains. Same as Preemption.

Presence - A mode of detector operation wherein a constant call is placed to the 170E controller as long as a vehicle is sensed over the loop. Contrasted with "pulse".

Programmable Read Only Memory (PROM) - A data memory device in the 170E controller that can be read but not written to by the controller. The data is written once by use of special equipment but cannot thereafter be altered or erased. As a slang term, "PROM" is often used to refer to any of a whole class of semi permanent memory devices including EPROM's.

PROM module - An electronic memory module that plugs into 170E controller. It can accept NOVRAM and EPROM chips that are used in some cases to store, upload and download programs and data.

Quadrant - A Lead/Lag pair of vehicle Phases (including associated Ped Phases) comprising one quarter of a standard dual Ring 8-Phase Phase diagram. That is, 01, 02 and 2Ped are in the same quadrant, 05, 06 and 6Ped are in another quadrant, etc.

Queue - Pertaining to a line of vehicles. Often used as an abbreviation for "Queue Clearing" detector.

Queue Clearing loop - A loop devoted only to clearing out an initial line of vehicles present when a Phase turns Green. The Phase is held Green until the first gap or the Queue Max timer expires, then the loop is disconnected until the next Phase Red.

Queue Maximum - A timer that starts with Phase Green. When the timer expires, the Queue clearing loops for that Phase are disabled until the next Phase Red

Radio Corrected Time Based (RCTB) - A method of implementing coordination using a WWV Clock as the time standard.

Railroad A (RRA) - A special railroad preempt routine which, following Track Clearance, results in a Red Flash condition until the preempt ends.

Railroad B (RRB) - A special railroad preempt routine which, following Track Clearance, resumes Limited Service automatic operation, with selected Phases omitted, until the preempt ends.

Random Access Memory (RAM) - A read-write memory device in the 170E controller used to store user-entered data as well as other data under program control.

Recall - A recurring demand for a Vehicle or Ped Phase set by program

Red Clearance - A clearance interval that follows the Yellow interval and prevents the next right-of-way Phase from going Green.

Red Revert - A Red interval timed by individual Vehicle Phases or Overlaps when they are set to go Green again immediately after terminating.

Reinitialization - The process of restoring the CPU RAM and/or 1000h NOVRAM to a known state.

Repoll - To request the current Time and Date from the WWV Clock to update the Real Time Clock.

Rest in Walk - see Pedestrian Recall/Rest in Walk

Right-of-Way - The right of a particular traffic movement to take precedence over others in the use of the roadway, indicated by a Green or Yellow signal.

Ring - A group of sequential, conflicting Phases. Typically Phases 1, 2, 3 and 4 comprise Ring A and Phases 5, 6, 7 and 8 Ring B.

RRA - see Railroad A

RRB - see Railroad B

RRB Limited Service - A partial, automatic operation during Railroad 2 preempt where certain designated phases are served and all other phases are omitted. The portion of RR2 Preempt that allows service of any movement that does not cross the RR tracks, see also Railroad 2

Serve (a Phase) - To give right-of-way to a Phase.

Service - To give right-of-way to a Phase in response to a Call to that Phase. A phase is considered to be in service from the beginning of its Green interval until the end of its Red clearance time, if any.

Short power down - A loss of power for less than 2 seconds.

Simultaneous gap - When crossing the barrier, Phases in both rings must gap out together in order to terminate the Green interval.

Simultaneous termination - The exactly coincident Green to Yellow transition of a pair of concurrent Phases. A condition required for barrier crossing.

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Slave - A 170E controller running Coordination and receiving its Dial, Offset and sync information from the Master controller via direct interconnect.

Software Flash - A flash condition in which all outputs to the signals remain under program control in contrast to a flash condition caused by activation of the controller cabinet Flash relays.

Split - A measure of the fraction of a complete cycle devoted to each Phase.

Startup - Controller operation just following initial application of A. C. power after a long power down.

Stop time - To suspend controller operation in the interval it is presently timing by means of external input or the 170E Front Panel Stop Time switch.

Supplemental phases - A Lead Phase and Lag Phase pair located in the same quadrant, for example phase1 and phase 2.

Sync pulse - The period of time that the Offset line is in a FALSE state.

System - A group of adjacent intersections that run under the same Coordination timing.

Table - Used in Coordination, a list of time-of-day OR calendar events or functions.

Termination - In general, the ending of a particular Phase. More specifically, termination can be thought of as the elapsed time beginning at the transition from Green-to-Yellow and continuing until any Red Clearance has timed.

Time based - A system to coordinate intersections not physically interconnected, but which instead relies on precisely synchronized clocks at each location.

Time space diagram - A special kind of graph showing the relative locations of a string of intersections and the time needed to traverse the intervening distances at a particular vehicle speed. It is used in the design of Coordination systems.

Time Of Day (TOD) - Referring to the actual time during the 24 hours in a day.

Track Clearance - The portion of RR Preempt that ensures clearance of traffic from the RR tracks before the train reaches the intersection.

True Max Termination - The condition for barrier crossing logically described as: [Ring A Max out **or** Gap out] **and** [Ring B Max out **or** Gap out].

True North - The actual geographic north, which may or may not be parallel with any street direction, see also phase north.

UART - **U**niversal **A**synchronous **R**eceiver **T**ransmitter. The comm processor by which the LACO-4E program communicates with external devices (WWV/GPS, Central System, other controllers, etc).

Variable initial green - same as Added Green per Actuation.

Vehicle Extension - The continuation of Green time beyond minimum Green (in the presence of an opposing call) by means of vehicle actuations on the Phase presently timing.

Walk - Time during which "WALK" or walking person symbol is displayed.

Watch Dog Timer (WDT) - A software generated pulse stream output of the 170E controller, which is monitored by the CMU to detect controller failures. A pulse missing for a specified time causes a hardware flash condition.

WWV Clock - An electronic unit containing a radio receiver and a clock that is updated from broadcasts by the National Institute of Standards and Technology. The time is then transmitted to the 170E controller via serial communications port.

Yellow Change - The first interval following the Green right-of-way interval in which the signal indication for that Phase is Yellow.

Yellow Clearance - same as Yellow Change.

Yellow Ranging - A flag that allows the selected Phase to time a Yellow interval longer or shorter than the minimum and maximum times customarily enforced by the program for safety reasons.

C2. ACRONYMS

ACIA - Asynchronous Communications Input Adapter
CMU - Conflict Monitor Unit
DOW -Day Of Week
DTA - Down Time Accumulator
EPROM - Erasable Programmable Read Only Memory
EV - Emergency Vehicle
FTA - Fully Traffic Actuated
LLA - Leading Left turn Arrow
LLT - Leading Left Turn
NOVRAM - NOn-Volatile Random Access Memory
PPB - Ped Push Button
PPLT - Protected Permissive Left Turn
PROM - Programmable Read Only Memory
RAM - Random Access Memory
RCTB - Radio Corrected Time Base
STA - Semi-Traffic Actuated
TOD - Time Of Day
UART - Universal Asynchronous Receiver Transmitter
WDT - Watch Dog Timer

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D1. LACO-1R to LACO-4E

D2. LACO-3 to LACO-4E

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APPENDIX D – TIMING SHEET CONVERSIONS

LACO-1R TO LACO-4E			
Page	LACO-1R	Page	LACO-4E
1	Phase Timing	1	Phase Timing
1	Minimum Walk	1	Walk
1	Flashing Don't Walk	1	Flashing Don't Walk
1	Minimum Green	1	Minimum Green
1	Queue Maximum	1	Queue Maximum
1	Added Green/Actuation	1	Added Green per Actuation
1	Vehicle Extension	1	Vehicle Extension
1	Maximum Gap	1	See Note at end of Appendix D2
1	Minimum Gap	1	Minimum Gap
1	Max Extension 1 (Free)	1	Max Green 1 (Free)
1	Max Extension 2 (Coord)	1	Max Green 2 (Coordination)
1	Offset 1/Dial 1	6	Plan 1 Offset
1	Offset 1/Dial 2	6	Plan 2 Offset
1	Offset 1/Dial 3	6	Plan 3 Offset
1	Offset 2/Dial 1	6	Plan 4 Offset
1	Offset 2/Dial 2	6	Plan 5 Offset
1	Offset 2/Dial 3	6	Plan 6 Offset
1	Offset 3/Dial 1	6	Plan 7 Offset
1	Offset 3/Dial 2	6	Plan 8 Offset
1	Offset 3/Dial 3	6	Plan 9 Offset
1	Reduce 0.1 Sec. Every...	1	See Note at end of Appendix D2
1	Yellow	1	Yellow Clearance
1	Red Clearance	1	Red Clearance
1	Max Added Green (for all phases)	1	Max Added Green (per phase)
1	Red Revert	1	Red Revert
1	Preemption	5	Preemption
1	RR Select (0, 1, 2)	5	Railroad Select (0, 1, 2, or 3)
1	Track Clearance	5	Track Clearance
1	RR Red	5	All Red Time After Railroad Flash
1	RR2 Maximum (Minutes)	5	Limited Service Max Time
1	EV-A Delay	5	EV-A Delay
1	EV-A Clearance	5	EV-A Clearance
1	EV-B Delay	5	EV-B Delay
1	EV-B Clearance	5	EV-B Clearance
1	EV-C Delay	5	EV-C Delay
1	EV-C Clearance	5	EV-C Clearance

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LACO-1R TO LACO-4E			
1	EV-D Delay	5	EV-D Delay
1	EV-D Clearance	5	EV-D Clearance
1	EV Maximum (Seconds) (for all EV's)	5	Maximum (per EV)
1	Phase Function Flags	2	Configuration
1	Phases Permitted	2	Permitted Phases (Phase Function Flags)
1	Red Lock	2	Red Lock (Phase Function Flags)
1	Red & Yellow Lock	2	Red and Yellow Lock (Phase Function Flags)
1	Minimum Vehicle Recall	2	Minimum Vehicle Recall (Phase Function Flags)
1	Ped Recall/Rest In Walk	2	Ped Recall (Street Configuration Flags)
1	Pedestrian Phases	2	Ped 2/4/6/8/A/B Load Switch (Street Configuration Flags)
1	Rest In Red	2	Rest In Red (Phase Function Flags)
1	Semi Traffic Actuated Mode	2	STA Mode (Street Configuration Flags)
1	Double Entry	2	Double Entry (Phase Function Flags)
1	Maximum Vehicle Recall	2	Maximum Vehicle Recall (Phase Function Flags)
1	Overlap A	4	Overlap A Parents (Normal, RR, EV)
1	Overlap B	4	Overlap B Parents (Normal, RR, EV)
1	Barrier Recall	2	Barrier Recall (Phase Function Flags)
1	Rest In Green	2	Rest In Green (Phase Function Flags)
1	Yellow Start Up	2	Yellow Startup Phases (Phase Function Flags)
1	Protected/Permissive Left Turn	2	Prot/Perm Left Turn (Phase Function Flags)
1	Lag Phase Flags		
1	Lag Free	2	Lag Phases (Free) (Phase Function Flags)
1	“ “	2	Lag Phases (Manual Control Configuration)
1	Lag Dial 1	10	Lagging Phases – Coordination Attributes (Plans 1/2/3)
1	Lag Dial 2	10	Lagging Phases – Coordination Attributes (Plans 4/5/6)
1	Lag Dial 3	10	Lagging Phases – Coordination Attributes (Plans 7/8/9)
2	Detector Assignments	3	Detector Assignments
2	Delay	3	Delay
2	Extended Call	3	Extended Call
2	Call (for programmable detectors)	3	Phase Flags (for all detectors)
2	Yellow Disconnect (for programmable detectors)	3	Attribute Flags (for all detectors)
2	Queue Clearing (for programmable detectors)	3	Attribute Flags (for all detectors)
3	WWV Time-Based Coordination	6	Coordination 1/2/3
3	Interconnect Select	2	Communications Options (Configuration)
3	Set Maximum Width		NO EQUIVALENT
3	Set Minimum Width		NO EQUIVALENT
3	System Manual	6	System Manual

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APPENDIX D – TIMING SHEET CONVERSIONS

LACO-1R TO LACO-4E			
3	Local Manual	6	Local Manual
3	Function 6		NO EQUIVALENT
3	Minimum Cycle	6	Minimum Cycle Length
3	Maximum Cycle	6	Maximum Cycle Length
3	Dial 1 Intervals	6	Plan 1/2/3 Intervals
3	Dial 2 Intervals	6	Plan 4/5/6 Intervals
3	Dial 3 Intervals	6	Plan 7/8/9 Intervals
3	WWV Time-Based Coordination	6	Coordination Function Flags
3	Dial 1 Force Off	6	Plan 1/2/3 Force Off
3	Dial 1 Hold	6	Plan 1/2/3 Hold
3	Dial 1 Ped Restrict	6	Plan 1/2/3 Ped Restrict
3	Dial 1 Call	6	Plan 1/2/3 Call
3	Dial 2 Force Off	6	Plan 4/5/6 Force Off
3	Dial 2 Hold	6	Plan 4/5/6 Hold
3	Dial 2 Ped Restrict	6	Plan 4/5/6 Ped Restrict
3	Dial 2 Call	6	Plan 4/5/6 Call
3	Dial 3 Force Off	6	Plan 7/8/9 Force Off
3	Dial 3 Hold	6	Plan 7/8/9 Hold
3	Dial 3 Ped Restrict	6	Plan 7/8/9 Ped Restrict
3	Dial 3 Call	6	Plan 7/8/9 Call
4	Setting Event Table 9 Data		NO EQUIVALENT
5	WWV Time-Base Event Tables	11	Coordination Tables
5	Table 0 – Default TOD	11	Table 0 – Default TOD
5	Table 1 – (TOD)	11	Table 1 – (TOD)
5	Table 2 – (TOD)	11	Table 2 – (TOD)
5	Table 3 – (TOD)	11	Table 3 – (TOD)
5	Table 4 – Floating Holidays	11	Table 6 – Floating Holidays
5	Table 5 – Annual Events	11	Table 5 – Annual Events
5	Table 6 – Annual Events		NO EQUIVALENT
5	Table 7 – Annual Events		NO EQUIVALENT
6	WWV Time-Base Annual Tables		
6	Table 8 – Exception Days	11	Table 7 – Exception Days
6	Table 9 – Exception Times		NO EQUIVALENT
6	Special Function Table	10	Coordination Attributes
6	(Green) Calling Phases	2	Green Calling Phases
6	(Green) Calling To Phases	2	Green Calling-To Phases
6	(Yellow) Calling Phases	2	NO EQUIVALENT

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LACO-1R TO LACO-4E			
6	(Yellow) Calling To Phases	2	<i>NO EQUIVALENT</i>
6	Auxiliary Ovlp A Output	4	Load Switch Assignment
6	Mid-Block Ped Crossing	2	
6	Driveway Flash	2	
6	Green Extension		NO EQUIVALENT
6	Sequential Ped	2	
6	EV-A Clearance Phases	5	EV-A Clearance Phases
6	EV-B Clearance Phases	5	EV-B Clearance Phases
6	EV-C Clearance Phases	5	EV-C Clearance Phases
6	EV-D Clearance Phases	5	EV-D Clearance Phases
6	Track Clearance Phases	5	Track Clearance
6	Limited Service Phases	5	Limited Service
6	Coordination Free Time (Seconds) After Preempt	5	Free Time After Preempt
6	Green Rest Delay Time (Seconds)	1	Green Rest Delay Time (Miscellaneous Timers)
6	Railroad Routine Select	5	Railroad Select (1, 2, or 3)
6	Manual Control	2	Recall Type (Manual Control Configuration)
6	Phase Omits	10	Coordination Attributes
6	Phase Omit for Dial 1	10	Omitted Phases (Plan 1/2/3)
6	Phase Omit for Dial 2	10	Omitted Phases (Plan 4/5/6)
6	Phase Omit for Dial 3	10	Omitted Phases (Plan 7/8/9)
6	Additional Overlaps	4	Overlaps
6	Aux File 2 Color Ovlp C	4	Load Switch Assignment
6	Aux File 2 Color Ovlp D	4	Load Switch Assignment
6	Phase 7 Load Sw. 3 Color Ovlp E	4	Load Switch Assignment
6	Overlap E Green Omit	4	Green Omit Parents

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APPENDIX D – TIMING SHEET CONVERSIONS

LACO-3 to LACO-4E			
Page	LACO-3	Page	LACO-4E
1	Phase Timing	1	Phase Timing
1	Minimum Walk	1	Walk
1	Flashing Don't Walk	1	Flashing Don't Walk
1	Minimum Green	1	Minimum Green
1	Queue Maximum	1	Queue Maximum
1	Added Green/Actuation	1	Added Green per Actuation
1	Vehicle Extension	1	Vehicle Extension
1	Maximum Gap	1	See Note at end of Appendix D2
1	Minimum Gap	1	Minimum Gap
1	Max Extension 1 (Free)	1	Max Green 1 (Free)
1	Max Extension 2 (Coord)	1	Max Green 2 (Coordination)
1	Ovlp Green Extension (for each overlap)	4	Ovlp Green Extension (for each overlap)
1	Ovlp Yellow Clearance (for each overlap)	4	Ovlp Yellow Clearance (for each overlap)
1	Ovlp Red Clearance (for each overlap)	4	Ovlp Red Clearance (for each overlap)
1	Reduce 0.1 Sec. Every...	1	See Note at end of Appendix D2
1	Yellow	1	Yellow Clearance
1	Red Clearance	1	Red Clearance
1	Green Rest Delay	1	Green Rest Delay Time (Miscellaneous Timers)
1	Red Rest Delay	1	Red Rest Delay Time (Miscellaneous Timers)
1	Max Added Green (for all phases)	1	Max Added Green Time (per phase)
1	Red Revert	1	Red Revert Time
1	Preemption	5	Preemption
1	RR Select (0, 1, 2)	5	Railroad Select (0, 1, 2, or 3)
1	RR Track Clearance	5	Track Clearance
1	RR1 All Red	5	All Red Time After Railroad Flash
1	RR2 Maximum (Minutes)	5	Limited Service Max Time
1	Free Time After Preempt (minutes)	5	Free Time After Preempt (seconds)
1	EV-A Delay	5	EV-A Delay
1	EV-A Clearance	5	EV-A Clearance
1	EV-B Delay	5	EV-B Delay
1	EV-B Clearance	5	EV-B Clearance
1	EV-C Delay	5	EV-C Delay
1	EV-C Clearance	5	EV-C Clearance
1	EV-D Delay	5	EV-D Delay
1	EV-D Clearance	5	EV-D Clearance
1	EV Maximum (Seconds) (for all EV's)	5	Maximum (per EV)

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APPENDIX D – TIMING SHEET CONVERSIONS

LACO-3 to LACO-4E			
1	EV-A Clearance Phases	5	EV-A Clearance Phases
1	EV-B Clearance Phases	5	EV-B Clearance Phases
1	EV-C Clearance Phases	5	EV-C Clearance Phases
1	EV-D Clearance Phases	5	EV-D Clearance Phases
1	RR Track Clear	5	Track Clearance
1	RR2 Ltd Service	5	Limited Service
1	RR1 Exit Phase	5	Railroad Exit
1	Railroad Routine Select	5	Railroad Select (1, 2, or 3)
1	Phase Function Flags	2	Configuration
1	Phases Permitted	2	Permitted Phases (Phase Function Flags)
1	Red Lock	2	Red Lock (Phase Function Flags)
1	Red & Yellow Lock	2	Red and Yellow Lock (Phase Function Flags)
1	Minimum Vehicle Recall	2	Minimum Vehicle Recall (Phase Function Flags)
1	Pedestrian Recall & Rest In Walk	2	Ped Recall (Street Configuration Flags)
1	Green Rest	2	Rest In Green (Phase Function Flags)
1	Red Rest	2	Rest In Red (Phase Function Flags)
1	Semi Traffic Actuated Mode	2	STA Mode (Street Configuration Flags)
1	Double Entry	2	Double Entry (Phase Function Flags)
1	Maximum Vehicle Recall	2	Maximum Vehicle Recall (Phase Function Flags)
1	Restricted Phases	4	Restricted Phases (Phase Function Flags)
1	Protected/Permissive Left Turn	2	Prot/Perm Left Turn (Phase Function Flags)
1	First Phases After Start Up	2	First Phases (after setup) (Phase Function Flags)
1	Barrier Recall	2	Barrier Recall (Phase Function Flags)
1	Yellow Start Up	2	Yellow Startup Phases (Phase Function Flags)
1	Overlap Yellow Start Up	2	Yellow Startup Overlaps (Phase Function Flags)
1	Lag Phase Flags		
1	Lag Free	2	Lag Phases (Free) (Phase Function Flags)
1	“ “	2	Lag Phases (Manual Control Configuration)
1	Lag Dial 1	10	Lagging Phases – Coordination Attributes (Plans 1/2/3)
1	Lag Dial 2	10	Lagging Phases – Coordination Attributes (Plans 4/5/6)
1	Lag Dial 3	10	Lagging Phases – Coordination Attributes (Plans 7/8/9)
2	Detector Assignments	3	Detector Assignments
2	All timing entries same as LACO-4E	3	All timing entries same as LACO-3
3	WWV Time-Based Coordination	6	Coordination
3	System Sync Width		NO EQUIVALENT
3	Set Maximum Width		NO EQUIVALENT
3	Set Minimum Width		NO EQUIVALENT

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APPENDIX D – TIMING SHEET CONVERSIONS

LACO-3 to LACO-4E			
3	System Manual	6	System Manual
3	Local Manual	6	Local Manual
3	Function 6		NO EQUIVALENT
3	Minimum Cycle	6	Minimum Cycle Length
3	Maximum Cycle	6	Maximum Cycle Length
3	Dial 1 Intervals	6	Plan 1/2/3 Intervals
3	Dial 2 Intervals	6	Plan 4/5/6 Intervals
3	Dial 3 Intervals	6	Plan 7/8/9 Intervals
3	WWV Time-Based Coordination	6	Coordination Function Flags
3	Dial 1 Force Off	6	Plan 1/2/3 Force Off
3	Dial 1 Hold	6	Plan 1/2/3 Hold
3	Dial 1 Ped Restrict	6	Plan 1/2/3 Ped Restrict
3	Dial 1 Call	6	Plan 1/2/3 Call
3	Dial 2 Force Off	6	Plan 4/5/6 Force Off
3	Dial 2 Hold	6	Plan 4/5/6 Hold
3	Dial 2 Ped Restrict	6	Plan 4/5/6 Ped Restrict
3	Dial 2 Call	6	Plan 4/5/6 Call
3	Dial 3 Force Off	6	Plan 7/8/9 Force Off
3	Dial 3 Hold	6	Plan 7/8/9 Hold
3	Dial 3 Ped Restrict	6	Plan 7/8/9 Ped Restrict
3	Dial 3 Call	6	Plan 7/8/9 Call
4	Special Functions		
4	Overlap Phase Flags (for each overlap)	4	Normal Parents (for each overlap)
4	Overlap Green Omit Flags (for each overlap)	4	Green Omit Parents (for each overlap)
4	Railroad Preempt Overlap Flags (for each overlap)	4	RR Preempt Parents (for each overlap)
4	Emergency Vehicle Preempt Overlap Flags (for each overlap)	4	EV Preempt Parents (for each overlap)
4	Load Switch Assignment (for each overlap)	4	Load Switch Assignment (for each overlap)
4	User Flag Options	2	User Flags (Miscellaneous Flags)
4	Associated Phase Recall (for each phase)	2	Associated Phase Recall (for each phase) (Miscellaneous Flags)
4	Phase Driveway Flash	2	Driveway Flash (Street Configuration Flags)
4	Phase Yellow Ranging	2	Yellow Ranging Phase (Miscellaneous Flags)
4	Overlap Driveway Flash	2	Overlap Driveway Flash (Street Configuration Flags)
4	Overlap Yellow Ranging	2	Yellow Ranging Overlap (Miscellaneous Flags)
4	Ped 2/4/6/8 Load Switch Overlap	2	Load Switch Assignment (for each overlap)
5	Event Tables	11	Coordination Tables
5	Table 0 – Default TOD	11	Table 0 – Default TOD
5	Table 1 – (TOD)	11	Table 1 – (TOD)

LACO-4E USERS MANUAL

APPENDIX D – TIMING SHEET CONVERSIONS

LACO-3 to LACO-4E			
5	Table 2 – (TOD)	11	Table 2 – (TOD)
5	Table 3 – (TOD)	11	Table 3 – (TOD)
5	Table 4 – (TOD)	11	Table 4 – (TOD)
5	Table 5 – Slave Mode Table		NO EQUIVALENT
5	Table 6 – Floating Holidays	11	Table 6 – Floating Holidays
5	Table 7 – Exception Days	11	Table 7 – Exception Days
6	Annual Tables		
6	Table 8 – Annual Events	11	Table 5 – Annual Events
6	Table 9 – Annual Events		NO EQUIVALENT
6	Offset 1/Dial 1	6	Plan 1 Offset
6	Offset 1/Dial 2	6	Plan 2 Offset
6	Offset 1/Dial 3	6	Plan 3 Offset
6	Offset 2/Dial 1	6	Plan 4 Offset
6	Offset 2/Dial 2	6	Plan 5 Offset
6	Offset 2/Dial 3	6	Plan 6 Offset
6	Offset 3/Dial 1	6	Plan 7 Offset
6	Offset 3/Dial 2	6	Plan 8 Offset
6	Offset 3/Dial 3	6	Plan 9 Offset
1	Communications Assignments	2	Communications Options (Configuration)

NOTE:

LACO-4E takes a slightly different approach from LACO-1R and LACO-3 for configuring Gap Reduction (a.k.a. Volume Density Timing). Both LACO-1R and LACO-3 ask the user to set Minimum Gap, Maximum Gap, Vehicle Extension and Reduce .1 Second Every... parameters and the program internally generates the Time Before Reduction and Time to Reduce times internally from these parameters. LACO-4E, on the other hand, asks the user to set Minimum Gap, Maximum Gap, Vehicle Extension, Time to Reduce and Time Before Reduction. From these parameters, the program internally generates the “Reduce .1 Second Every...” time.

- E1. LACO-4E** Input Function Map
- E2. LACO-4E** Output Function Map
- E3.** Caltrans 332 Cabinet “I” Input File Layout
- E4.** Caltrans 332 Cabinet “J” Input File Layout
- E5.** Caltrans 336 Cabinet Input File Layout
- E6.** L. A. County 337 Cabinet Input File Layout
- E7.** Caltrans 332/336 Cabinet Output File Layout
- E8.** Caltrans 337 Cabinet Output File Layout
- E9.** Caltrans Auxiliary Output File Layout
- E10.** C1 Connector Map
- E11. LACO-4E** System Detector Cross Reference
- E12.** C5 Connector Map
- E13.** Cabling Information For AB3418E and BSP Communications

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E1. LACO-4E Input Function Map

↓ Firmware Address	8	7	6	5	4	3	2	1	↓ Hardware Address
080	8J6L C1 Pin - 46 Logic - 08	4I6L C1 Pin - 45 Logic - 07	6J2L C1 Pin - 44 Logic - 06	2I2L C1 Pin - 43 Logic - 05	8J6U C1 Pin - 42 Logic - 04	4I6U C1 Pin - 41 Logic - 03	6J2U C1 Pin - 40 Logic - 02	2I2U C1 Pin - 39 Logic - 01	7401
081	Cabinet Door Open C1 Pin - 54 Logic - 18	MAN ENA <i>PED B</i> C1 Pin - 53 Logic - 17	RR B C1 Pin - 52 Logic - 16	RR A <i>Offset Timing</i> Pin - 51 Logic - 15	8J8 C1 Pin - 50 Logic - 14	4I8 C1 Pin - 49 Logic - 13	6J4 C1 Pin - 48 Logic - 12	2I4 C1 Pin - 47 Logic - 11	7402
082	3I9L C1 Pin - 62 Logic - 28	7J9L C1 Pin - 61 Logic - 27	1I9U C1 Pin - 60 Logic - 26	5J9U C1 Pin - 59 Logic - 25	3I5 C1 Pin - 58 Logic - 24	7J5 C1 Pin - 57 Logic - 23	1I1 C1 Pin - 56 Logic - 22	5J1 C1 Pin - 55 Logic - 21	7403
083	8J7U C1 Pin - 66 Logic - 38	4I7U C1 Pin - 65 Logic - 37	6J3U C1 Pin - 64 Logic - 36	2I3U C1 Pin - 63 Logic - 35	unused	unused	unused	unused	7404
084	EV D C1 Pin - 74 Logic - 48	EV C C1 Pin - 73 Logic - 47	EV B C1 Pin - 72 Logic - 46	EV A C1 Pin - 71 Logic - 45	8 PPB C1 Pin - 70 Logic - 44	4 PPB C1 Pin - 69 Logic - 43	6 PPB C1 Pin - 68 Logic - 42	2 PPB C1 Pin - 67 Logic - 41	7405
085	EXTERNAL STOP TIME C1 Pin - 82 Logic - 58	FLASH SENSE C1 Pin - 81 Logic - 57	MAN ADV <i>PED A</i> C1 Pin - 80 Logic - 56	8J7L C1 Pin - 79 Logic - 55	4I7L C1 Pin - 78 Logic - 54	6J3L C1 Pin - 77 Logic - 53	2I3L C1 Pin - 76 Logic - 52	Police Panel Door Open C1 Pin - 75 Logic - 51	7406
086	unused	unused	FRONT PANEL STOP TIME Logic - 66	Internal Use					7407

The first line in each block indicates the LACO-4E default input function. The lines in *italics* show optional input functions. The next to the last line shows the associated C1 pin and the last line shows the Logic pin number used for Programmable Logic data entry.

E2. LACO-4E Output Function Map

Firmware Address ↓	8	7	6	5	4	3	2	1	Hardware Address ↓
090	Ø3 GREEN C1 Pin - 9 Logic - 108	Ø3 YELLOW C1 Pin - 8 Logic - 107	Ø3 RED C1 Pin - 7 Logic - 106	Ø4 GREEN C1 Pin - 6 Logic - 105	Ø4 YELLOW C1 Pin - 5 Logic - 104	Ø4 RED C1 Pin - 4 Logic - 103	Ø4 WALK C1 Pin - 3 Logic - 102	Ø4 DWALK C1 Pin - 2 Logic - 101	7401
091	Ø1 GREEN C1 Pin - 18 Logic - 118	Ø1 YELLOW C1 Pin - 17 Logic - 117	Ø1 RED C1 Pin - 16 Logic - 116	Ø2 GREEN C1 Pin - 15 Logic - 115	Ø2 YELLOW C1 Pin - 13 Logic - 114	Ø2 RED C1 Pin - 12 Logic - 113	Ø2 WALK C1 Pin - 11 Logic - 112	Ø2 DWALK C1 Pin - 10 Logic - 111	7402
092	Ø7 GREEN C1 Pin - 26 Logic - 128	Ø7 YELLOW C1 Pin - 25 Logic - 127	Ø7 RED C1 Pin - 24 Logic - 126	Ø8 GREEN C1 Pin - 23 Logic - 125	Ø8 YELLOW C1 Pin - 22 Logic - 124	Ø8 RED C1 Pin - 21 Logic - 123	Ø8 WALK C1 Pin - 20 Logic - 122	Ø8 DWALK C1 Pin - 19 Logic - 121	7403
093	Ø5 GREEN C1 Pin - 34 Logic - 138	Ø5 YELLOW C1 Pin - 33 Logic - 137	Ø5 RED C1 Pin - 32 Logic - 136	Ø6 GREEN C1 Pin - 31 Logic - 135	Ø6 YELLOW C1 Pin - 30 Logic - 134	Ø6 RED C1 Pin - 29 Logic - 133	Ø6 WALK C1 Pin - 28 Logic - 132	Ø6 DWALK C1 Pin - 27 Logic - 131	7404
094	WATCHDOG C1 Pin - 103 Logic - 148	DETECTOR RESET C1 Pin - 102 Logic - 147	AUX 3 YELLOW Preempt Ind C1 Pin - 101 Logic - 146	AUX 6 YELLOW C1 Pin - 100 Logic - 145	OVERLAP B YELLOW C1 Pin - 38 Logic - 144	OVERLAP A YELLOW C1 Pin - 37 Logic - 143	OVERLAP B GREEN C1 Pin - 36 Logic - 142	OVERLAP A GREEN C1 Pin - 35 Logic - 141	7405
095	AUX 4 GREEN OVERLAP E C1 Pin - 90 Logic - 158	AUX 4 YELLOW OVERLAP E C1 Pin - 89 Logic - 157	AUX 4 RED OVERLAP E C1 Pin - 88 Logic - 156	AUX 5 GREEN OVERLAP F C1 Pin - 87 Logic - 155	AUX 5 YELLOW OVERLAP F C1 Pin - 86 Logic - 154	AUX 5 RED OVERLAP F C1 Pin - 85 Logic - 153	AUX 6 GREEN C1 Pin - 84 Logic - 152	AUX 6 RED C1 Pin - 83 Logic - 151	7406
096	AUX 1 GREEN OVERLAP C C1 Pin - 99 Logic - 168	AUX 1 YELLOW OVERLAP C C1 Pin - 98 Logic - 167	AUX 1 RED OVERLAP C C1 Pin - 97 Logic - 166	AUX 2 GREEN OVERLAP D C1 Pin - 96 Logic - 165	AUX 2 YELLOW OVERLAP D C1 Pin - 95 Logic - 164	AUX 2 RED OVERLAP D C1 Pin - 94 Logic - 163	AUX 3 GREEN Aux Output C1 Pin - 93 Logic - 162	AUX 3 RED C1 Pin - 91 Logic - 161	7407

The first line (or as many as three lines) in each block indicates the LACO-4E default output function. The next to the last line shows the associated C1 pin and the last line shows the Logic pin number used for Programmable Logic data entry.

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Ø1 Det 56	Ø2 Det 39	Ø2 Det 63	Ø2 Det 47	Ø3 Det 58	Ø4 Det 41	Ø4 Det 65	Ø4 Det 49	Ø1 Det 60	Not wired	Man Adv or <i>PedA</i> 80	PED2 67	PED6 68	FLASH SENSE 81
<i>Same as above</i>	Ø2 Det 43	Ø2 Det 76	<i>Same as above</i>	<i>Same as above</i>	Ø4 Det 45	Ø4 Det 78	<i>Same as above</i>	Ø3 Det 62	Not wired	Man Ena or <i>PedB</i> 53	PED4 69	PED8 70	STOP TIME 82

(Upper) Default <i>Alternate</i> C1 Pin
(Lower) Default <i>Alternate</i> C1 Pin

The Caltrans 332 Cabinet “I” Input File layout is shown above and the format of each slot is shown to the left. The Input File is divided into an Upper slot and a Lower slot. The first row in each slot indicates the LACO-4E default function. An alternate function, if available, is shown on the next row in *italics*. The slot’s associated C1 pin number is on the bottom row. Slot 10 on the Input File is not wired. Slots 1, 4, 5 and 8 have the upper slot output wires connected with jumpers to the lower slot’s outputs (pins F and W).

E3. Caltrans 332 Cabinet “I” Input File Layout

Ø5 Det 55	Ø6 Det 40	Ø6 Det 64	Ø6 Det 48	Ø7 Det 57	Ø8 Det 42	Ø8 Det 66	Ø8 Det 50	Ø5 Det 59	Not wired	Cab. Door Open 54	EVA 71	EVB 72	OFFSET TIMING or RR A 51
<i>Same as above</i>	Ø6 Det 44	Ø6 Det 77	<i>Same as above</i>	<i>Same as above</i>	Ø8 Det 46	Ø8 Det 79	<i>Same as above</i>	Ø7 Det 61	Not wired	Police Panel Door Open 75	EVC 73	EVD 74	RR B 52

(Upper)
Default
Alternate
C1 Pin

(Lower)
Default
Alternate
C1 Pin

The Caltrans 332 Cabinet “I” Input File layout is shown above and the format of each slot is shown to the left. The Input File is divided into an Upper slot and a Lower slot. The first row in each slot indicates the LACO-4E default function. An alternate function, if available, is shown on the next row in *italics*. The slot’s associated C1 pin number is on the bottom row. Slot 10 on the Input File is not wired. Slots 1, 4, 5 and 8 have the upper slot output wires connected with jumpers to the lower slot’s outputs (pins F and W).

E4. Caltrans 332 Cabinet “J” Input File Layout

Ø1 Det 56	Ø2 Det 39	Ø3 Det 58	Ø4 Det 41	Ø5 Det 55	Ø6 Det 40	Ø7 Det 57	Ø8 Det 42	OFFSET TIMING or <i>RR A</i> 51	EVA 71	EVB 72	PED2 67	PED6 68	FLASH SENSE 81
Ø2 Det 47	Ø2 Det 43	Ø4 Det 49	Ø4 Det 45	Ø6 Det 48	Ø6 Det 44	Ø8 Det 50	Ø8 Det 46	RR B 52	EVC 73	EVD 74	PED4 69	PED8 70	STOP TIME 82

(Upper)
Default
Alternate
C1 Pin

The Caltrans 336 Cabinet Input File layout is shown above and the format of each slot is shown to the left. The Input File is divided into an Upper slot and a Lower slot. The first row in each slot indicates the Caltrans default function. An alternate function, if available, is shown on the next row in *italics*. The slot's associated C1 pin number is on the bottom row.

(Lower)
Default
Alternate
C1 Pin

E5. Caltrans 336 Cabinet Input File Lavout

Ø2 39	Ø2 63	Ø4 41	Ø4 65	Ø6 40	Ø6 64	PED2 67	PED6 68	FLASH SENSE 81	Man Adv or <i>PedA</i> 80	Cab. Door Open 54
Ø2 43	Ø2 47	Ø4 45	Ø4 49	Ø6 44	Ø6 48	PED4 69	Not wired	OFFSET TIMING or <i>RR A</i> 51	Man Ena or <i>PedB</i> 53	Police Panel Door Open 75

(Upper)
Default
Alternate
C1 Pin

(Lower)
Default
Alternate
C1 Pin

The L. A. County 337 Cabinet Input File layout is shown above and the format of each slot is shown to the left. The Input File is divided into an Upper slot and a Lower slot. The first row in each slot indicates the LACO-4E default function, with its associated C1 pin number on the second row. An alternate function, if available, is shown on the next row in *italics*. The 337 Input File has only 11 slots. The lower channel of slot 8 has no C1 pin wired to it. Consult the 337 Cabinet prints provided by the manufacturer for details on which (if any) C1 pins are connected to each slot's "SP" (spare) terminal.

E6. L. A. County 337 Cabinet Input File Layout

LS = Load Switch

LS1	LS2	LS3	LS4	LS5	LS6
Ø1 Red C1-16	Ø2 Red C1-12	Ø2 DWALK C1-10	Ø3 Red C1-7	Ø4 Red C1-4	Ø4 DWALK C1-2
Ø1 Yellow C1-17	Ø2 Yellow C1-13	OL A Green C1-35	Ø3 Yellow C1-8	Ø4 Yellow C1-5	OL A Yellow C1-37
Ø1 Green C1-18	Ø2 Green C1-15	Ø2 WALK C1-11	Ø3 Green C1-9	Ø4 Green C1-6	Ø4 WALK C1-3
Ø5 Red C1-32	Ø6 Red C1-29	Ø6 DWALK C1-27	Ø7 Red C1-24	Ø8 Red C1-21	Ø8 DWALK C1-19
Ø5 Yellow C1-33	Ø6 Yellow C1-30	OL B Green C1-36	Ø7 Yellow C1-25	Ø8 Yellow C1-22	OL B Yellow C1-38
Ø5 Green C1-34	Ø6 Green C1-31	Ø6 WALK C1-28	Ø7 Green C1-26	Ø8 Green C1-23	Ø8 WALK C1-20
LS7	LS8	LS9	LS10	LS11	LS12

E7. Caltrans 332/336 Cabinet Output File Layout

LS = Load Switch

LS1	LS2	LS3	LS4	LS5	LS6
AUX1 Red C1-97	Ø2 Red C1-12	Ø4 Red C1-4	Ø6 Red C1-29	Ø2 DWALK C1-10	Ø4 DWALK C1-2
AUX1 Yellow C1-98	Ø2 Yellow C1-13	Ø4 Yellow C1-5	Ø6 Yellow C1-30	Ø6 DWALK C1-27	Ø6 WALK C1-28
AUX1 Green C1-99	Ø2 Green C1-15	Ø4 Green C1-6	Ø6 Green C1-31	Ø2 WALK C1-11	Ø4 WALK C1-3

E8. Caltrans 337 Cabinet Output File Layout

LS = Load Switch

LS1	LS2	LS3	LS4	LS5	LS6
AUX1 Red C1-97	AUX2 Red C1-94	AUX3 Red C1-91	AUX4 Red C1-88	AUX5 Red C1-85	AUX6 Red C1-83
AUX1 Yellow C1-98	AUX2 Yellow C1-95	AUX3 Yellow C1-101	AUX4 Yellow C1-89	AUX5 Yellow C1-86	AUX6 Yellow C1-100
AUX1 Green C1-99	AUX2 Green C1-96	AUX3 Green C1-93	AUX4 Green C1-90	AUX5 Green C1-87	AUX6 Green C1-84

E9. Caltrans Auxiliary Output File Layout

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C1	Function	C1	Function	C1	Function	C1	Function
1	Logic Ground	27	6 Ped Don't Walk	53	Manual Enable (<i>PedB</i>)	79	Det J7 Lower
2	4 Ped Don't Walk	28	6 Ped Walk	54	Cabinet Door Open	80	Manual Advance (<i>PedA</i>)
3	4 Ped Walk	29	Phase 6 Red	55	Det J1 Both	81	Flash Sense
4	Phase 4 Red	30	Phase 6 Yellow	56	Det I1 Both	82	Ext. Stop Time
5	Phase 4 Yellow	31	Phase 6 Green	57	Det J5 Both	83	Aux6 Red
6	Phase 4 Green	32	Phase 5 Red	58	Det I5 Both	84	Aux6 Green
7	Phase 3 Red	33	Phase 5 Yellow	59	Det J9 Upper	85	Overlap C Red
8	Phase 3 Yellow	34	Phase 5 Green	60	Det I9 Upper	86	Overlap C Yellow
9	Phase 3 Green	35	Overlap A Green	61	Det J9 Lower	87	Overlap C Green
10	2 Ped Don't Walk	36	Overlap B Green	62	Det I9 Lower	88	Overlap D Red
11	2 Ped Walk	37	Overlap A Yellow	63	Det I3 Upper	89	Overlap D Yellow
12	Phase 2 Red	38	Overlap B Yellow	64	Det J3 Upper	90	Overlap D Green
13	Phase 2 Yellow	39	Det I2 Upper	65	Det I7 Upper	91	Aux3 Red
14	Logic Ground	40	Det J2 Upper	66	Det J7 Upper	92	Logic Ground
15	Phase 2 Green	41	Det I6 Upper	67	2 Ped Pushbutton	93	Aux3 Green (TOD Output)
16	Phase 1 Red	42	Det J6 Upper	68	6 Ped Pushbutton	94	Overlap E Red
17	Phase 1 Yellow	43	Det I2 Lower	69	4 Ped Pushbutton	95	Overlap E Yellow
18	Phase 1 Green	44	Det J2 Lower	70	8 Ped Pushbutton	96	Overlap E Green
19	8 Ped Don't Walk	45	Det I6 Lower	71	EV A	97	Overlap F Red
20	8 Ped Walk	46	Det J6 Lower	72	EV B	98	Overlap F Yellow
21	Phase 8 Red	47	Det I4 Both	73	EV C	99	Overlap F Green
22	Phase 8 Yellow	48	Det J4 Both	74	EV D	100	Aux6 Yellow
23	Phase 8 Green	49	Det I8 Both	75	Police Panel Door Open	101	Aux3 Yellow (Preempt)
24	Phase 7 Red	50	Det J8 Both	76	Det I3 Lower	102	Detector Reset
25	Phase 7 Yellow	51	RR A (<i>Offset Timing</i>)	77	Det J3 Lower	103	Watch Dog
26	Phase 7 Green	52	RR B	78	Det I7 Lower	104	Logic Ground

E10. C1 Connector Map

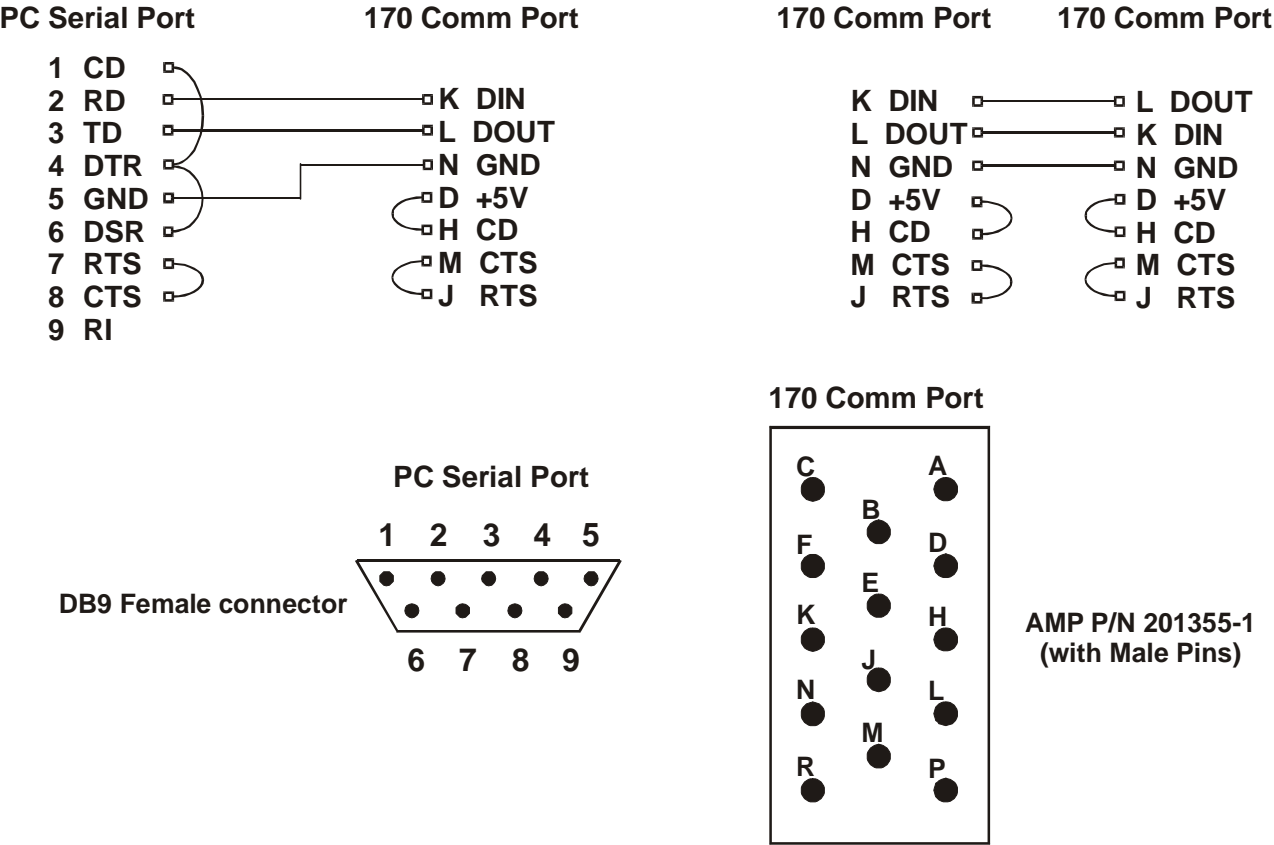
C1 Pin	System Detector	Input File/Slot	Associated Phase	C1 Pin	System Detector	Input File/Slot	Associated Phase
39	Det 1	I2U	2	57	Det 15	J5U/L	7
40	Det 2	J2U	6	58	Det 16	I5U/L	3
41	Det 3	I6U	4	59	Det 17	J9U	5
42	Det 4	J6U	8	60	Det 18	I9U	1
43	Det 5	I2L	2	61	Det 19	J9L	7
44	Det 6	J2L	6	62	Det 20	I9L	3
45	Det 7	I6L	4	63	Det 21	I3U	2
46	Det 8	J6L	8	64	Det 22	J3U	6
47	Det 9	I4U/L	2	65	Det 23	I7U	4
48	Det 10	J4U/L	6	66	Det 24	J7U	8
49	Det 11	I8U/L	4	76	Det 25	I3L	2
50	Det 12	J8U/L	8	77	Det 26	J3L	6
55	Det 13	J1U/L	5	78	Det 27	I7L	4
56	Det 14	I1U/L	1	79	Det 28	J7L	8

E11. LACO-4E System Detector Cross Reference

C1 Pin	Function	C5 Pin
83	Aux 6 Red	1
84	Aux 6 Green	2
85	Aux 5 Red	3
86	Aux 5 Yellow	4
87	Aux 5 Green	5
88	Aux 4 Red	6
89	Aux 4 Yellow	7
90	Aux 4 Green	8
91	Aux 3 Red	9
93	Aux 3 Green	10
94	Aux 2 Red	11
95	Aux 2 Yellow	12
96	Aux 2 Green	13
97	Aux 1 Red	14
98	Aux 1 Yellow	15
99	Aux 1 Green	16
100	Aux 6 Yellow	17
101	Aux 3 Yellow	18

E12. C1/C5 Cross Reference

The figure below provides all of the information needed to construct a cable for PC to 170E controller serial communications using AB3418E. This would be necessary when using a PC (desktop or laptop) to verify AB3418E messaging before installing a controller in the field. This will also be used for Upload/Download of timing data (future implementation). For 170 family to 170 family communications using AB3418E, replace the “PC Serial Port” connector with a “170E Comm Port” connector with pins K and L reversed. That is, the DIN pin on one end of the cable should be connected to the DOUT on the other end. Twisted pair wire should be used for the data lines.



E13. Cabling Information for AB-3418E and BSP Communications

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F1. RAM MAPS

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PROGRAM CONTROL

	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	
0	N17m	CalFlg	DspFlg	Temp0	Xtemp0	ThsRng	Dynxcl	GFaze	In1	Out1	SysErr	SysFlg	RACurr	RBCurr	RAWTim	RBWTim	0
1	N100m	Ph1Flg	KeyFlg	Temp1	“	OthRng	Dynrst	WFaze	In2	Out2	MeMErr	MemFlg	RANext	RBNext	RADTim	RBDTim	1
2	C17m	Ph2Flg	PgAdd	Temp2	Xtemp1	ThisSt	Barset	DWFaze	In3	Out3	MonErr	MonFlg	RALast	RBLast	RAHold	RBHold	2
3	C100m	Ph3Flg	“	Temp3	“	OthrSt	Queact	YFaze	In4	Out4	PrtErr	FlsFlg	RALead	RBLead	RAOdd	RBOdd	3
4	PFlag	Ph4Flg	Phase	Temp4	Xtemp2	RAMain	TmpDet	RFaze	In5	Out5	CrdErr	PrtFlg	RATerm	RBTerm	RASupp	RBSupp	4
5	DspTmr	Ph5Flg	Intrvl	Temp5	“	RBMain	LLAMsk	FazIn	In6	Out6	WWVErr	CrdFlg	RAColr	RBColr	RAExt	RBEExt	5
6	DIM	Ph6Flg	LSB	Temp6	Xtemp3	RASide	OlpClr	FazNxt	In7	Out7	RstVec	ClkFlg	RAFazd	RBFazD	RATBR	RBTR	6
7	KeyBuf	Ph7Flg	NLSB	Temp7	“	RBSide	DynTrm	FazLst	In8	Out8	ErrFlg	DatFlg	RAIntD	RBIntD	RAMGap	RBMGap	7
8	PreTmr	Ph8Flg	NMSB	Temp8	Xtemp4	ThsQad	OIGFaz	OGFaze	In1L	Out9	DoorFlg	LetFlg	RALag	RBLag	RAMax	RBMax	8
9	OIFzIn	InTmp1	MSB	Temp9	“	XCIFlg	QHold	OYFaze	In2L	OutA	UARTXI	IntCnt	RAStop	RBStop	RAΦBuf	RBΦBuf	9
A	XOIFaz	InTmp2	Event	TempA	Xtemp5	RstFlg		ORFaze	In3L	Lead	“	StrtUp	RACntl	RBCntl	RAMadd	RBMadd	A
B	DynOFz	InTmp3	Table	TempB	“	DynRRP		IRCall	In4L	CLiteo	DetLok	StrFlg	RATFlg	RBTFlg	RAGot	RBGot	B
C	KeyPtr	InTmp4	LagFlg	TempC	Xtemp6	RXPTrm		DCall	In5L	Clite9	ResLok	PreFlg	RACall	RBCall	RAGrt	RBGr	C
D	“	“	Lag	TempD	“	Ped		VCall	In6L	CalAct	XCILok	RngFlg	RALTrm	RBLTrm	RASep	RBStep	D
E	ChkFlg	InTmp5	SavStk	TempE	Xtemp7	CalMsk	Force2	PCall	In7L	Callit	OLock	OlpFlg	RBFlag	RAFlag	RATemp	RBTemp	E
F	UTemp1	“	“	TempF	“	Allow	Advan	Call	In8L	Cntinu		QadFlg	RABrFz	RBBrFz	RALimt	RBLimt	F
	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	

FLAG

DECIMAL

Page 0000h RAM Map

Key Press to view = Column + Row

NOTE: This entire page is write protected

PHASE TIMING/INTERSECTION CONTROL AND CONFIGURATION

	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	
0	CpyFrm	Fz1Tmg	Fz2Tmg	Fz3Tmg	Fz4Tmg	Fz5Tmg	Fz6Tmg	Fz7Tmg	Fz8Tmg	SysNum	RAWalk	RBWalk	P1Baud		MnStFz	Permit	0
1	CpyTo									Port1A	RADWlk	RBDWlk	P2Baud	Assoc1	SdStFz	RLock	1
2	RATTRT									Port2A	RAMGrn	RBMGrn	P3Baud	Assoc2	Ped2	YLock	2
3	RBTTTRT									Port3A	RAQuLm	RBQuLm	P4Baud	Assoc3	Ped4	VRCall	3
4	PrgNum									Port4A	RAInit	RBInit	P1ParA	Assoc4	Ped6	VXCall	4
5	Vrsion									Port1X	RAVExt	RBVExt	P2ParA	Assoc5	Ped8	GRest	5
6	RRsTim									Port2X	RATBRT	RBTBRT	P3ParA	Assoc6	PedA	RRest	6
7	GRsTim									Port3X	RACGap	RBCGap	P4ParA	Assoc7	PedB	Barrier	7
8	GRsTmr									Port4X	RACMax	RBCMax	P1BaudX	Assoc8	PRest	DblEnt	8
9	AllRed										RASec	RBSec	P2BaudX	CallΦY	STA	Xclusv	9
A	SpFunc										RACint	RBCint	P3BaudX	Call2Y		Rstrct	A
B	NMICnt										RARRev	RBRRev	P4BaudX	UFlag		LIARow	B
C	PLong									P1Reset	RARRst	RBRRst	P1ParX	GrnOff		LagFre	C
D	PShort									P2Reset	RAStpT	RBStpT	P2ParX	YelOff	DrwyFz	Faz1st	D
E	RedAll									P3Reset	RAYClr	RBYSclr	P3ParX	YRngFz	Drwy2H	Start	E
F	RedRev	▼	▼	▼	▼	▼	▼	▼	▼	P4Reset	RARClr	RBRClr	P4ParX	YRngOI	DrwYOI	StrtOI	F
	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	

FLAG DECIMAL

WWV CONTROL/DETECTORS

	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	
0	TxMsg	DetlDx	DetJDx	DetlCo	DetJCo	DetlVa	DetJVa	DtIDTm	DtJDTm	DtICTm	DtJCTm	ldetFz	JdetFz	ldetAt	JdetAt		0
1	WHour																1
2	WMin																2
3	WSec																3
4	WMonth																4
5	WDay																5
6	WYear																6
7	WDOW																7
8	Hour															Delop1	8
9	Minute															Delop2	9
A	Second																A
B	Month																B
C	Day																C
D	Year	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		D
E	DOW																E
F	TMCClk	StuckOn	StuckOff	Chatter	Period												F
	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	

FLAG

DECIMAL

Page 0200h RAM Map
Key Press to view = Column + Row

PREEMPTION/OVERLAPS/WWV BUFFERS

	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	
0	Delay	EVADly	EVBDly	EVCDly	EVDDly		RRSel	OnBBSTim	RRACnt	EVFlag	RRFaz	BBSFlag	PreLit	WWVFlag			0
1	Active	EVAAct	EVBAct	EVCAct	EVDAct		RR1Red		RRBCnt	EVAFaz	RRExit		ManOmt	BytTim			1
2	EVClear	EVAClr	EVBClr	EVCClr	EVDClr		RRClr		EVACnt	EVBFaz	RRPed	DynRRX	LagMan	TxDlay			2
3	Max	EVAMax	EVBMax	EVCMMax	EVDMax		RRMax		EVBCnt	EVCFaz	RRBLim	RRCntl		RegX			3
4	Link	EVALnk	EVBLnk	EVCLnk	EVDLnk		RRLnk		EVCCnt	EVDFaz		RRStat		"			4
5	EVClr	EVAMin	EVBMin	EVCMMin	EVDMin		MrkTim	↓	EVDCnt	SavVeh		RRPre		WWVTxRx			5
6	RRClear	EVATmr	EVBTmr	EVCTmr	EVDTmr		MrkTmr	OfBBSTim	ManCnt			EVStat		"			6
7	BBSFlsh						RRMin			EVPre		EVMax		TxTime			7
8	BBSRed						RRSec			EVAAct		EntFlg		TxBC			8
9	ManCon						RRDly			EVOlde		PreStat		RxBC			9
A	OIALod	OIADly	OIAGrn	OIAYel	OIARed	OIATmr	OADTmr		OIARev	DynOIA	OvlpA	AGOmit	RROIA	EVOIA			A
B	OIBLod	OIBDly	OIBGrn	OIBYel	OIBRed	OIBTmr	OBdTmr	↓	OIBRev	DynOIB	OvlpB	BGOmit	RROIB	EVOIB		↓	B
C	OICLod	OICDly	OICGrn	OICYel	OICRed	OICTmr	OCdTmr		OICRev	DynOIC	OvlpC	CGOmit	RROIC	EVOIC		CoCall	C
D	OIDLod	OIDDly	OIDGrn	OIDYel	OIDRed	OIDTmr	ODDTmr		OIDRev	DynOID	OvlpD	DGOmit	RROID	EVOID		PedRst	D
E	OIELod	OIEDly	OIEGrn	OIEYel	OIERed	OIETmr	OEDTmr		OIERev	DynOIE	OvlpE	EGOmit	RROIE	EVOIE	ABIEcho	Hold	E
F	OIFLod	OIFDly	OIFGrn	OIFYel	OIFRed	OIFTmr	OFDTmr		OIFRev	DynOIF	OvlpF	FGOmit	RROIF	EVOIF	IOStat	Force1	F
	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	

FLAG

DECIMAL

Page 0300h RAM Map

Key Press to view = Column + Row

Set ZIPCRD (location 7-A-D) = 001

to activate this RAM configuration

		PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	PLAN 8	PLAN 9	to activate this RAM configuration						
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	
0	SysMan	Cycle	_____							➡							0
1	LocMan	Force1	_____							➡							1
2	MasPln	Force2	_____							➡							2
3	LocPln	Force3	_____							➡							3
4	TMCPIn	Force4	_____							➡							4
5	TODPln	Force5	_____							➡							5
6	TODSpF	Force6	_____							➡							6
7	TODTbl	Force7	_____							➡							7
8	MinCyc	Force8	_____							➡							8
9	MaxCyc	Free	_____							➡							9
A	MasCyc															A	
B	LocCyc															B	
C	NewOff															C	
D	CurOff															D	
E	LMster															E	
F	LLocal															F	
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	

NOT USED

DECIMAL

Alternate Page 0400h RAM Map (when using Zip Coord)

Key Press to view = Column + Row

		CYCLE/INTERVALS				PLAN 1 FLAGS				PLAN 2 FLAGS				PLAN 3 FLAGS				
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F		
0	SysMan	Plan1x	Plan2x	Plan3x	P1Frce	P1Hold	P1PRst	P1Call	P2Frce	P2Hold	P2PRst	P2Call	P3Frce	P3Hold	P3PRst	P3Call	0	
1	LocMan																1	
2	MasPln																2	
3	LocPln																3	
4	TMCPIn																4	
5	TODPln																5	
6	TODSpF																6	
7	TODTbl																7	
8	MinCyc																8	
9	MaxCyc																9	
A	MasCyc																A	
B	LocCyc																B	
C	NewOff																C	
D	CurOff																D	
E	LMster																E	
F	LLocal	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	F	
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F		

FLAG

DECIMAL

	CYCLE/INTERVALS				PLAN 7 FLAGS				PLAN 8 FLAGS				PLAN 9 FLAGS				
	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	
0		Plan7x	Plan8x	Plan9x	P7Frce	P7Hold	P7PRst	P7Call	P8Frce	P8Hold	P8PRst	P8Call	P9Frce	P9Hold	P9PRst	P9Call	0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	F
	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	

FLAG

DECIMAL

Page 0600h RAM Map
Key Press to view = Column + Row

COORDINATION ATTRIBUTES																	
	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	
0	Lag0	Lag1	Lag2	Lag3	Lag4	Lag5	Lag6	Lag7	Lag8	Lag9	Offst0	CycLen			SICBit	DialX	0
1	VCall0	VCall1	VCall2	VCall3	VCall4	VCall5	VCall6	VCall7	VCall8	VCall9	OffSt1	CurPorF			CordM	“	1
2	PCall0	PCall1	PCall2	PCall3	PCall4	PCall5	PCall6	PCall7	PCall8	PCall9	OffSt2	NewPorF			CordE		2
3	VXCal0	VXCal1	VXCal2	VXCal3	VXCal4	VXCal5	VXCal6	VXCal7	VXCal8	VXCal9	OffSt3	CurPln			CordO		3
4	BaRcl0	BaRcl1	BaRcl2	BaRcl3	BaRcl4	BaRcl5	BaRcl6	BaRcl7	BaRcl8	BarCl9	OffSt4	LastPln			CordF	ForceX	4
5	GrnC10	GrnC11	GrnC12	GrnC13	GrnC14	GrnC15	GrnC16	GrnC17	GrnC18	GrnC19	OffSt5	PlnTMC			FloatB	“	5
6	Grn20	Grn21	Grn22	Grn23	Grn24	Grn25	Grn26	Grn27	Grn28	Grn29	OffSt6	MSync			Adaptv		6
7											OffSt7				MAX2		7
8	NoMax0	NoMax1	NoMax2	NoMax3	NoMax4	NoMax5	NoMax6	NoMax7	NoMax8	NoMax9	OffSt8				FunTmr		8
9	RdRst0	RdRst1	RdRst2	RdRst3	RdRst4	RdRst5	RdRst6	RdRst7	RdRst8	RdRst9	OffSt9						9
A	Omit0	Omit1	Omit2	Omit3	Omit4	Omit5	Omit6	Omit7	Omit8	Omit9	OffPln						A
B	OmtSd0	OmtSd1	OmtSd2	OmtSd3	OmtSd4	OmtSd5	OmtSd6	OmtSd7	OmtSd8	OmtSd9	MSPHr						B
C	Costa0	Costa1	Costa2	Costa3	Costa4	Costa5	Costa6	Costa7	Costa8	Costa9	MSPMin					InitByte	C
D	CondS0	CondS1	CondS2	CondS3	CondS4	CondS5	CondS6	CondS7	CondS8	CondS9	ZipCrd					CurN17M	D
E																HiN17M	E
F															ZipMsk	CrdDis	F
	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	

FLAG

DECIMAL

Page 0700h RAM Map

Key Press to view = Column + Row

**Page 0800h RAM Map
Through
Page 0F00 RAM Map**

UNUSED

EVENT TABLE 0				EVENT TABLE 1				EVENT TABLE 2				EVENT TABLE 3					
100	101	102	103	104	105	106	107	108	109	10A	10B	10C	10D	10E	10F		
0	Table0				Table1				Table2				Table3				0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F																	F
	100	101	102	103	104	105	106	107	108	109	10A	10B	10C	10D	10E	10F	

Page 1000h RAM Map

Key Press to view = 8 + Column + Row

EVENT TABLE 4				ANNUAL TABLE 5				FLOAT TABLE 6				EXCEPTION TABLE 7					
110	111	112	113	114	115	116	117	118	119	11A	11B	11C	11D	11E	11F		
0	Table4				Table5				Table6				Table7				0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F																	F
	110	111	112	113	114	115	116	117	118	119	11A	11B	11C	11D	11E	11F	

Page 1100h RAM Map

Key Press to view = 8 + Column + Row

FUTURE TABLE 8				BSP TABLE 9				PROGRAMMABLE LOGIC									
	120	121	122	123	124	125	126	127	128	129	12A	12B	12C	12D	12E	12F	
0	Table8				Table9				INAA1		INAA2		INAA3		INAA4		0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F																	F
	120	121	122	123	124	125	126	127	128	129	12A	12B	12C	12D	12E	12F	

Page 1200h RAM Map

Key Press to view = 8 + Column + Row

STACK

	130	131	132	133	134	135	136	137	138	139	13A	13B	13C	13D	13E	13F	
0		Stack															0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F																TStack	F
	130	131	132	133	134	135	136	137	138	139	13A	13B	13C	13D	13E	13F	

Page 1300h RAM Map

Key Press to view = 8 + Column + Row

NOTE: This entire page is write protected

AB3418E SLAVE COMMUNICATIONS

	140	141	142	143	144	145	146	147	148	149	14A	14B	14C	14D	14E	14F	
0	ABRxBuf				AStufBuf				ABTxBuf					AB_Addr	ABFCS		0
1														AB_Ctrl			1
2														AB_IPI			2
3														AB_Cmd			3
4														AB_Intvl			4
5														FCSFlag			5
6														ABRxCnt			6
7														ABTxCnt		▼	7
8														AB_Plan			8
9														ABTxRx			9
A														"			A
B																ABStat1	B
C																ABStat2	C
D																ABPStat	D
E																NonCrit	E
F	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	Flags	F
	140	141	142	143	144	145	146	147	148	149	14A	14B	14C	14D	14E	14F	

Page 1400h RAM Map

Key Press to view = 8 + Column + Row

SYSTEM DETECTION

	150	151	152	153	154	155	156	157	158	159	15A	15B	15C	15D	15E	15F	
0	Occ10ths	SDIchCtr	SDJChCtr	SDIOOnCtr	SDJOnCtr	SDIOOfCtr	SDJOOfCtr	SDIVCtr	SDJVCtr	SDIOccH	SDIOccL	SDJOccH	SDJOccL				0
1	“																1
2	IFile																2
3	RstAllSD																3
4	SDReset																4
5	SDXfr																5
6	StOnOff																6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				D
E																	E
F	SDPerTmr															SDSeqNum	F
	150	151	152	153	154	155	156	157	158	159	15A	15B	15C	15D	15E	15F	

Page 1500h RAM Map

Key Press to view = 8 + Column + Row

AB3418E DETECTOR STATUS DATA/AB3418E MASTER

	160	161	162	163	164	165	166	167	168	169	16A	16B	16C	16D	16E	16F	
0	SDIVol	SDJVol	SDIOStat	SDJOStat	Scratch								AB7TxBuf		AB7FCS		0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																↓	7
8																	8
9																	9
A																	A
B																	B
C																AB7Tx	C
D	↓	↓	↓	↓												“	D
E																AB7TxCnt	E
F					↓								↓	↓	↓	ABTime	F
	160	161	162	163	164	165	166	167	168	169	16A	16B	16C	16D	16E	16F	

Page 1600h RAM Map

Key Press to view = 8 + Column + Row

Page 1700h RAM Map

Page 1800h RAM Map

UNUSED

DIAGNOSTICS/MISCELLANEOUS

	190	191	192	193	194	195	196	197	198	199	19A	19B	19C	19D	19E	19F	
0			DwnTim	RRTim	StpTim	IntMap	Loc01C	Loc11C	Stop1	RAXMap	RBXMap	CmuMap		WWVRxBuf			0
1			↓	↓	↓	↓	“	“	Stop2					↓			1
2			↓	↓	↓	↓	Loc02C	Loc12C	Stop3	↓	↓	↓					2
3			↓	↓	↓	↓	“	“	Stop4							PwrFlg	3
4			↓	↓	↓	↓	Loc03C	Loc1EC	Stop5							ResFlg	4
5			↓	↓	↓	↓	“	“	Stop6							MsgErr	5
6			UpTime	EVTime			Loc04C		Stop7							ComErr	6
7			↓	↓		↓	“		FazMap							PasTmr	7
8			↓	↓		↓	Loc05C		↓							DROMSum	8
9			↓	↓		↓	“		↓							“	9
A			↓	↓		↓	Loc06C		↓							SROMSum	A
B			↓	↓		↓	“		↓							“	B
C			DwnMin			↓	Loc07C		↓							SRAMSum	C
D		DoRAMSum	DwnSec			↓	“		↓	↓	↓	↓				“	D
E		N17Tst	NovRed			↓	Loc10C		↓	↓	↓	↓		↓		Rompag	E
F		N17Last	NovRit			↓	“			↓	↓	↓		W100M	“		F
	190	191	192	193	194	195	196	197	198	199	19A	19B	19C	19D	19E	19F	

Page 1900h RAM Map

Key Press to view = 8 + Column + Row

AB3418E COORDINATION MOE's

	1A0	1A1	1A2	1A3	1A4	1A5	1A6	1A7	1A8	1A9	1AA	1AB	1AC	1AD	1AE	1AF	
0		LSplits	Splt10s	CSplits													0
1																	1
2		↓	↓	↓													2
3		↓	↓	↓													3
4		↓	↓	↓													4
5		↓	↓	↓													5
6		↓	↓	↓													6
7		↓	↓	↓													7
8		LDelays	Dlay10s	CDelays													8
9																	9
A		↓	↓	↓													A
B	CFazOut	↓	↓	↓													B
C	EchoPerm	↓	↓	↓													C
D	EchoPlan	↓	↓	↓													D
E	EchoLMst	↓	↓	↓													E
F	CordSeq	↓	↓	↓													F
	1A0	1A1	1A2	1A3	1A4	1A5	1A6	1A7	1A8	1A9	1AA	1AB	1AC	1AD	1AE	1AF	

Page 1A00h RAM Map

Key Press to view = 8 + Column + Row

Page 1B00h RAM Map

Page 1C00h RAM Map

Page 1D00h RAM Map

UNUSED

BSP CONTROL AND CONFIGURATION

	1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE	1EF	
0	BSPMode	ETATmr	Slop	TxDtGP	BSPFCS	“	BusRT	“	“	BRxAddr	BSP_Pkt	BSPunStuff	BSPRxBuf	“		BusHdwy	0
1	BAddr1	DTGP	AGAVG	ETApReq						BRxAddr2	BNewReq	ETAPtr					1
2	BAddr2	PriFlag	BGAVG	“			(Route)	(DIR)	(TmrMin)	BRxCity	BDiag1	“					2
3	BCityCode	PriFaz	BSPRAG	BAdjPtr			(RtelSB)	(HDWY)	(TmrSec)	BRxCtrl	BDiag2	BusExTmr					3
4	HWETA EarlyGrn	BSPTOD	BSPRBG	“						BRxIPI		BusExt					4
5	TrpPnt LateGrn	BSPFix	AGFlag	BCRCPtr						BRxCMD		LockTmr					5
6		BSPFloa t	BGFlag	“						BRxRev	HW_Stat	ErlyGrn					6
7		BSPDFaz	BSPFTB	BTemp1						BRxBusID	HW_ETA	PriFzReq					7
8	PriPhz NoEGrn	BSPFaz 1	BSPDone	“						“		M88HV					8
9	DemPhz	BSPFaz 2	BSPMax	BTemp2						BRxStat		BRDir					9
A	NFaze_A	BSPFaz 3	CYCNT	“		PASStart				BRxETA		RAPTM					A
B	SFaze_B	BSPFaz 4	BAICP	BSPTxRx		PAEnd				LoArvA	DTGPA	MSRte					B
C	EFaze_C	BSPFaz 5	PStart	“		PAGrn				LoArvB	DTGPB	LSRte					C
D	WFaze_D	BSPFaz 6	Pend	BSPRxCnt		PBStart				LoArvC	DTGPC	Prev_Tmr					D
E		BSPFaz 7	EarlyFO	BSPComErr		PBEnd				LoArvD	DTGPD	Prev_Dir					E
F		BSPFaz 8	BSPSMFO	BSPMsgErr		PBGrn					CordCalc	Prev_DTGP					F
	1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE	1EF	

Page 1E00h RAM Map
BSP CONTROL AND CONFIGURATION

	1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE	1EF	
0	BSPMode	ETATmr	Slop	TxDtGP	BSPFCS	“	BusRT	“	“	BRxAddr	BSP_Pkt	BSPunStuff	BSPRxBuf	“		BusHdwy	0
1	BAddr1	DTGP	AGAVG	ETApReq						BRxAddr2	BNewReq	ETAPtr					1
2	BAddr2	PriFlag	BGAVG	“			(Route)	(DIR)	(TmrMin)	BRxCity	Bdiag1	“					2
3	BCityCode	PriFaz	BSPRAG	BAdjPtr			(RtelSB)	(HDVY)	(TmrSec)	BRxCtrl	Bdiag2	BusExTmr					3
4	HWETA EarlyGrn	BSPTOD	BSPRBG	“						BRxIPI		BusExt					4
5	TrpPnt LateGrn	BSPFix	AGFlag	BCRCPtr						BRxCMD		LockTmr					5
6		BSPFloa t	BGFlag	“						BRxRev	HW_Stat	ErlyGrn					6
7		BSPDFaz	BSPFTB	BTemp1						BRxBusID	HW_ETA	PriFzReq					7
8	PriPhz NoEGrn	BSPFaz 1	BSPDone	“						“		M88HV					8
9	DemPhz	BSPFaz 2	BSPMax	BTemp2						BRxStat		BRDir					9
A	NFaze_A	BSPFaz 3	CYCNT	“		PAStart				BRxETA		RAPTM					A
B	SFaze_B	BSPFaz 4	BAICP	BSPTxRx		PAEnd				LoArvA	DTGPA	MSRte					B
C	EFaze_C	BSPFaz 5	PStart	“		PAGrn				LoArvB	DTGPB	LSRte					C
D	WFaze_D	BSPFaz 6	Pend	BSPRxCnt	↓	PBStart	↓	↓	↓	LoArvC	DTGPC	Prev_Tmr	↓	↓		↓	D
E		BSPFaz 7	EarlyFO	BSPComErr		PBEnd				LoArvD	DTGPD	Prev_Dir					E
F		BSPFaz 8	BSPSMFO	BSPMsgErr		PBGrn					CordCalc	Prev_DTG P					F

1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE	1EF
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Page 1E00h RAM Map

Key Press to view = 8 + Column + Row

TIMING
SHEET
DATA

DYNAMIC
DATA

BUS HEADWAY

	1F0	1F1	1F2	1F2	1F4	1F5	1F6	1F7	1F8	1F9	1FA	1FB	1FC	1FD	1FE	1FF	
0	BegBHdy																0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F																EndBHdy	F
	1F0	1F1	1F2	1F3	1F4	1F5	1F6	1F7	1F8	1F9	1FA	1FB	1FC	1FD	1FE	1FF	

Page 1F00 RAM Map

Key Press to view = 8 + Column + Row

G1. Checksum Maps

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PHASE TIMING/INTERSECTION CONTROL AND CONFIGURATION

	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	
0	CpyFrm	Fz1Tmg	Fz2Tmg	Fz3Tmg	Fz4Tmg	Fz5Tmg	Fz6Tmg	Fz7Tmg	Fz8Tmg	SysNum	RAWalk	RBWalk	P1BaudA		MnStFz	Permit	0
1	CpyTo									Port1A	RADWik	RBDWik	P2BaudA	Assoc1	SdStFz	RLock	1
2	RATTRT									Port2A	RAMGrn	RBMGrn	P3BaudA	Assoc2	Ped2	YLock	2
3	RBTTTRT									Port3A	RAQuLm	RBQuLm	P4BaudA	Assoc3	Ped4	VRCall	3
4	PrgNum									Port4A	RAInIt	RBInIt	P1ParA	Assoc4	Ped6	VXCall	4
5	Vrsion									Port1X	RAVExt	RBVExt	P2ParA	Assoc5	Ped8	GRest	5
6	RRsTim									Port2X	RATBRT	RBTBRT	P3ParA	Assoc6	PedA	RRest	6
7	GRsTim									Port3X	RACGap	RBCGap	P4ParA	Assoc7	PedB	Barrier	7
8	GRsTmr									Port4X	RACMax	RBCMax	P1BaudX	Assoc8	PRest	DblEnt	8
9	AllRed										RASec	RBSec	P2BaudX	CallΦY	STA	Xclusv	9
A	SpFunc										RACint	RBCint	P3BaudX	Call2Y		Rstrct	A
B	NMICnt										RARRev	RBRRev	P4BaudX	UFlag		LIARow	B
C	PLong									P1Reset	RARRst	RBRRst	P1ParX	GrnOff		LagFre	C
D	PShort									P2Reset	RASpT	RBSpT	P2ParX	YelOff	DrwyFz	Faz1st	D
E	RedAll									P3Reset	RAYClr	RBYSclr	P3ParX	YRngFz	Drwy2H	Start	E
F	RedRev	▼	▼	▼	▼	▼	▼	▼	▼	P4Reset	RARClr	RBRClr	P4ParX	YRngOI	DrwYOI	StrtOI	F
	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	

WWV CONTROL/DETECTORS

	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	
0	TxMsg	DetIDx	DetJDx	DetlCo	DetJCo	DetlVa	DetJVa	DtlDTm	DtJDTm	DtICTm	DtJCTm	ldetFz	JdetFz	ldetAt	JdetAt		0
1	WHour																1
2	WMin																2
3	WSec																3
4	WMonth																4
5	WDay																5
6	WYear																6
7	WDOW																7
8	Hour															Delop1	8
9	Minute															Delop2	9
A	Second																A
B	Month																B
C	Day																C
D	Year																D
E	DOW																E
F	TMCClk	StuckOn	StuckOff	Chatter	Period												F
	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	

Page 0200h Checksum/Copy Mask



















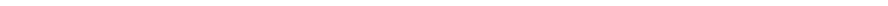

**TIMING
SHEET
DATA**

**DYNAMIC
DATA**

PREEMPTION/OVERLAPS/WWV BUFFERS

	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	
0	Delay	EVADly	EVBDly	EVCDly	EVDDly		RRSel	OnBBSTim	RRACnt	EVFlag	RRFaz		PreLit	WWVFlag			0
1	Active	EVAAct	EVBAAct	EVCAAct	EVDAAct		RR1Red		RRBCnt	EVAFaz	RRExit		ManOmt	BytTim			1
2	EVClear	EVAClr	EVBClr	EVCClr	EVDClr		RRClr		EVACnt	EVBFaz	RRPed	DynRRX	LagMan	TxDlay			2
3	Max	EVAMax	EVBMMax	EVCMMax	EVDMMax		RRMax		EVBCnt	EVCFaz	RRBLim	RRCntl		RegX			3
4	Link	EVALnk	EVBLnk	EVCLnk	EVDLnk		RRLnk		EVCCnt	EVDFaz		RRStat		“			4
5	EVClr	EVAMin	EVBMMin	EVCMMin	EVDMMin		MrkTim	↓	EVDCnt	SavVeh		RRPre		WWVTxRx			5
6	RRClear	EVATmr	EVBTmr	EVCTmr	EVDTmr		MrkTmr	OfBBSTim	ManCnt			EVStat		“			6
7							RRMin			EVPre		EVMax		TxTime			7
8							RRSec			EVAAct		EntFlg		TxBC			8
9	ManCon						RRDly			EVOIde		PreStt		RxBC			9
A	OIALod	OIADly	OIAGrn	OIAYel	OIARed	OIATmr	OADTmr		OIARev	DynOIA	OvlpA	AGOmit	RROIA	EVOIA			A
B	OIBLod	OIBDly	OIBGrn	OIBYel	OIBRed	OIBTmr	OBdTmr	↓	OIBRev	DynOIB	OvlpB	BGOmit	RROIB	EVOIB			B
C	OICLod	OICDly	OICGrn	OICYel	OICRed	OICTmr	OCdTmr		OICRev	DynOIC	OvlpC	CGOmit	RROIC	EVOIC		CoCall	C
D	OIDLod	OIDDly	OIDGrn	OIDYel	OIDRed	OIDTmr	ODdTmr		OIDRev	DynOID	OvlpD	DGOmit	RROID	EVOID		PedRst	D
E	OIELod	OIEDly	OIEGrn	OIEYel	OIERed	OIETmr	OEDTmr		OIERev	DynOIE	OvlpE	EGOmit	RROIE	EVOIE	ABIEcho	Hold	E
F	OIFLod	OIFDly	OIFGrn	OIFYel	OIFRed	OIFTmr	OFdTmr		OIFRev	DynOIF	OvlpF	FGOmit	RROIF	EVOIF	IOStat	Force1	F
	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	

**Set ZIPCRD (location 7-A-D) = 001
to activate this RAM configuration**

		PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	PLAN 8	PLAN 9	Set ZIPCRD (location 7-A-D) = 001 to activate this RAM configuration						
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	
0	SysMan	Cycle															0
1	LocMan	Force1															1
2	MasPln	Force2															2
3	LocPln	Force3															3
4	TMCPln	Force4															4
5	TODPln	Force5															5
6	TODSpF	Force6															6
7	TODTbl	Force7															7
8	MinCyc	Force8															8
9	MaxCyc	Free															9
A	MasCyc															A	
B	LocCyc															B	
C	NewOff															C	
D	CurOff															D	
E	LMster															E	
F	LLocal															F	
	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	

**Alternate Page 0400h Checksum/Copy Mask
(when using Zip Coord)**

**TIMING
SHEET
DATA**

**DYNAMIC
DATA**

		CYCLE/INTERVALS				PLAN 1 FLAGS				PLAN 2 FLAGS				PLAN 3 FLAGS				
		40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	
0	SysMan	Plan1x	Plan2x	Plan3x	P1Frce	P1Hold	P1PRst	P1Call	P2Frce	P2Hold	P2PRst	P2Call	P3Frce	P3Hold	P3PRst	P3Call		0
1	LocMan																	1
2	MasPln																	2
3	LocPln																	3
4	TMCPln																	4
5	TODPln																	5
6	TODSpF																	6
7	TODTbl																	7
8	MinCyc																	8
9	MaxCyc																	9
A	MasCyc																	A
B	LocCyc																	B
C	NewOff																	C
D	CurOff																	D
E	LMster	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
F	LLocal																	F
		40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	

Page 0400h Checksum/Copy Mask

**TIMING
SHEET
DATA**

**DYNAMIC
DATA**

		CYCLE/INTERVALS				PLAN 4 FLAGS				PLAN 5 FLAGS				PLAN 6 FLAGS				
		50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	
0			Plan4x	Plan5x	Plan6x	P4Frce	P4Hold	P4PRst	P4Call	P5Frce	P5Hold	P5PRst	P5Call	P6Frce	P6Hold	P6PRst	P6Call	0
1																		1
2																		2
3																		3
4																		4
5																		5
6																		6
7																		7
8																		8
9																		9
A																		A
B																		B
C																		C
D																		D
E																		E
F																		F
		50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	

Page 0500h Checksum/Copy Mask

TIMING
SHEET
DATA

DYNAMIC
DATA

CYCLE/INTERVALS				PLAN 7 FLAGS				PLAN 8 FLAGS				PLAN 9 FLAGS					
	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	
0		Plan7x	Plan8x	Plan9x	P7Frce	P7Hold	P7PRst	P7Call	P8Frce	P8Hold	P8PRst	P8Call	P9Frce	P9Hold	P9PRst	P9Call	0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	F
	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	

Page 0600h Checksum/Copy Mask

**TIMING
SHEET
DATA**

**DYNAMIC
DATA**

COORDINATION ATTRIBUTES																	
	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	
0	Lag0	Lag1	Lag2	Lag3	Lag4	Lag5	Lag6	Lag7	Lag8	Lag9	Offst0	CycLen			SICBit	DialX	0
1	VCall0	VCall1	VCall2	VCall3	VCall4	VCall5	VCall6	VCall7	VCall8	VCall9	OffSt1	CurPorF			CordM	“	1
2	PCall0	PCall1	PCall2	PCall3	PCall4	PCall5	PCall6	PCall7	PCall8	PCall9	OffSt2	NewPorF			CordE		2
3	VXCal0	VXCal1	VXCal2	VXCal3	VXCal4	VXCal5	VXCal6	VXCal7	VXCal8	VXCal9	OffSt3	CurPln			CordO		3
4	BaRcl0	BaRcl1	BaRcl2	BaRcl3	BaRcl4	BaRcl5	BaRcl6	BaRcl7	BaRcl8	BarCl9	OffSt4	LastPln			CordF	ForceX	4
5	GrnC10	GrnC11	GrnC12	GrnC13	GrnC14	GrnC15	GrnC16	GrnC17	GrnC18	GrnC19	OffSt5	PlnTMC			FloatB	“	5
6	Grn20	Grn21	Grn22	Grn23	Grn24	Grn25	Grn26	Grn27	Grn28	Grn29	OffSt6	MSync			Adaptv		6
7											OffSt7				MAX2		7
8	NoMax0	NoMax1	NoMax2	NoMax3	NoMax4	NoMax5	NoMax6	NoMax7	NoMax8	NoMax9	OffSt8				FunTmr		8
9	RdRst0	RdRst1	RdRst2	RdRst3	RdRst4	RdRst5	RdRst6	RdRst7	RdRst8	RdRst9	OffSt9						9
A	Omit0	Omit1	Omit2	Omit3	Omit4	Omit5	Omit6	Omit7	Omit8	Omit9	OffPln						A
B	OmtSd0	OmtSd1	OmtSd2	OmtSd3	OmtSd4	OmtSd5	OmtSd6	OmtSd7	OmtSd8	OmtSd9	MSPHr						B
C	Costa0	Costa1	Costa2	Costa3	Costa4	Costa5	Costa6	Costa7	Costa8	Costa9	MSPMin					InitByte	C
D	CondS0	CondS1	CondS2	CondS3	CondS4	CondS5	CondS6	CondS7	CondS8	CondS9	ZipCrd					CurN17M	D
E																HiN17M	E
F															ZipMsk	CrdDis	F
	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	

TOD TABLE 0				TOD TABLE 1				TOD TABLE 2				TOD TABLE 3				
	100	101	102	103	104	105	106	107	108	109	10A	10B	10C	10D	10E	10F
0	Table0				Table 1				Table 2				Table 3			
1																
2																
3																
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																
	100	101	102	103	104	105	106	107	108	109	10A	10B	10C	10D	10E	10F

Page 1000h Checksum/Copy Mask

**TIMING
SHEET
DATA**

**DYNAMIC
DATA**

TOD TABLE 4				ANNUAL TABLE 5				FLOAT TABLE 6				EXCEPTION TABLE 7				
	110	111	112	113	114	115	116	117	118	119	11A	11B	11C	11D	11E	11F
0	Table 4				Table 5				Table 6				Table 7			
1																
2																
3																
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																
	110	111	112	113	114	115	116	117	118	119	11A	11B	11C	11D	11E	11F

FUTURE TABLE 8				BSP TABLE 9				PROGRAMMABLE LOGIC									
	120	121	122	123	124	125	126	127	128	129	12A	12B	12C	12D	12E	12F	
0	Table 8				Table 9				INAA1		INAA2		INAA3		INAA4		0
1																	1
2																	2
3																	3
4																	4
5																	5
6																	6
7																	7
8																	8
9																	9
A																	A
B																	B
C																	C
D																	D
E																	E
F																	F
	120	121	122	123	124	125	126	127	128	129	12A	12B	12C	12D	12E	12F	

Page 1200h Checksum/Copy Mask

TIMING
SHEET
DATA

DYNAMIC
DATA

BUS SIGNAL PRIORITY CONTROL AND CONFIGURATION

	1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE	1EF	
0	BSPMode	ETATmr	Slop	TxDtGP	BSPFCS	“	BusRT	“	“	BRxAddr	BSP_Pkt	BSPunStuff	BSPRxBuf	“		BusHdwy	0
1	BAddr1	DTGP	AGAVG	ETApReq						BRxAddr2	BNewReq	ETAPtr					1
2	BAddr2	PriFlag	BGAVG	“			(Route)	(DIR)	(TmrMin)	BRxCity	BDiag1	“					2
3	BCityCode	PriFaz	BSPRAG	BAdjPtr			(RtelSB)	(HDWY)	(TmrSec)	BRxCtrl	BDiag2	BusExTmr					3
4	HWETA EarlyGrn	BSPTOD	BSPRBG	“						BRxIPI		BusExt					4
5	TrpPnt LateGrn	BSPFix	AGFlag	BCRCPtr						BRxCMD		LockTmr					5
6		BSPFloat	BGFlag	“						BRxRev	HW_Stat	ErlyGrn					6
7		BSPDFaz	BSPFTB	BTemp1		↓				BRxBusID	HW_ETA	PriFzReq					7
8	PriPhz NoEGrn	BSPFaz1	BSPDone	“						“		M88HV					8
9	DemPhz	BSPFaz2	BSPMax	BTemp2						BRxStat		BRDir					9
A	NFaze_A	BSPFaz3	CYCNT	“		PASStart				BRxETA		RAPTM					A
B	SFaze_B	BSPFaz4	BAICP	BSPTxRx		PAEnd				LoArvA	DTGPA	MSRte					B
C	EFaze_C	BSPFaz5	PStart	“		PAGrn				LoArvB	DTGPB	LSRte					C
D	WFaze_D	BSPFaz6	Pend	BSPRxCnt		PBStart				LoArvC	DTGPC	Prev_Tmr					D
E		BSPFaz7	EarlyFO	BSPComErr		PBEnd				LoArvD	DTGPD	Prev_Dir					E
F		BSPFaz8	BSPSMFO	BSPMsgErr	↓	PBGrn	↓	↓	↓		CordCalc	Prev_DTGP	↓	↓		↓	F
	1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE	1EF	

Page 1E00h RAM Map

Key Press to view = 8 + Column + Row

**TIMING
SHEET
DATA**

**DYNAMIC
DATA**

TROUBLESHOOTING GUIDE

- H1. IS IT THE FIRMWARE OR THE HARDWARE?**
- H2. FIELD ENVIRONMENT AND CABINET ENVIRONMENT**
 - OUTPUTS**
 - INPUTS**
- H3. COMMUNICATIONS ENVIRONMENT**
 - AB3418E TO CENTRAL**
- H4. BUS SIGNAL PRIORITY**
- H5. WWV/GPS**
- H6. PEER TO PEER**
- H7. FIRMWARE ENVIRONMENT**
 - SIGNALS**
 - PHASE CALLS**
 - WHY IS THE INTERSECTION IN FLASH?**
 - CONFLICT MONITOR FLASH FAULT ANALYSIS**
- H8. MISCELLANEOUS**
 - RAILROAD INPUTS**
 - COMMUNICATIONS TESTING**

FIGURES:

FIGURE H1 – LACO-4E ENVIRONMENTS

FIGURE H2 – LOCAL COORDINATOR PLAN SELECTION HIERARCHY

FIGURE H3 – LACO-4E KEY PRESS MAP

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H1. IS IT THE FIRMWARE OR THE HARDWARE?

When encountering problems in the field or lab, this is often one of the first questions asked. The lab environment is a simulation of the field environment with a tester replacing all of the cabinet and field wiring/hardware (with the exception of the CMU and communications). While the majority of problems can be detected in a lab environment, because of the presence of random inputs, field outputs and the CMU, some problems only manifest themselves when in a real-world field environment. This guide takes the approach that a problem has been detected at an intersection, unless otherwise noted.

To assist in fault isolation, it helps to break down the LACO-4E environment into smaller pieces (**see figure H-1 at the end of this section**):

1. Field Environment
 - Field Wiring

LACO-4E USERS MANUAL

Appendix H - TROUBLESHOOTING GUIDE

- Field Devices
- 2. Communications Environment
 - Wiring
 - Antennas
 - Communications Devices (i.e. GPS Receiver, External Modems, etc)
- 3. Cabinet Environment
 - Controller Hardware
 - CPU Module (CPU, EPROM, NVRAM, Quad UART)
 - Input Module
 - Output Module
 - Modems
 - Front Panel
 - Cabinet Hardware
 - Input File(s)
 - Output File(s)
 - Conflict Monitor
 - Police Panel
 - Power Supply
 - Battery Backup System (future)
 - Cabinet Wiring
- 4. Firmware Environment
 - LACO-4E Program

Additionally, the types of faults that are typically experienced can be broken down into distinct categories. The source of I/O problems and communications problems are usually confined to the Field, Communications and Cabinet environments. That is, they are most often a result of hardware issues. Signal logic problems, on the other hand, almost always originate in the Firmware environment. The source for signal logic problems can usually be traced to either configuration (user entered timing) or program logic (bugs).

H2. FIELD ENVIRONMENT AND CABINET ENVIRONMENT

From the LACO-4E firmware perspective, these will be treated as the same environment.

Outputs

A typical problem encountered is an intersection in cabinet flash. That is, the CMU has sensed one or more field problems, set the Flash Sense and External Stop Time inputs to ON and enabled the cabinet Flash relays. Observation of the CMU is the first step in fault isolation. However, the CMU only knows if (for example) phase 2 signal heads are displaying both green and red at the same time. It does not know the source of the conflicting output, which can be any of the LACO-4E, Field or Cabinet environments.

Problems involving field outputs can be quickly isolated using the LACO-4E integrated FlashOut utility (see section 8 for more information). This feature bypasses all intersection timing, which can cloud fault isolation at an intersection.

Basically, if the desired output goes ON/OFF when toggled from the keypad, but not when the LACO-4E Signals program is running, then the problem is in the intersection timing. Otherwise, the problem lies somewhere in the output circuit path including any of the following:

- Field device
- Field wiring
- Cabinet wiring
- Output File
- C1 harness and connector
- 170E Controller Backplane assembly
- 170E Controller Output module

When the desired output toggles successfully from the FlashOut utility, incorrect Programmable Logic timing is likely to cause this type of faulty operation. If an examination of the intersection timing does not reveal the problem, faulty program logic (bug) should be considered a possibility and the user should consult with LACO-4E technical support.

Inputs

Problems involving field inputs require a little more investigation to resolve. The first step involves isolating the problem to either the controller or the rest of the input path (field wiring/devices and cabinet wiring/hardware).

Appendix E1 is the LACO-4E Input Function Map. It provides a cross reference between the hardware addresses, firmware addresses and the default function of all forty four inputs to the 170E Controller. The general fault isolation process is as follows:

- Locate the suspect input on the Input Function Map
- Access the **firmware** (080 through 085) address that corresponds to the suspect input
- Toggle the suspect input (using the appropriate circuit card in the Input File)
- Observe the call light corresponding to the suspect input's *column* in the Input Function Map.
- If it illuminates and extinguishes with the toggling of the input, then the input circuit path from the Input file up to and including the RAM chip on the CPU module has been validated. This also eliminates the intersection timing as a possible cause. At this point, the remaining portion of the input circuit path (cabinet wiring, field wiring and field input devices) should be verified.
- If the call light does not change with a change in the input, then access the **hardware** address (7401 through 7406) that corresponds to the suspect input.
- Toggle the suspect input again (using a circuit card in the Input File)
- Observe the call light corresponding to the suspect input's *column* in the Input Function Map.
- If it illuminates and extinguishes with the toggling of the input, then the input path from the Input file up to and including the 170E Controller Input module has been validated and the problem is in the cabinet wiring to the input file, the field wiring or the field input device.

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- If the call light does not change with a change in the input then one of the following is possibly defective.
 - Input File card
 - C1 harness and connector
 - 170E Controller Backplane assembly
 - 170E Controller Input module

H3. COMMUNICATIONS ENVIRONMENT

AB3418E to Central

For proper Central System communication to take place, several things need to be in place:

- The desired Comm port must be set to "008" (AB3418E Slave).
- The desired Comm port's Baud Rate and Parity must be set to match the Baud Rate and Parity of the Central System (or intervening communications device if any).
- A properly configured modem must be connected to the desired Comm port.
- The System ID (SysNum, location 190) must be configured properly. Only values between "001" and "063" are valid. The System ID of each controller on a communications channel must be unique.

Is the 170E Controller receiving a message?

- Access memory location 1400 (AB3418E Slave Receive Data Buffer)
- Observe that call lights 2 through 6 are illuminated
- Press the "0" key and observe that all call lights extinguish
- Send a message from Central and observe that call lights 2 through 6 illuminate

If the above sequence occurs, then the **receive** side of the communications path up to and including the LACO-4E firmware has been validated.

If the above sequence does not occur, then the communications path up to the controller comm port should be examined.

Is the 170E Controller responding to the message?

- Access memory location 1480 (AB3418E Slave Transmit Data Buffer)
- Observe that call lights 2 through 6 are illuminated
- Press the "0" key and observe that all call lights extinguish
- Send a message from Central and observe that call lights 2 through 6 illuminate

If the above sequence occurs, then the **transmit** side of the communications path up to and including the LACO-4E firmware has been validated.

Has LACO-4E detected any errors?

If the above sequence does not occur, then the communications path up to the controller comm port should be examined. Access memory location 14E0. If call light 4 is illuminated, then the checksum of the message received at the controller did not match the checksum of the message sent from Central. This situation requires a detailed examination of the receive side of the communications path.

The 170E Controller does not accept a Time/Date download from Central. This will occur if the 170E controller is connected to functioning WWV/GPS receiver and configured for WWV/GPS operation on another comm port.

H4. BUS SIGNAL PRIORITY (BSP)

For proper BSP operation to take place, several things need to be in place:

- 1** The desired Comm port must be set to "009" (Bus Signal Priority).
- 2** The desired Comm port's Baud Rate and Parity must be set to match the Baud Rate and Parity of the bus.
- 3** A properly configured modem must be connected to the desired Comm port.
- 4** The BSP Mode, Primary Address, Secondary Address and City Code must be configured properly.

Is the 170E Controller receiving a message?

- Access memory location 1EC0 (BSP Receive Data Buffer)
- Observe that call lights 2 through 7 are illuminated (for 0x7E, the message start flag)
- Press the "0" key and observe that all call lights extinguish
- Initiate a bus check-in message and observe that call lights 2 through 7 illuminate

If the above sequence occurs, then the **receive** side of the communications path up to and including the LACO-4E firmware has been validated.

If the above sequence does not occur, then the communications path up to the controller comm port should be examined.

Is the 170E Controller responding to the message?

The BSP response is built using the same buffer area and the messages are different lengths, so this check only applies if the secondary address is not used.

- Access memory location 1EC5 (BSPRxBuf) of the BSP command received
- Observe whether call lights 8, 3, and 1 (for 0x85) or 8 and 2 (for 0x88) are illuminated
- If 8, 3, and 1 for command 0x85 then access memory location 1ECE for the end flag at the end of the 14 byte Pilot Project Protocol response
- If 8 and 2 for command 0x88 then access memory location 1ED1 for the end flag at the end of the 17 byte Metro Rapid Protocol response
- Press the "0" key and observe that all call lights extinguish
- Send a message from Central and observe that call lights 2 through 7 illuminate

If the above sequence occurs, then the **transmit** side of the communications path up to and including the LACO-4E firmware has been validated.

Has LACO-4E detected any errors?

Observe location 1E3F (BSPMsgErr, for BSP Communication Errors). Illuminated call lights indicate a problem with the received message.

1 - Bad Opening/Closing flag: The first and/or last byte of the received message was **not** a "07Eh".

2 - Wrong Primary Address: The Primary Address encoded in the received message does not match the Primary Address set in the controller.

Ensure that the Primary Address is set properly in the controller

3 - Wrong Secondary Address: The Secondary Address encoded in the received message does not match the Secondary Address set in the controller.

Ensure that the Secondary Address is set properly in the controller.

4 - Wrong City Code: The City code in the received message does not match the City code set in the controller

Ensure that the City code is set properly in the controller.

5 - Bad Control byte/IPI byte/Command: At least one of these three bytes in the received message was incorrect. The Control byte must always be "003h", the IPI byte must always be "0C3h" and the Command byte must be either "085h" (for Rev 1 protocol) or "088h" (for Rev 2 protocol).

6 - Bad Revision: As of Dec 1, 2006, there are two revisions of the BSP protocol used by the L.A. County MTA. Revision 1 is the LACO-4E only supports "Revision 1" of the Bus Signal Priority Protocol.

7 - Not used

8 - Bad Check Sum: The computed checksum of the received message does not match the checksum of the message transmitted by the bus.

Items 1, 5, 6 and 8 are issues that originate outside the LACO-4E environment. The system transmitting the message with the errors should be inspected to confirm proper configuration.

H5. WWV and GPS

For proper WWV/GPS operation to take place, several things need to be in place:

- 1** - The desired Comm port must be set to "001" (WWV/GPS).
- 2** - The desired Comm port's Baud Rate and Parity must be set to match the Baud Rate and Parity of the WWV/GPS unit.
- 3** - One end of a properly wired cable must be connected to the desired Comm port.
- 4** - The other end of a properly wired cable must be connected to a functional WWV/GPS unit.
- 5** - A compatible antenna must be connected to the WWV/GPS unit.
- 6** - The WWV/GPS unit must be powered up. A GPS unit receives power from the 170E Controller's Comm port through the attached cable. A WWV unit receives power from a separate power supply and cable.

Has LACO-4E detected any errors? Observe WWV Clock Errors (WWVErr, location 0A5). Illuminated call lights indicate problem.

- 1** - Not Locked On: The WWV/GPS unit is connected and the desired Comm port is configured correctly but the WWV/GPS unit has not locked on to a valid signal.

Atmospheric conditions and the physical location of the WWV/GPS unit's antenna can affect this. If this error persists, the WWV/GPS unit itself may be malfunctioning.

Exchange the WWV/GPS unit for a known good WWV/GPS unit.

2 - Not used

- 3** - Clock Receive Timed Out: A cable is connected to the port configured for WWV/GPS but the WWV/GPS unit is either not connected to the cable or is not functional.

Ensure that the WWV/GPS unit is connected to its antenna.

Ensure that the WWV/GPS unit is powered up.

Exchange the existing cable for a known good cable or exchange the WWV/GPS unit for a known good WWV/GPS unit.

- 4** - Bad/Unrecognized Data: The first byte received for the Time update was **not** the ASCII "space" character (020h). The WWV/GPS unit could be malfunctioning or the Comm port's Baud Rate and/or Parity do not match the WWV/GPS unit's Baud Rate and/or Parity.

Ensure that the WWV/GPS Comm port's Baud Rate and/or Parity match the WWV/GPS unit's Baud Rate and/or Parity.

5 - Not used

6 - Not used

- 7** - No Port Configured: None of the four Comm ports is set to "001" (WWV/GPS).

Ensure that the desired Comm port is set to "001".

- 8** - Cable Disconnected: The WWV/GPS cable is not connected to the desired Comm port, or the cable is defective or improperly wired.

Ensure that a properly wired cable is connected between the desired Comm port and a WWV/GPS unit.

Exchange the existing cable with a known good cable.

H6. PEER TO PEER

Peer to Peer communication is any communication between controllers. LACO-4E provides the following Peer to Peer options.

For LACO-4E to LACO-4E controller

- Send Time and Date using AB3418E protocol
- Send Time and Date using L.A. County proprietary protocol
- Send Coordination Plan information

For LACO-4E to LACO-1R and LACO-3 controller

- Send Time and Date using AB3418E protocol
- Send Time and Date using L.A. County proprietary protocol

For LACO-4E to any AB3418E compliant controller (170, NEMA or 2070/ATC)

- Send Time and Date using AB3418E protocol

Send Time and Date using AB3418E protocol

For proper peer to peer communications to occur, several things need to be in place:

- The desired Comm port of the LACO-4E Master must be set to "007" (AB3418E Master).
- The desired Comm port's Baud Rate and Parity must be set to match the Baud Rate and Parity of the AB3418E Slave(s).
- A properly configured modem must be connected to the desired Comm port.

Is the 170E Master Controller transmitting the *SetTime* message?

This applies to any peer to peer combination where the LACO-4E controller is acting as the AB3418E Master.

- Access memory location 16E0 (AB3418E Master Transmit Data Buffer)
- Observe that call lights 2 through 6 are illuminated
- Press the "0" key and observe that all call lights extinguish
- Send a message from Central and observe that call lights 2 through 6 illuminate

If the above sequence occurs, then the **transmit** side of the communications path up to and including the LACO-4E firmware has been validated.

Is the 170E Slave Controller receiving the *SetTime* message?

This applies to any peer to peer combination where the LACO-4E controller is acting as the AB3418E Slave.

- Access memory location 1400 (AB3418E Slave Receive Data Buffer)
- Observe that call lights 2 through 6 are illuminated
- Press the "0" key and observe that all call lights extinguish
- Send a message from Central and observe that call lights 2 through 6 illuminate

If the above sequence occurs, then the **receive** side of the communications path up to and including the LACO-4E firmware has been validated.

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Send Time and Date using LACO-xx Proprietary Protocol

For proper peer to peer communication to take place, several things need to be in place:

- The desired Comm port of the LACO-4E controller must be set to "004" (Transmit Time/Date).
- The desired Comm port's Baud Rate and Parity must match that of the receiving controller
- A properly configured modem must be connected to the desired Comm port.

Receive Time and Date using LACO-xx Proprietary Protocol

For proper peer to peer communication to take place, several things need to be in place:

- The desired Comm port of the LACO-4E controller must be set to "005" (Receive Time/Date).
- The desired Comm port's Baud Rate and Parity must match that of the transmitting controller
- A properly configured modem must be connected to the desired Comm port.

Send 7-Wire data using LACO-xx Proprietary Protocol

For proper peer to peer communication to take place, several things need to be in place:

- The desired Comm port of the LACO-4E controller must be set to "002" (Transmit 7-Wire).
- The desired Comm port's Baud Rate and Parity must match that of the receiving controller
- A properly configured modem must be connected to the desired Comm port.

Receive 7-Wire data using LACO-xx Proprietary Protocol

For proper peer to peer communication to take place, several things need to be in place:

- The desired Comm port of the LACO-4E controller must be set to "003" (Receive 7-Wire).
- The desired Comm port's Baud Rate and Parity must match that of the transmitting controller
- A properly configured modem must be connected to the desired Comm port.

H7. FIRMWARE ENVIRONMENT

Signals

Phase Calls

Source – Sometimes a phase will call unexpectedly and tracking down the source of such a call can be challenging. Phase calls can originate from any of a number of sources in LACO-4E. They generally fall into one of three categories:

1. Field Initiated – A call is initiated for one or more phases associated with a field device.
 - Vehicle Detector
 - Ped Pushbutton
 - Railroad Preemption (Track Clearance phases and/or Exit phases)
 - Emergency Vehicle Preemption (EV Clearance phases)
2. Configuration Initiated – A call is initiated as a result of Phase Timing Configuration
 - Minimum Vehicle Recall (location 1F3)
 - Maximum Vehicle Recall (location 1F4)
 - Rest In Green (location 1F5)
 - Barrier Recall (location 1F7)
 - Double Entry (location 1F8)
 - Ped Recall (location 1E8)
 - STA Mode (location 1E9)
 - Associated Phase Recall (locations 1D1 through 1D8)
 - Yellow Phases Called (location 1DA)
 - Manual Control operation (ManCon, location 309)
3. Coordination Initiated – A call is initiated as a result of Coordination Phase Attributes. Similar to Configuration Initiated but only occurs when running plans 1–9.
 - Minimum Vehicle Recall (location 7x1, where x = plan number)
 - Ped Recall (location 7x2, where x = plan number)
 - Maximum Vehicle Recall (location 7x3, where x = plan number)
 - Barrier Recall (location 7x4, where x = plan number)
 - Green Call-To (location 7x6, where x = plan number)
 - STA Mode (location 7x1C, where x = plan number)
4. LACO-4E Logic Initiated – A call remains with no apparent source.
 - Phase Maxed Out
 - Programmable Logic
 - Red Lock (location 1F1)
 - Red and Yellow Lock (location 1F2)
 - Restricted Phase Lock
 - Exclusive Phase Lock
 - Overlap Lock

LACO-4E offers several memory locations that give real time status of different call mechanisms.

Description	Location
Calls on detectors set for Red or Yellow lock	0AB (DetLok)
Locked calls to Restricted phases	0AC (ResLok)
Locked calls to Exclusive phases	0AD (XCLLok)
Locked calls due to termination of Overlap parent phase	0AE (OLock)
Current calls generated by Detector logic	07C (DCall)
Current Vehicle calls	07D (VCall)
Current Ped calls	07E (PCall)

Why is the Intersection in Flash?

The two categories of intersection flash and their types are:

1. Hardware (or cabinet) Flash
 - A malfunction in the cabinet and/or field environments has been sensed by the CMU
 - Someone has placed the cabinet in maintenance flash
 - Someone has placed the cabinet in police panel flash
2. Software Flash
 - Railroad Preemption
 - Coordination
 - BADA/BADE
 - Stuck All Red
 - Battery Backup System (future)

By observation of the signal heads, one can determine whether the intersection is in hardware or software flash. When the intersection is in software flash, the program sets all the even phases red and all the odd phases dark for ½ second, and then reverses that for the next ½ second and so on. When the intersection is in hardware flash, cabinet hardware sets two quadrants red and two quadrants dark for ½ second, and then reverses that for the next ½ second etc.

Observation of the CMU, the Flash/Normal switch and the Police Panel switch will provide the necessary information to diagnose a hardware flash condition.

Access FlsFlg (location 0B3) and observe the call lights to determine the reason for software flash:

1. Railroad Preempt Input Active At Startup (only if Railroad operation is configured)
2. Coordination Flash
3. Railroad Flash
4. Battery Backup System Flash (future)
5. unused
6. BADA Flash (disables WatchDog output which should also trigger hardware flash)
7. BADE Flash (disables WatchDog output which should also trigger hardware flash)
8. Stuck All Red

If the intersection is in software flash because of a “Stuck All Red” condition, the Front Panel LED display also flashes ON/OFF once per second.

Conflict Monitor Flash Fault Analysis

When an intersection is put into cabinet flash by the CMU, an intensive fault isolation feature is initiated by LACO-4E. As soon as LACO-4E senses a transition of the External Stop Time input (C1-82) from False to True, it copies crucial program data to 357 bytes of contiguous memory starting at location 6C00. This memory, in essence, captures the state of the intersection (from the program’s perspective) within 1 second of the event that triggered the CMU Flash condition. The following two pages show the memory map of this data using the mnemonic names of the copied memory locations.

This memory can be retrieved from Central with repeated *GetControllerTiming* messages, starting at address 6C00h, until all data has been uploaded. If the Central System has the capability, this data can be used to perform detailed fault analysis of the event that caused the CMU Flash. Alternatively, a technician can exchange the CPU module in the 170E Controller and return the CPU module with the copied data to the L.A. County Signal Shop for fault analysis.

The data retrieved using this procedure could prove invaluable during accident investigation or for litigation purposes.

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Trouble Shooting Buffer

	6C0	6C1	6C2	6C3	6C4	6C5	6C6	6C7	6C8	6C9	6CA	6CB	6CC	6CD	6CE	6CF	
0	ThsRng	Dynxcl	GFaze	In1	Out1	SysErr	SysFlg	RACurr	RBCurr	RAWTim	RBWTim	RAWalk	RBWalk	Delay		RRSel	0
1	OthRng	Dynrst	WFaze	In2	Out2	MeMErr	MemFlg	RANext	RBNext	RADTim	RBDTim	RADWlk	RBDWlk	Active		RR1Red	1
2	ThisSt	Barset	DWFaze	In3	Out3	MonErr	MonFlg	RALast	RBLast	RAHold	RBHold	RAMGrn	RBMGrn	EVClear		RRClr	2
3	OthrSt	Queact	YFaze	In4	Out4	PrtErr	FisFlg	RALead	RBLLead	RAOdd	RBOdd	RAQuLm	RBQuLm	Max		RRMax	3
4	RAMain	TmpDet	RFaze	In5	Out5	CrdErr	PrtFlg	RATerm	RBTerm	RASupp	RBSupp	RAInit	RBInit	Link		RRLnk	4
5	RBMMain	LLAMsk	FazIn	In6	Out6	WWVErr	CrdFlg	RAColr	RBColr	RAExt	RBExt	RAVExt	RBVExt	EVClr		MrkTim	5
6	RASide	OlpClr	FazNxt	In7	Out7	RstVec	ClkFlg	RAFazd	RBFazD	RATBR	RBTBR	RATBRT	RBTBRT	RRClear		MrkTmr	6
7	RBSide	DynTrm	FazLst	In8	Out8	ErrFlg	DatFlg	RAIntD	RBIIntD	RAMGap	RBMGap	RACGap	RBCGap	BBSFlsh		RRMin	7
8	ThsQad	OIGFaz	OGFaze	In1L	Out9	DoorFlg	LetFlg	RALag	RBLag	RAMax	RBMax	RACMax	RBCMax	BBSRed		RRSec	8
9	XCIFlg	QHold	OYFaze	In2L	OutA	UARTXI	IntCnt	RAStop	RBStop	RAΦBuf	RBΦBuf	RASec	RBSec	ManCon		RRDly	9
A	RstFlg		ORFaze	In3L	Lead	“	StrtUp	RACntl	RBCntl	RAMadd	RBMadd	RACint	RBCint	OIALod	OIATmr	OADTmr	A
B	DynRRP		IRCall	In4L	CLiteo	DetLok	StrFlg	RATFlg	RBTFlg	RAGot	RBGot	RARRev	RBRRev	OIBLod	OIBTmr	OBDTmr	B
C	RXPTrm		DCall	In5L	Clite9	ResLok	PreFlg	RACall	RBCall	RAGrt	RBGr	RARRst	RBRrst	OICLod	OICTmr	OCDTmr	C
D	Ped		VCall	In6L	CalAct	XCILok	RngFlg	RALTrm	RBLTrm	RAStep	RBStep	RASpT	RBSpT	OIDLod	OIDTmr	ODDTmr	D
E	CalMsk	Force2	PCall	In7L	Callit	OLock	OlpFlg	RBFflag	RAFlag	RATemp	RBTemp	RAYClr	RBYClr	OIELod	OIETmr	OEDTmr	E
F	Allow	Advan	Call	In8L	Cntinu		QadFlg	RABrFz	RBBrFz	RALimt	RBLimt	RARClr	RBRClr	OIFLod	OIFTmr	OFDTmr	F
	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	

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Trouble Shooting Buffer (continued)

	6D0	6D1	6D2	6D3	6D4	6D5	6D6	6D7	6D8	6D9	6DA	6DB	6DC	6DD	6DE	6DF	
0	RRACnt	EVFlag	BBSFlag	DwnTim	RRTim	StpTim	PwrFlg										0
1	RRBCnt	EVAfFaz		↓	↓	↓	CoCall										1
2	EVACnt	EVBFaz	DynRRX	↓	↓	↓	PedRst										2
3	EVBCnt	EVCfFaz	RRCntI	↓	↓	↓	Hold										3
4	EVCCnt	EVDfFaz	RRStat	↓	↓	↓	Force1										4
5	EVDCnt	SavVeh	RRPre	↓	↓	↓											5
6	ManCnt		EVStat	UpTime	EVTime												6
7		EVPre	EVMax	↓	↓												7
8		EVAct	EntFlg	↓	↓												8
9		EVOIde	PreStat	↓	↓												9
A	OIARev	DynOIA	AGOmit	↓	↓												A
B	OIBRev	DynOIB	BGOmit	↓	↓												B
C	OICRev	DynOIC	CGOmit	DwnMin													C
D	OIDRev	DynOID	DGOmit	DwnSec													D
E	OIERev	DynOIE	EGOmit	NovRed													E
F	OIFRev	DynOIF	FGOmit	NovRit													F
	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	

H8. MISCELLANEOUS

RAILROAD INPUTS

Los Angeles County requires that railroad inputs be configured in a “fail safe” mode. This means that, when there is no train approaching, the wire pair coming from the railroad cabinet to the controller cabinet should always have 115 vac on it. The *absence* of 115 vac can result from normal operation of the railroad equipment or by damage to the railroad input field wires. This causes the LACO-4E program to initiate a railroad preempt sequence (assuming the intersection timing is configured for railroad preempt).

The cabinet input file normally treats the presence of voltage as a TRUE input. To accommodate the “inverted” logic of the railroad input, a special 252 AC Isolator with inverted inputs is used. This allows the input file to correctly detect a railroad input when no voltage is present and, in turn, conditions this input correctly at the 170E Controller C1 connector.

In a lab environment, typically a suitcase or other type tester is used in place of an actual controller cabinet. This means that the railroad inputs at the C1 connector in effect, behave **opposite** to the way they would in an intersection environment. In other words, for the LACO-4E to initiate a railroad sequence (again, assuming the intersection timing is configured for railroad preempt), the appropriate railroad input switch on the tester must be set to the OFF position. Also, to achieve normal operation (i.e. **no** railroad inputs active), both railroad input switches should remain in the ON position.

COMMUNICATIONS TESTING

Communications testing in a lab environment often involves a direct connection between a PC’s serial port and the 170E Controller’s comm port. The only thing to remember in this situation is that one use a “Null modem” to connect the two. All this really means is that the “receive pin” from one device needs to connect to the “transmit pin” on the other device.

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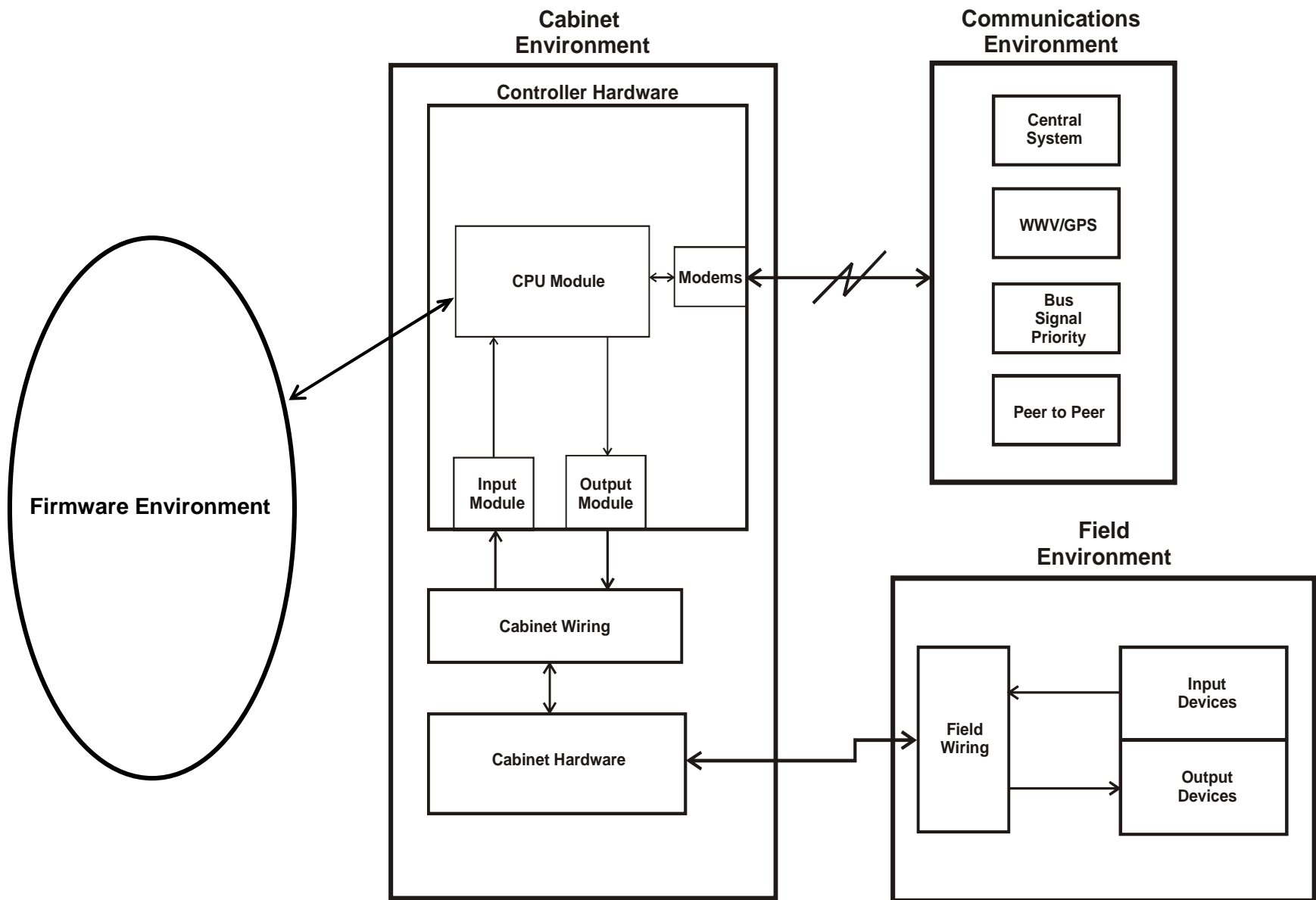


Figure H-1 LACO- 4E Environments

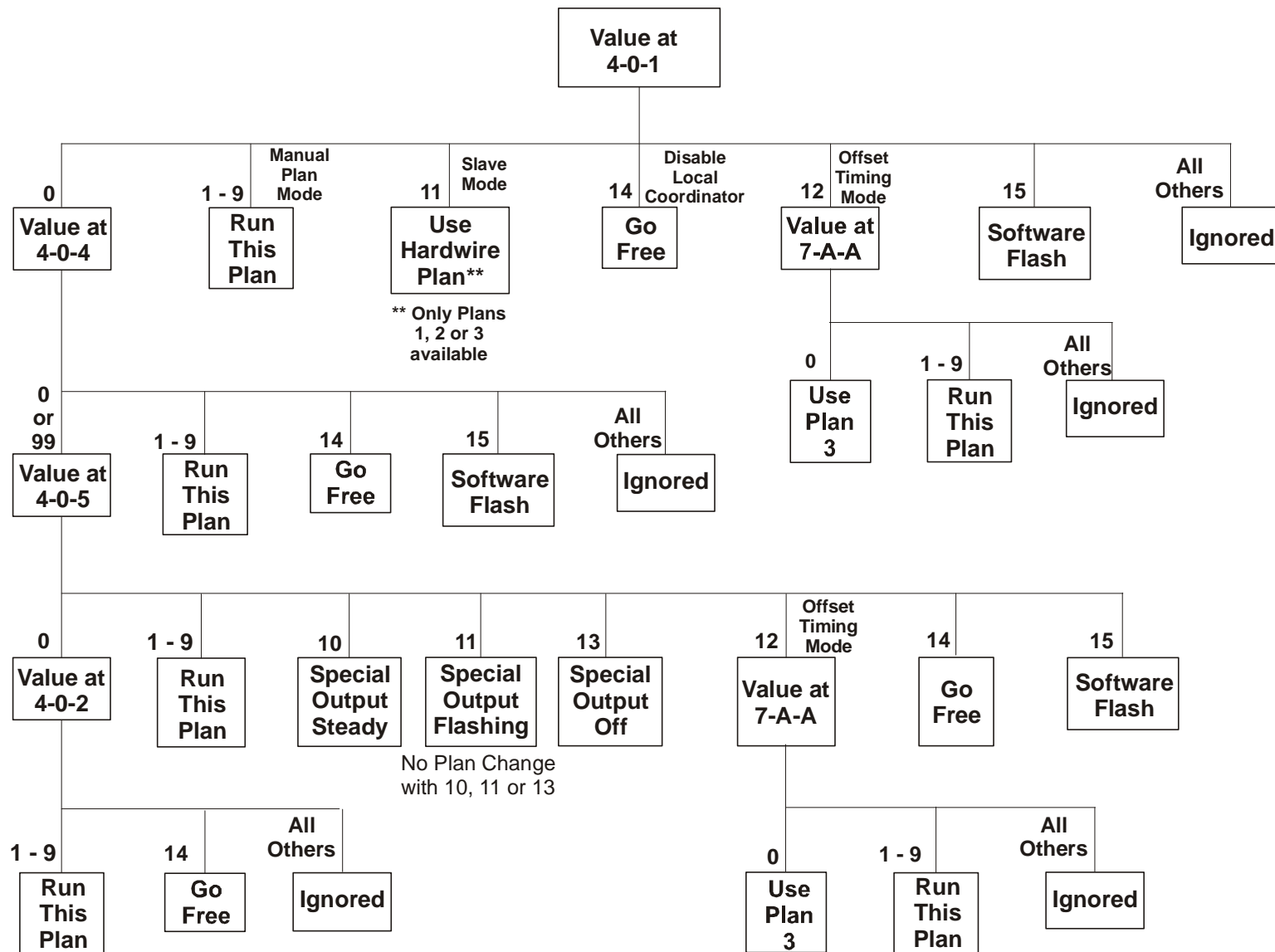


Figure H-2 Local Coordinator Plan Selection Hierarchy

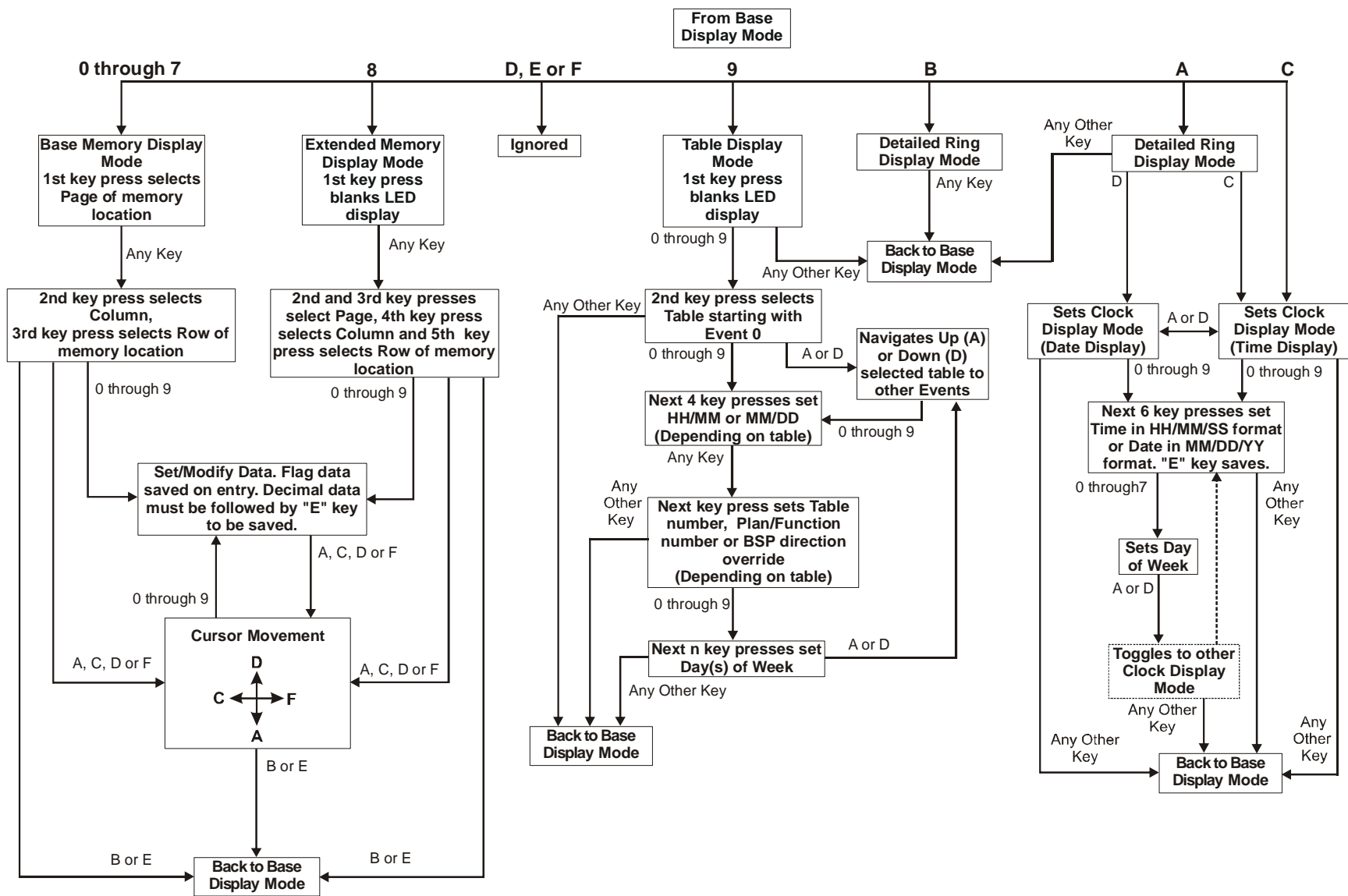


Figure H-3 LACO- 4E Key Press Map

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ATTACHMENT A.2 – ACCEPTANCE CERTIFICATE

(Name and Address)		TRANSMITTAL DATE
ACCEPTANCE CERTIFICATE		CONTRACT NUMBER
		TITLE
FROM: <div style="border-bottom: 1px solid black; width: 100%; margin-top: 5px;"></div> Contractor's Project Director (Signature Required)	TO: Amir Ibrahim County's Project Director Department of Public Works	
Contractor hereby certifies to County that as of the date of this Task/Deliverable Acceptance Certificate, it has satisfied all conditions precedent in the Agreement, including the Exhibits thereto to the completion of the Tasks and delivery of the Deliverables set forth below, including satisfaction of the completion criteria applicable to such Tasks and Deliverables for County's approval of the Work performed in connection with the achievement of such Task. Contractor further represents and warrants that the Work performed in respect of such Tasks and Deliverables has been completed in accordance with the Exhibit A (Statement of Work). County's approval and signature constitutes an acceptance of the Tasks and Deliverables listed below.		
<div style="text-align: center;">TASK DESCRIPTION</div> (including Task and subtask numbers as set forth in the Statement of Work)	<div style="text-align: center;">DELIVERABLES</div> (including Deliverable numbers as set forth in the Statement of Work)	
Contractor's Peer Review: The below named person certifies all changes made to the Source Code were for the sole purpose of performing the repair or enhancement as requested by Public Works		
DATE AND TIME PEER REVIEW WAS COMPLETED _____		
BY _____ SIGNATURE _____		
Comments: <div style="height: 40px; border: 1px solid black;"></div>		
Attached hereto is a copy of all supporting documentation required pursuant to the Agreement and Exhibit A (Statement of Work), including any additional documentation reasonably requested by County.		
County Acceptance: <div style="display: flex; justify-content: space-between; margin-top: 10px;"> NAME _____ SIGNATURE _____ DATE _____ </div> <div style="margin-top: 5px;">County's Project Director</div>		

Distribution:

Original – Financial Services

Copy 1 - Contractor

Copy 2 - County's Project Director

Copy 3 - DPW Master Contract File

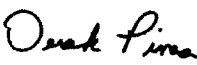
PAYMENT SCHEDULE

Task	Description	Deliverables	Payment Type
1	Project Management	1.1 Minutes for meetings 1.2 Monthly Progress Reports	Time and Materials once all deliverables are reviewed and accepted by DPW
2	Troubleshooting, Repairs, and Enhancements	2.1 Repaired LACO-4E program including Source Code Documentation 2.2 Enhanced LACO-4E Software including Source Code Documentation	Time and Materials 50% paid upon DPW acceptance of the updated LACO-4E program and Source Code Documentation 50% paid as follows: 30% when LACO-4E has performed error free for a period of thirty (30) consecutive days, and 20% when LACO-4E has performed error free for a period of ninety (90) consecutive days.

**SCHEDULE OF PRICES FOR
LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE DEVELOPMENT AND SUPPORT (BRC0000120)**

The undersigned Proposer offers to perform the work described in the Request for Proposals (RFP) for the following price(s). The Proposer rate(s) (hourly, monthly, etc.) shall include all administrative costs, labor, supervision, overtime, materials, transportation, taxes, equipment, and supplies unless stated otherwise in the RFP. It is understood and agreed that where quantities, if any, are set forth in the Schedule of Prices, they are only estimates, and the unit prices quoted, if any, will apply to the actual quantities, whatever they may be.

TASK	DESCRIPTION	ESTIMATED NUMBER OF HOURS	HOURLY RATE	PROPOSED PRICE (ESTIMATED NUMBER OF HRS X HOURLY RATE)
1	Project Management 1.1 Minutes for meetings 1.2 Monthly Progress Reports	120	\$ 248.88 per hour	\$ 29,865.60
2	Troubleshooting, Repairs, and Enhancements 2.1 Repaired LACO-4E program including Source Code Documentation 2.2 Enhanced LACO-4E program including Source Code Documentation	1,200	\$ 140.46 per hour	\$ 168,552.00
ESTIMATED TOTAL HOURS		1,320		
TOTAL PROPOSED PRICE (Tasks 1 - 2)				\$ 198,417.60

LEGAL NAME OF PROPOSER Parsons Transportation Group		
SIGNATURE OF PERSON AUTHORIZED TO SUBMIT PROPOSAL 		
TITLE OF AUTHORIZED PERSON VICE PRESIDENT		
DATE AUGUST 21, 2020	STATE CONTRACTOR'S LICENSE NUMBER 510924	LICENSE TYPE GENERAL ENGINEERING/GENERAL BUILDING
PROPOSER'S ADDRESS: 1 CENTERPOINTE DRIVE, SUITE 210, LA PALMA, CA 90623		
PHONE 714-562-5725	FAX 714-562-5728	E-MAIL DEREK.PINES@PARSONS.COM

PROPOSER'S EQUAL EMPLOYMENT OPPORTUNITY CERTIFICATION

Proposer's Name
Address
Internal Revenue Service Employer Identification Number

In accordance with Los Angeles County Code, Section 4.32.010, the Proposer certifies and agrees that all persons employed by it, its affiliates, subsidiaries, or holding companies are and will be treated equally by the firm without regard to or because of race, religion, ancestry, national origin, or sex and in compliance with all antidiscrimination laws of the United States of America and the State of California.

1.	The proposer has a written policy statement prohibiting any discrimination in all phases of employment.	<input type="checkbox"/> YES <input type="checkbox"/> NO
2.	The proposer periodically conducts a self-analysis or utilization analysis of its work force.	<input type="checkbox"/> YES <input type="checkbox"/> NO
3.	The proposer has a system for determining if its employment practices are discriminatory against protected groups.	<input type="checkbox"/> YES <input type="checkbox"/> NO
4.	Where problem areas are identified in employment practices, the proposer has a system for taking reasonable corrective action to include establishment of goals and timetables.	<input type="checkbox"/> YES <input type="checkbox"/> NO

Proposer	
Authorized representative	
Signature	Date

ADMINISITRATION OF AGREEMENT

COUNTY'S ADMINISTRATION

CONTRACT NO. _____

COUNTY PROJECT DIRECTOR:

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

COUNTY PROJECT MANAGER:

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

COUNTY CONTRACT PROJECT MONITOR:

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

CONTRACTOR'S ADMINISTRATION**CONTRACTOR'S NAME:** _____**CONTRACT NO:** _____**CONTRACTOR'S PROJECT MANAGER:** _____

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

CONTRACTOR'S AUTHORIZED OFFICIAL(S)

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

Notices to Contractor shall be sent to the following:

Name: _____

Title: _____

Address: _____

Telephone: _____ Facsimile: _____

E-Mail Address: _____

PERFORMANCE REQUIREMENTS SUMMARY

The items listed under this Performance Requirements Summary (PRS) are not all encompassing, and any conflict or discrepancy between the requirements specified in Exhibits A through N, inclusive, of this Contract (Exhibits A-N) and this PRS, Exhibits A-N shall control. The County reserves the right to modify this PRS at any time consistent with the requirements set forth in Exhibits A-N, to clarify Performance Requirements, or to monitor of any part of this Contract.

Required Service/Tasks	Performance Indicator	Deductions / Consequences for Failure to Meet Performance Indicator*	Compliance	Comments
			<input type="checkbox"/> N/A	
D. SUPERVISOR/MANAGERS				
1. Change in Project Manager	Contractor shall notify the County in writing of any change in name or address of the Project Manager.	\$50 per occurrence.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
2. Respond to complaints, requests, and discrepancies.	Respond within the time frame outlined in the Contract.	\$50 per complaint not responded to within the time frame outlined in the specifications.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
3. Makes Site Inspections	Facility inspected each shift or as required by Contract.	\$50 per occurrence.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
4. Competent Supervisory Staff	Responsiveness to complaints and requests; maintain good work records, and acceptable level of service.	\$50 per day; possible suspension.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
5. Provide Adequate Supervision and Training	Contract specifications met.	\$50 per occurrence; possible suspension.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

*Deductions may be imposed in addition to the Liquidated Damages at the sole discretion of the Contract Manager.

PERFORMANCE REQUIREMENTS SUMMARY

The items listed under this Performance Requirements Summary (PRS) are not all encompassing, and any conflict or discrepancy between the requirements specified in Exhibits A through N, inclusive, of this Contract (Exhibits A-N) and this PRS, Exhibits A-N shall control. The County reserves the right to modify this PRS at any time consistent with the requirements set forth in Exhibits A-N, to clarify Performance Requirements, or to monitor of any part of this Contract.

Required Service/Tasks	Performance Indicator	Deductions / Consequences for Failure to Meet Performance Indicator*	Compliance	Comments
6. Project Safety Official	Project Safety Official who shall be thoroughly familiar with the Contractor's Injury and Illness Prevention Program and Code of Safe Practices.	\$200 per occurrence.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
E. CONTRACT ADMINISTRATION				
1. Insurance Certifications	Certifications submitted before implementation of contract and on a timely basis there-after.	\$100 per day; work/contract; possible suspension; possible termination for default of contract.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
2. Record Retention & Inspection/Audit Settlement	Maintain all required documents as specified in contract.	\$200 per occurrence.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
3. Use of Subcontractor without Approval and/or Authorization.	Obtain County's written approval prior to subcontracting any work.	\$500 per occurrence; possible suspension; possible termination for default of contract.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
4. License and Certification	All license and certifications required to perform the work, if any.	\$100 per day; possible suspension; possible termination for default of contract.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
5. Assignment and Delegation	Contractor shall not assign its rights or delegate its duties under this Contract, or both, whether in whole or in part, without the prior written consent of County.	\$200 per day the County is not informed of this change; possible suspension; possible termination for default of contract.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

*Deductions may be imposed in addition to the Liquidated Damages at the sole discretion of the Contract Manager.

PERFORMANCE REQUIREMENTS SUMMARY

The items listed under this Performance Requirements Summary (PRS) are not all encompassing, and any conflict or discrepancy between the requirements specified in Exhibits A through N, inclusive, of this Contract (Exhibits A-N) and this PRS, Exhibits A-N shall control. The County reserves the right to modify this PRS at any time consistent with the requirements set forth in Exhibits A-N, to clarify Performance Requirements, or to monitor of any part of this Contract.

Required Service/Tasks	Performance Indicator	Deductions / Consequences for Failure to Meet Performance Indicator*	Compliance	Comments
6. Safety Requirements	Comply with all applicable State of California Occupational Safety and Health Administration (Cal/OSHA).	\$500 per occurrence; possible suspension.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	

*Deductions may be imposed in addition to the Liquidated Damages at the sole discretion of the Contract Manager.

CONTRACTOR ACKNOWLEDGEMENT, CONFIDENTIALITY, AND COPYRIGHT ASSIGNMENT AGREEMENT

Page 1 of 2

(Note: This certification is to be executed and returned to County with Contractor's executed Contract. Work cannot begin on the Contract until County receives this executed document.)

CONTRACTOR NAME _____ Contract No. _____

GENERAL INFORMATION:

The Contractor referenced above has entered into a contract with the County of Los Angeles to provide certain services to the County. The County requires the Corporation to sign this Contractor Acknowledgement, Confidentiality, and Copyright Assignment Agreement.

CONTRACTOR ACKNOWLEDGEMENT:

Contractor understands and agrees that the Contractor employees, consultants, Outsourced Vendors and independent contractors (Contractor's Staff) that will provide services in the above referenced agreement are Contractor's sole responsibility. Contractor understands and agrees that Contractor's Staff must rely exclusively upon Contractor for payment of salary and any and all other benefits payable by virtue of Contractor's Staff's performance of work under the above-referenced contract.

Contractor understands and agrees that Contractor's Staff are not employees of the County of Los Angeles for any purpose whatsoever and that Contractor's Staff do not have and will not acquire any rights or benefits of any kind from the County of Los Angeles by virtue of my performance of work under the above-referenced contract. Contractor understands and agrees that Contractor's Staff will not acquire any rights or benefits from the County of Los Angeles pursuant to any agreement between any person or entity and the County of Los Angeles.

CONFIDENTIALITY AGREEMENT:

Contractor and Contractor's Staff may be involved with work pertaining to services provided by the County of Los Angeles and, if so, Contractor and Contractor's Staff may have access to confidential data and information pertaining to persons and/or entities receiving services from the County. In addition, Contractor and Contractor's Staff may also have access to proprietary information supplied by other vendors doing business with the County of Los Angeles. The County has a legal obligation to protect all such confidential data and information in its possession, especially data and information concerning health, criminal, and welfare recipient records. Contractor and Contractor's Staff understand that if they are involved in County work, the County must ensure that Contractor and Contractor's Staff, will protect the confidentiality of such data and information. Consequently, Contractor must sign this Confidentiality Agreement as a condition of work to be provided by Contractor's Staff for the County.

Contractor and Contractor's Staff hereby agrees that they will not divulge to any unauthorized person any data or information obtained while performing work pursuant to the above-referenced contract between Contractor and the County of Los Angeles. Contractor and Contractor's Staff agree to forward all requests for the release of any data or information received to County's Project Manager.

Contractor and Contractor's Staff agree to keep confidential all health, criminal, and welfare recipient records and all data and information pertaining to persons and/or entities receiving services from the County, design concepts, algorithms, programs, formats, documentation, Contractor proprietary information and all other

CONTRACTOR ACKNOWLEDGEMENT, CONFIDENTIALITY, AND COPYRIGHT ASSIGNMENT AGREEMENT

Page 2 of 2

original materials produced, created, or provided to Contractor and Contractor's Staff under the above-referenced contract. Contractor and Contractor's Staff agree to protect these confidential materials against disclosure to other than Contractor or County employees who have a need to know the information. Contractor and Contractor's Staff agree that if proprietary information supplied by other County vendors is provided to me during this employment, Contractor and Contractor's Staff shall keep such information confidential.

Contractor and Contractor's Staff agree to report any and all violations of this agreement by Contractor and Contractor's Staff and/or by any other person of whom Contractor and Contractor's Staff become aware.

Contractor and Contractor's Staff acknowledge that violation of this agreement may subject Contractor and Contractor's Staff to civil and/or criminal action and that the County of Los Angeles may seek all possible legal redress.

COPYRIGHT ASSIGNMENT AGREEMENT

Contractor and Contractor's Staff agree that all materials, documents, software programs and documentation, written designs, plans, diagrams, reports, software development tools and aids, diagnostic aids, computer processable media, source codes, object codes, conversion aids, training documentation and aids, and other information and/or tools of all types, developed or acquired by Contractor and Contractor's Staff in whole or in part pursuant to the above referenced contract, and all works based thereon, incorporated therein, or derived therefrom shall be the sole property of the County. In this connection, Contractor and Contractor's Staff hereby assign and transfer to the County in perpetuity for all purposes all my right, title, and interest in and to all such items, including, but not limited to, all unrestricted and exclusive copyrights, patent rights, trade secret rights, and all renewals and extensions thereof. Whenever requested by the County, Contractor and Contractor's Staff agree to promptly execute and deliver to County all papers, instruments, and other documents requested by the County, and to promptly perform all other acts requested by the County to carry out the terms of this agreement, including, but not limited to, executing an assignment and transfer of copyright in a form substantially similar to Exhibit M1, attached hereto and incorporated herein by reference.

The County shall have the right to register all copyrights in the name of the County of Los Angeles and shall have the right to assign, license, or otherwise transfer any and all of the County's right, title, and interest, including, but not limited to, copyrights, in and to the items described above.

Contractor and Contractor's Staff acknowledge that violation of this agreement may subject them to civil and/or criminal action and that the County of Los Angeles may seek all possible legal redress.

SIGNATURE: _____

DATE: ____/____/____

PRINTED NAME: _____

POSITION: _____

Title 2 ADMINISTRATION
Chapter 2.203.010 through 2.203.090
CONTRACTOR EMPLOYEE JURY SERVICE

2.203.010 Findings.

The board of supervisors makes the following findings. The county of Los Angeles allows its permanent, full-time employees unlimited jury service at their regular pay. Unfortunately, many businesses do not offer or are reducing or even eliminating compensation to employees who serve on juries. This creates a potential financial hardship for employees who do not receive their pay when called to jury service, and those employees often seek to be excused from having to serve. Although changes in the court rules make it more difficult to excuse a potential juror on grounds of financial hardship, potential jurors continue to be excused on this basis, especially from longer trials. This reduces the number of potential jurors and increases the burden on those employers, such as the county of Los Angeles, who pay their permanent, full-time employees while on juror duty. For these reasons, the county of Los Angeles has determined that it is appropriate to require that the businesses with which the county contracts possess reasonable jury service policies. (Ord. 2002-0015 § 1 (part), 2002)

2.203.020 Definitions.

The following definitions shall be applicable to this chapter:

- A. "Contractor" means a person, partnership, corporation or other entity which has a contract with the county or a subcontract with a county contractor and has received or will receive an aggregate sum of \$50,000 or more in any 12-month period under one or more such contracts or subcontracts.
- B. "Employee" means any California resident who is a full-time employee of a contractor under the laws of California.
- C. "Contract" means any agreement to provide goods to, or perform services for or on behalf of, the county but does not include:
 - 1. A contract where the board finds that special circumstances exist that justify a waiver of the requirements of this chapter; or
 - 2. A contract where federal or state law or a condition of a federal or state program mandates the use of a particular contractor; or
 - 3. A purchase made through a state or federal contract; or
 - 4. A monopoly purchase that is exclusive and proprietary to a specific manufacturer, distributor, or reseller, and must match and inter-member with existing supplies, equipment or systems maintained by the county pursuant to the Los Angeles County Purchasing Policy and Procedures Manual, Section P-3700 or a successor provision; or
 - 5. A revolving fund (petty cash) purchase pursuant to the Los Angeles County Fiscal Manual, Section 4.4.0 or a successor provision; or
 - 6. A purchase card purchase pursuant to the Los Angeles County Purchasing Policy and Procedures Manual, Section P-2810 or a successor provision; or
 - 7. A non-agreement purchase with a value of less than \$5,000 pursuant to the Los Angeles County Purchasing Policy and Procedures Manual, Section A-0300 or a successor provision; or
 - 8. A bona fide emergency purchase pursuant to the Los Angeles County Purchasing Policy and Procedures Manual, Section PP-1100 or a successor provision.

**Title 2 ADMINISTRATION
Chapter 2.203.010 through 2.203.090
CONTRACTOR EMPLOYEE JURY SERVICE**

- D. "Full time" means 40 hours or more worked per week, or a lesser number of hours if:
1. The lesser number is a recognized industry standard as determined by the chief administrative officer, or
 2. The contractor has a long-standing practice that defines the lesser number of hours as full time.
- E. "County" means the county of Los Angeles or any public entities for which the board of supervisors is the governing body. (Ord. 2002-0040 § 1, 2002: Ord. 2002-0015 § 1 (part), 2002)

2.203.030 Applicability.

This chapter shall apply to contractors who enter into contracts that commence after July 11, 2002. This chapter shall also apply to contractors with existing contracts which are extended into option years that commence after July 11, 2002. Contracts that commence after May 28, 2002, but before July 11, 2002, shall be subject to the provisions of this chapter only if the solicitations for such contracts stated that the chapter would be applicable. (Ord. 2002-0040 § 2, 2002: Ord. 2002-0015 § 1 (part), 2002)

2.203.040 Contractor Jury Service Policy.

A contractor shall have and adhere to a written policy that provides that its employees shall receive from the contractor, on an annual basis, no less than five days of regular pay for actual jury service. The policy may provide that employees deposit any fees received for such jury service with the contractor or that the contractor deduct from the employees' regular pay the fees received for jury service. (Ord. 2002-0015 § 1 (part), 2002)

2.203.050 Other Provisions.

- A. Administration. The chief administrative officer shall be responsible for the administration of this chapter. The chief administrative officer may, with the advice of county counsel, issue interpretations of the provisions of this chapter and shall issue written instructions on the implementation and ongoing administration of this chapter. Such instructions may provide for the delegation of functions to other county departments.
- B. Compliance Certification. At the time of seeking a contract, a contractor shall certify to the county that it has and adheres to a policy consistent with this chapter or will have and adhere to such a policy prior to award of the contract. (Ord. 2002-0015 § 1 (part), 2002)

2.203.060 Enforcement and Remedies.

For a contractor's violation of any provision of this chapter, the county department head responsible for administering the contract may do one or more of the following:

1. Recommend to the board of supervisors the termination of the contract; and/or,
2. Pursuant to chapter 2.202, seek the debarment of the contractor. (Ord. 2002-0015 § 1 (part), 2002)

Title 2 ADMINISTRATION
Chapter 2.203.010 through 2.203.090
CONTRACTOR EMPLOYEE JURY SERVICE

2.203.070. Exceptions.

- A. Other Laws. This chapter shall not be interpreted or applied to any contractor or to any employee in a manner inconsistent with the laws of the United States or California.
- B. Collective Bargaining Agreements. This chapter shall be superseded by a collective bargaining agreement that expressly so provides.
- C. Small Business. This chapter shall not be applied to any contractor that meets all of the following:
 - 1. Has ten or fewer employees during the contract period; and,
 - 2. Has annual gross revenues in the preceding twelve months which, if added to the annual amount of the contract awarded, are less than \$500,000; and,
 - 3. Is not an affiliate or subsidiary of a business dominant in its field of operation.

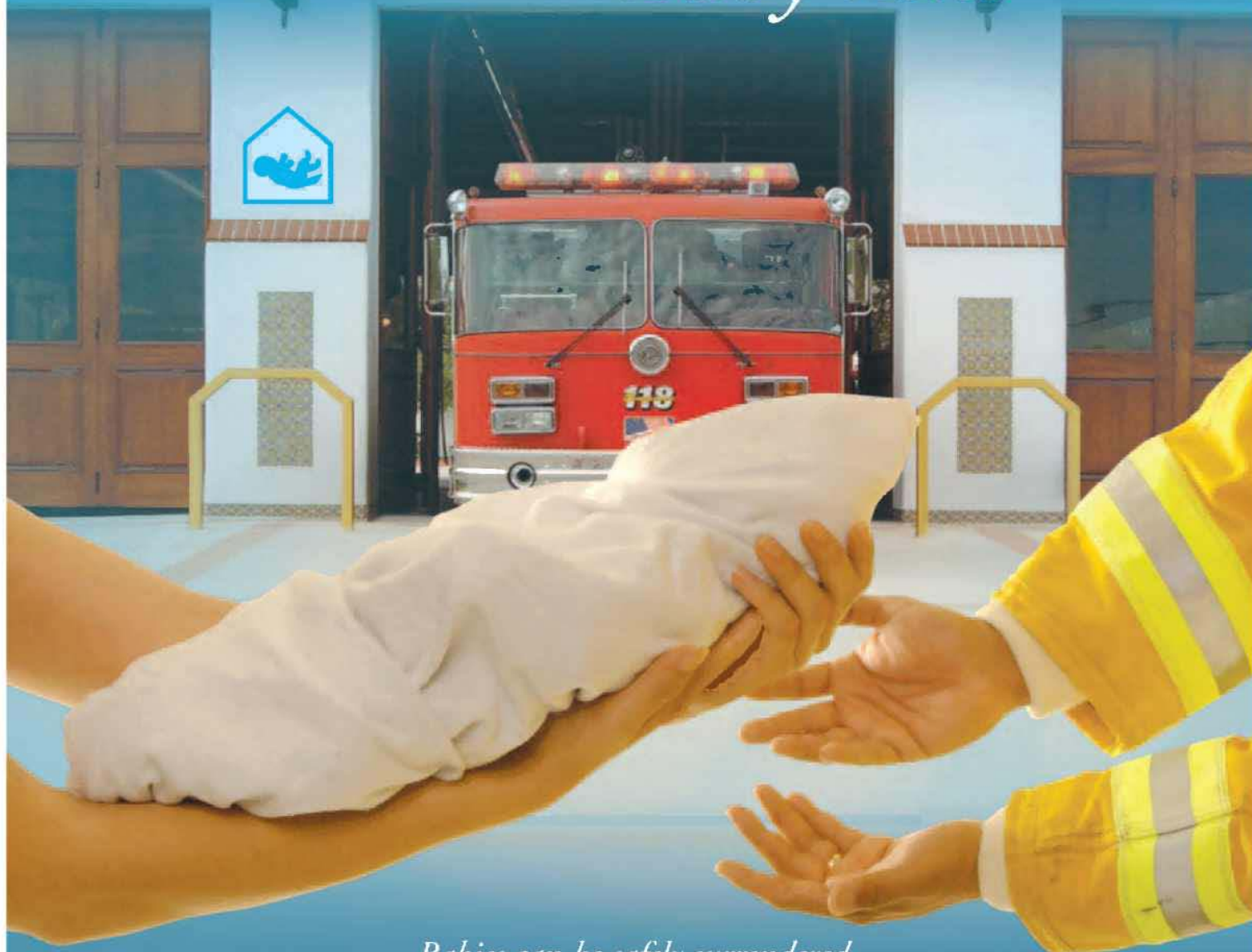
"Dominant in its field of operation" means having more than ten employees and annual gross revenues in the preceding twelve months which, if added to the annual amount of the contract awarded, exceed \$500,000.

"Affiliate or subsidiary of a business dominant in its field of operation" means a business which is at least 20 percent owned by a business dominant in its field of operation, or by partners, officers, directors, majority stockholders, or their equivalent, of a business dominant in that field of operation. (Ord. 2002-0015 § 1 (part), 2002)

2.203.090. Severability.

If any provision of this chapter is found invalid by a court of competent jurisdiction, the remaining provisions shall remain in full force and effect. (Ord. 2002-0015 § 1 (part), 2002)

Safely Surrendered *Baby Law*



*Babies can be safely surrendered
to staff at any hospital or fire station in Los Angeles County*

No shame. No blame. No names.

In Los Angeles County: 1-877-BABY SAFE • 1-877-222-9723

www.babysafela.org



Safely Surrendered Baby Law

What is the Safely Surrendered Baby Law?

California's Safely Surrendered Baby Law allows parents or other persons, with lawful custody, which means anyone to whom the parent has given permission to confidentially surrender a baby. As long as the baby is three days (72 hours) of age or younger and has not been abused or neglected, the baby may be surrendered without fear of arrest or prosecution.

Every baby deserves a chance for a healthy life. If someone you know is considering abandoning a baby, let her know there are other options. For three days (72 hours) after birth, a baby can be surrendered to staff at any hospital or fire station in Los Angeles County.

How does it work?

A distressed parent who is unable or unwilling to care for a baby can legally, confidentially, and safely surrender a baby within three days (72 hours) of birth. The baby must be handed to an employee at a hospital or fire station in Los Angeles County. As long as the baby shows no sign of abuse or neglect, no name or other information is required. In case the parent changes his or her mind at a later date and wants the baby back, staff will use bracelets to help connect them to each other. One bracelet will be placed on the baby, and a matching bracelet will be given to the parent or other surrendering adult.

What if a parent wants the baby back?

Parents who change their minds can begin the process of reclaiming their baby within 14 days. These parents should call the Los Angeles County Department of Children and Family Services at 1-800-540-4000.

Can only a parent bring in the baby?

No. While in most cases a parent will bring in the baby, the Law allows other people to bring in the baby if they have lawful custody.

Does the parent or surrendering adult have to call before bringing in the baby?

No. A parent or surrendering adult can bring in a baby anytime, 24 hours a day, 7 days a week, as long as the parent or surrendering adult surrenders the baby to someone who works at the hospital or fire station.

Does the parent or surrendering adult have to tell anything to the people taking the baby?

No. However, hospital or fire station personnel will ask the surrendering party to fill out a questionnaire designed to gather important medical history information, which is very useful in caring for the baby. The questionnaire includes a stamped return envelope and can be sent in at a later time.

What happens to the baby?

The baby will be examined and given medical treatment. Upon release from the hospital, social workers immediately place the baby in a safe and loving home and begin the adoption process.

What happens to the parent or surrendering adult?

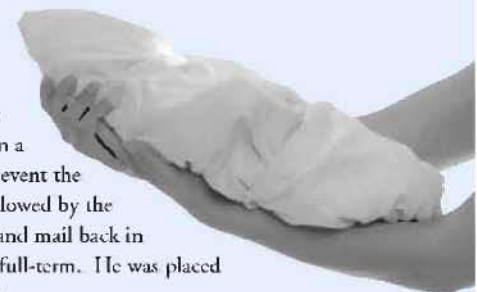
Once the parent or surrendering adult surrenders the baby to hospital or fire station personnel, they may leave at any time.

Why is California doing this?

The purpose of the Safely Surrendered Baby Law is to protect babies from being abandoned, hurt or killed by their parents. You may have heard tragic stories of babies left in dumpsters or public bathrooms. Their parents may have been under severe emotional distress. The mothers may have hidden their pregnancies, fearful of what would happen if their families found out. Because they were afraid and had no one or nowhere to turn for help, they abandoned their babies. Abandoning a baby is illegal and places the baby in extreme danger. Too often, it results in the baby's death. The Safely Surrendered Baby Law prevents this tragedy from ever happening again in California.

A baby's story

Early in the morning on April 9, 2005, a healthy baby boy was safely surrendered to nurses at Harbor-UCLA Medical Center. The woman who brought the baby to the hospital identified herself as the baby's aunt and stated the baby's mother had asked her to bring the baby to the hospital on her behalf. The aunt was given a bracelet with a number matching the anklet placed on the baby; this would provide some identification in the event the mother changed her mind about surrendering the baby and wished to reclaim the baby in the 14-day period allowed by the Law. The aunt was also provided with a medical questionnaire and said she would have the mother complete and mail back in the stamped return envelope provided. The baby was examined by medical staff and pronounced healthy and full-term. He was placed with a loving family that had been approved to adopt him by the Department of Children and Family Services.



Ley de Entrega de Bebés *Sin Peligro*



Los recién nacidos pueden ser entregados en forma segura al personal de cualquier hospital o cuartel de bomberos del Condado de Los Ángeles

Sin pena. Sin culpa. Sin nombres.

En el Condado de Los Ángeles: 1-877-BABY SAFE • 1-877-222-9723

www.babysafela.org



Ley de Entrega de Bebés Sin Peligro

¿Qué es la Ley de Entrega de Bebés sin Peligro?

La Ley de Entrega de Bebés sin Peligro de California permite la entrega confidencial de un recién nacido por parte de sus padres u otras personas con custodia legal, es decir cualquier persona a quien los padres le hayan dado permiso. Siempre que el bebé tenga tres días (72 horas) de vida o menos, y no haya sufrido abuso ni negligencia, pueden entregar al recién nacido sin temor de ser arrestados o procesados.

Cada recién nacido se merece la oportunidad de tener una vida saludable. Si alguien que usted conoce está pensando en abandonar a un recién nacido, infórmele que tiene otras opciones. Hasta tres días (72 horas) después del nacimiento, se puede entregar un recién nacido al personal de cualquier hospital o cuartel de bomberos del condado de Los Angeles.

¿Cómo funciona?

El padre/madre con dificultades que no pueda o no quiera cuidar de su recién nacido puede entregarlo en forma legal, confidencial y segura dentro de los tres días (72 horas) del nacimiento. El bebé debe ser entregado a un empleado de cualquier hospital o cuartel de bomberos del Condado de Los Ángeles. Siempre que el bebé no presente signos de abuso o negligencia, no será necesario suministrar nombres ni información alguna. Si el padre/madre cambia de opinión posteriormente y desea recuperar a su bebé, los trabajadores utilizarán brazaletes para poder vincularlos. El bebé llevará un brazalete y el padre/madre o el adulto que lo entregue recibirá un brazalete igual.

¿Qué pasa si el padre/madre desea recuperar a su bebé?

Los padres que cambien de opinión pueden comenzar el proceso de reclamar a su recién nacido dentro de los 14 días. Estos padres deberán llamar al Departamento de Servicios para Niños y Familias (Department of Children and Family Services) del Condado de Los Ángeles al 1-800-540-4000.

¿Sólo los padres podrán llevar al recién nacido?

No. Si bien en la mayoría de los casos son los padres los que llevan al bebé, la ley permite que otras personas lo hagan si tienen custodia legal.

¿Los padres o el adulto que entrega al bebé deben llamar antes de llevar al bebé?

No. El padre/madre o adulto puede llevar al bebé en cualquier momento, las 24 horas del día, los 7 días de la semana, siempre y cuando entreguen a su bebé a un empleado del hospital o cuartel de bomberos.

¿Es necesario que el padre/madre o adulto diga algo a las personas que reciben al bebé?

No. Sin embargo, el personal del hospital o cuartel de bomberos le pedirá a la persona que entregue al bebé que llene un cuestionario con la finalidad de recabar antecedentes médicos importantes, que resultan de gran utilidad para cuidar bien del bebé. El cuestionario incluye un sobre con el sello postal pagado para enviarlo en otro momento.

¿Qué pasará con el bebé?

El bebé será examinado y le brindarán atención médica. Cuando le den el alta del hospital, los trabajadores sociales inmediatamente ubicarán al bebé en un hogar seguro donde estará bien atendido, y se comenzará el proceso de adopción.

¿Qué pasará con el padre/madre o adulto que entregue al bebé?

Una vez que los padres o adulto hayan entregado al bebé al personal del hospital o cuartel de bomberos, pueden irse en cualquier momento.

¿Por qué se está haciendo esto en California? ?

La finalidad de la Ley de Entrega de Bebés sin Peligro es proteger a los bebés para que no sean abandonados, lastimados o muertos por sus padres. Usted probablemente haya escuchado historias trágicas sobre bebés abandonados en basureros o en baños públicos. Los padres de esos bebés probablemente hayan estado pasando por dificultades emocionales graves. Las madres pueden haber ocultado su embarazo, por temor a lo que pasaría si sus familias se enteraran. Abandonaron a sus bebés porque tenían miedo y no tenían nadie a quien pedir ayuda. El abandono de un recién nacido es ilegal y pone al bebé en una situación de peligro extremo. Muy a menudo el abandono provoca la muerte del bebé. La Ley de Entrega de Bebés sin Peligro impide que vuelva a suceder esta tragedia en California.

Historia de un bebé

A la mañana temprano del día 9 de abril de 2005, se entregó un recién nacido saludable a las enfermeras del Harbor-UCLA Medical Center. La mujer que llevó el recién nacido al hospital se dio a conocer como la tía del bebé, y dijo que la madre le había pedido que llevara al bebé al hospital en su nombre. Le entregaron a la tía un brazalete con un número que coincidía con la pulsera del bebé; esto serviría como identificación en caso de que la madre cambiara de opinión con respecto a la entrega del bebé y decidiera recuperarlo dentro del período de 14 días que permite esta ley. También le dieron a la tía un cuestionario médico, y ella dijo que la madre lo llenaría y lo enviaría de vuelta dentro del sobre con franqueo pagado que le habían dado. El personal médico examinó al bebé y se determinó que estaba saludable y a término. El bebé fue ubicado con una buena familia que ya había sido aprobada para adoptarlo por el Departamento de Servicios para Niños y Familias.



Chapter 2.206 DEFAULTED PROPERTY TAX REDUCTION PROGRAM

- 2.206.010 Findings and declarations.
- 2.206.020 Definitions.
- 2.206.030 Applicability.
- 2.206.040 Required solicitation and Contract language.
- 2.206.050 Administration and compliance certification.
- 2.206.060 Exclusions/Exemptions.
- 2.206.070 Enforcement and remedies.
- 2.206.080 Severability.

2.206.010 Findings and declarations.

The Board of Supervisors finds that significant revenues are lost each year as a result of taxpayers who fail to pay their tax obligations on time. The delinquencies impose an economic burden upon the County and its taxpayers. Therefore, the Board of Supervisors establishes the goal of ensuring that individuals and businesses that benefit financially from Contracts with the County fulfill their property tax obligation. (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.020 Definitions.

The following definitions shall be applicable to this chapter:

- A. "Contractor" shall mean any person, firm, corporation, partnership, or combination thereof, which submits a bid or proposal or enters into a Contract or agreement with the County.
- B. "County" shall mean the County of Los Angeles or any public entities for which the Board of Supervisors is the governing body.
- C. "County Property Taxes" shall mean any property tax obligation on the County's secured or unsecured roll; except for tax obligations on the secured roll with respect to property held by a Contractor in a trust or fiduciary capacity or otherwise not beneficially owned by the Contractor.
- D. "Department" shall mean the County department, entity, or organization responsible for the solicitation and/or administration of the Contract.
- E. "Default" shall mean any property tax obligation on the secured roll that has been deemed defaulted by operation of law pursuant to California Revenue and Taxation Code section 3436; or any property tax obligation on the unsecured roll that remains unpaid on the applicable delinquency date pursuant to California Revenue and Taxation Code section 2922; except for any property tax obligation dispute pending before the Assessment Appeals Board.

- F. "Solicitation" shall mean the County's process to obtain bids or proposals for goods and services.
- G. "Treasurer-Tax Collector" shall mean the Treasurer and Tax Collector of the County of Los Angeles. (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.030 Applicability.

This chapter shall apply to all solicitations issued 60 days after the effective date of the ordinance codified in this chapter. This chapter shall also apply to all new, renewed, extended, and/or amended Contracts entered into 60 days after the effective date of the ordinance codified in this chapter. (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.040 Required solicitation and Contract language.

All solicitations and all new, renewed, extended, and/or amended Contracts shall contain language, which:

- A. Requires any Contractor to keep County Property Taxes out of Default status at all times during the term of an awarded Contract;
- B. Provides that the failure of the Contractor to comply with the provisions in this chapter may prevent the Contractor from being awarded a new Contract; and
- C. Provides that the failure of the Contractor to comply with the provisions in this chapter may constitute a material breach of an existing Contract, and failure to cure the breach within ten days of notice by the County by paying the outstanding County Property Tax or making payments in a manner agreed to and approved by the Treasurer-Tax Collector, may subject the Contract to suspension and/or termination. (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.050 Administration and compliance certification.

- A. The Treasurer-Tax Collector shall be responsible for the administration of this chapter. The Treasurer-Tax Collector shall, with the assistance of the Chief Executive Officer, Director of Internal Services, and County Counsel issue written instructions on the implementation and ongoing administration of this chapter. Such instructions may provide for the delegation of functions to other departments.
- B. Contractor shall be required to certify, at the time of submitting any bid or proposal to the County, or entering into any new Contract, or renewal, extension or amendment of an existing Contract with the County, that it is in compliance with this chapter is not in Default on any County Property Taxes or is current in

payments due under any approved payment arrangement (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.060 Exclusions/Exemptions.

A. This chapter shall not apply to the following Contracts:

1. Chief Executive Office delegated authority agreements under \$50,000;
2. A Contract where Federal or State law or a condition of a Federal or State program mandates the use of a particular Contractor;
3. A purchase made through a State or Federal Contract;
4. A Contract where State or Federal monies are used to fund service-related programs including, but not limited to, voucher programs, foster care, or other social programs that provide immediate direct assistance;
5. Purchase orders under a master agreement, where the Contractor was certified at the time the master agreement was entered into and at any subsequent renewal, extension and/or amendment to the master agreement;
6. Purchase orders issued by Internal Services Department under \$100,000 that is not the result of a competitive bidding process;
7. Program agreements that utilize Board of Supervisors' discretionary funds;
8. National Contracts established for the purchase of equipment and supplies for and by the National Association of Counties, U.S. Communities Government Purchasing Alliance, or any similar related group purchasing organization;
9. A monopoly purchase that is exclusive and proprietary to a specific manufacturer, distributor, reseller, and must match and intermember with existing supplies, equipment, or systems maintained by the County pursuant to the Los Angeles Purchasing Policy and Procedures Manual, Section P-3700 or a successor provision;
10. A revolving fund (petty cash) purchase pursuant to the Los Angeles County Fiscal Manual, Section 4.6.0 or a successor provision;
11. A purchase card purchase pursuant to the Los Angeles County Purchasing Policy and Procedures Manual, Section P-2810 or a successor provision;
12. A nonagreement purchase worth a value of less than \$5,000 pursuant to

the Los Angeles County Purchasing Policy and Procedures Manual, Section A-0300 or a successor provision; or

13. A bona fide emergency purchase pursuant to the Los Angeles County Purchasing Policy and Procedures Manual Section P-0900 or a successor provision;
 14. Other Contracts for mission critical goods and/or services where the Board of Supervisors determines that an exemption is justified.
- B. Other laws. This chapter shall not be interpreted or applied to any Contractor in a manner inconsistent with the laws of the United States or California. (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.070 Enforcement and remedies.

- A. The information furnished by each Contractor certifying that it is in compliance with this chapter shall be under penalty of perjury.
- B. No Contractor shall willfully and knowingly make a false statement certifying compliance with this chapter for the purpose of obtaining or retaining a County Contract.
- C. For Contractor's violation of any provision of this chapter, the County department head responsible for administering the Contract may do one or more of the following:
1. Recommend to the Board of Supervisors the termination of the Contract; and/or,
 2. Pursuant to Chapter 2.202, seek the debarment of the Contractor; and/or,
 3. Recommend to the Board of Supervisors that an exemption is justified pursuant to Section 2.206.060.A.14 of this chapter or payment deferral as provided pursuant to the California Revenue and Taxation Code. (Ord. No. 2009-0026 § 1 (part), 2009.)

2.206.080 Severability.

If any provision of this chapter is found invalid by a court of competent jurisdiction, the remaining provisions shall remain in full force and effect. (Ord. No. 2009-0026 § 1 (part), 2009.)



COUNTY OF LOS ANGELES

Policy on Doing Business

With Small Business

Forty-two percent of businesses in Los Angeles County have five or fewer employees. Only about 4 percent of businesses in the area exceed 100 employees. According to the Los Angeles Times and local economists, it is not large corporations, but these small companies that are generating new jobs and helping move Los Angeles County out of its worst recession in decades.

WE RECOGNIZE...

The importance of small business to the County:

- In fueling local economic growth.
- Providing new jobs.
- Creating new local tax revenues.
- Offering new entrepreneurial opportunity to those historically under-represented in business.

The County can play a positive role in helping small business grow:

- As a multi-billion dollar purchaser of goods and services.
- As a broker of intergovernmental cooperation among numerous local jurisdictions.
- By greater outreach in providing information and training.
- By simplifying the bid/proposal process.
- By maintaining selection criteria which are fair to all.
- By streamlining the payment process.

WE THEREFORE SHALL:

1. Constantly seek to streamline and simplify our processes for selecting our vendors and for conducting business with them.
2. Maintain a strong outreach program, fully coordinated among our departments and districts, as well as other participating governments to: (a) inform and assist the local business community in competing to provide goods and services; and, (b) provide for ongoing dialogue with and involvement by the business community in implementing this policy.
3. Continually review and revise how we package and advertise solicitations, evaluate, and select prospective vendors, address subcontracting, and conduct business with our vendors, in order to: (a) expand opportunity for small business to compete for our business; and, (b) to further opportunities for all businesses to compete regardless of size.
4. Ensure that staff who manage and carry out the business of purchasing goods and services are well-trained, capable, and highly motivated to carry out the letter and spirit of this policy.

Listing of Contractors Debarred in Los Angeles County

List of Debarred Contractors in Los Angeles County may be obtained by going to the following website:

<https://doingbusiness.lacounty.gov/listing-of-contractors-debarred-in-los-angeles-county/>

County of Los Angeles *Lobbyist Ordinance*



IT'S THE LAW

It may affect you!

Chapter 2.160 of the Los Angeles County Code requires Lobbyists, Lobbying Firms and Lobbyist Employers to register with the Executive Office of the Board of Supervisors. This ordinance imposes extensive reporting requirements on individuals, businesses and other organizations. It places restrictions on the activities of anyone seeking to influence an official action of the County of Los Angeles including actions of the Board of Supervisors or the granting or denial of County contracts, licenses, permits, grants and franchises.

YOU MAY BE CONSIDERED A COUNTY LOBBYIST

If you are compensated to communicate directly (or through agents) with any County official for the purpose of influencing official action, then you may be required to register with the Executive Office of the Board of Supervisors. The requirement to register is the same whether you are an employee of, or on contract with, a firm or organization with business before the County. Additionally, an individual or business entity may be considered a County Lobbying Firm if it receives compensation to influence the County on behalf of any **other** persons or businesses. An individual, business entity or organization that employs or contracts with another individual or firm to represent or make contacts with a County agency on their behalf to influence County action may be considered a County Lobbyist Employer who must also register. If in doubt, it is best to register.

Furthermore, each person or entity who is not otherwise required to register as a County Lobbyist, Lobbying Firm or Lobbyist Employer, but who directly or indirectly expends \$5,000 or more during a calendar quarter to influence official action need not register BUT must report the expenditure to the Executive Office of the Board of Supervisors on a form available from the Executive Office.

REGISTERING IS IMPORTANT

Failure to comply with the ordinance may subject offending Lobbyists, Lobbying Firms, and Lobbyist Employers to **serious penalties including fines up to \$2,000 and denial of contracts, licenses, permits, grants or franchises. Moreover, some violators may be refused permission to address the Board of Supervisors or any County commission.**

HERE'S HOW TO COMPLY WITH THE LAW

Within 10 days of qualifying as a County Lobbyist, Lobbying Firm, or Lobbyist Employer as described in the ordinance, you must register with the Executive Office of the Board of Supervisors.

Registering with the County is easy. To receive a copy of the ordinance and registration forms, or to receive additional information or answers to specific questions, please contact the Executive Office of the Board of Supervisors at the following address or you may call one of the following telephone numbers:

Executive Office of the Board of Supervisors
County of Los Angeles
383 Kenneth Hahn Hall Of Administration
500 West Temple Street
Los Angeles, California 90012

(213) 974-1093 (213) 974-1578

A copy of the ordinance is available for your review at this County facility or on the Internet.

<http://bos.co.la.ca.us/>

Thank you for your cooperation and attention.



Department of the Treasury
Internal Revenue Service

Notice 1015

(Rev. December 2018)

Have You Told Your Employees About the Earned Income Credit (EIC)?

What is the EIC?

The EIC is a refundable tax credit for certain workers.

Which Employees Must I Notify About the EIC?

You must notify each employee who worked for you at any time during the year and from whose wages you did not withhold income tax.

However, you do not have to notify any employee who claimed exemption from withholding on Form W-4, Employee's Withholding Allowance Certificate.

Note: You are encouraged to notify each employee whose wages for 2018 are less than \$54,884 that he or she may be eligible for the EIC.

How and When Must I Notify My Employees?

You must give the employee one of the following.

- The IRS Form W-2, Wage and Tax Statement, which has the required information about the EIC on the back of Copy B.
- A substitute Form W-2 with the same EIC information on the back of the employee's copy that is on Copy B of the IRS Form W-2.
- Notice 797, Possible Federal Tax Refund Due to the Earned Income Credit (EIC).
- Your written statement with the same wording as Notice 797.

If you give an employee a Form W-2 on time, no further notice is necessary if the Form W-2 has the required information about the EIC on the back of the employee's copy. If you give an employee a substitute Form W-2, but it does not have the required information, you

must notify the employee within 1 week of the date the substitute Form W-2 is given. If Form W-2 is required but is not given on time, you must give the employee Notice 797 or your written statement by the date Form W-2 is required to be given. If Form W-2 is not required, you must notify the employee by February 7, 2019.

You must hand the notice directly to the employee or send it by first-class mail to the employee's last known address. You will not meet the notification requirements by posting Notice 797 on an employee bulletin board or sending it through office mail. However, you may want to post the notice to help inform all employees of the EIC. You can download copies of the notice at www.irs.gov/FormsPubs. Or you can go to www.irs.gov/OrderForms to order it.

How Will My Employees Know If They Can Claim the EIC?

The basic requirements are covered in Notice 797. For more detailed information, the employee needs to see Pub. 596, Earned Income Credit (EIC), or the instructions for Form 1040.

How Do My Employees Claim the EIC?

An eligible employee claims the EIC on his or her 2018 tax return. Even an employee who has no tax withheld from wages and owes no tax may claim the EIC and ask for a refund, but he or she must file a tax return to do so. For example, if an employee has no tax withheld in 2018 and owes no tax but is eligible for a credit of \$800, he or she must file a 2018 tax return to get the \$800 refund.

**PROPOSERS' UTILIZATION PARTICIPATION AND COMMUNITY BUSINESS ENTERPRISE PROGRAM INFORMATION FOR
LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE DEVELOPMENT AND SUPPORT**

SELECTED FIRMS

	Small-Sized Business Category Proposer Name	Local SBE	SBE	Minority	Women	Disadvantaged	DisabledVet
1	None	N/A	N/A	N/A	N/A	N/A	N/A
	Medium-Sized Business Category Proposer Name						
2	None	N/A	N/A	N/A	N/A	N/A	N/A
	Large-Sized Business Category Proposer Name						
3	Parsons Transportation Group, Inc.	N/A	N/A	N/A	N/A	N/A	N/A

NON-SELECTED FIRMS

	Small-Sized Business Category Proposer Name	Local SBE	SBE	Minority	Women	Disadvantaged	DisabledVet
1	None	N/A	N/A	N/A	N/A	N/A	N/A
	Medium-Sized Business Category Proposer Name						
2	None	N/A	N/A	N/A	N/A	N/A	N/A
	Large-Sized Business Category Proposer Name						
3	None	N/A	N/A	N/A	N/A	N/A	N/A

*Information provided by proposers in response to the Request for Proposal. On final analysis and consideration of award, vendors were selected without regard to race, creed, gender, or color.

**PROPOSERS' UTILIZATION PARTICIPATION AND COMMUNITY BUSINESS ENTERPRISE PROGRAM INFORMATION FOR
LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE DEVELOPMENT AND SUPPORT**

FIRM INFORMATION*	Parsons Transportation Group, Inc.
--------------------------	--

BUSINESS STRUCTURE	Corporation
---------------------------	-------------

CULTURAL/ETHNIC COMPOSITION		NUMBER / % OF OWNERSHIP
OWNERS/PARTNERS	Black/African American	2/9%
	Hispanic/Latino	1/4%
	Asian or Pacific Islander	5/22%
	American Indian	0
	Filipino	0
	White	15/65%
	<i>Female (included above)</i>	2
		NUMBER
MANAGER	Black/African American	13
	Hispanic/Latino	24
	Asian or Pacific Islander	73
	American Indian	1
	Filipino	0
	White	150
	<i>Female (included above)</i>	55
STAFF	Black/African American	28
	Hispanic/Latino	77
	Asian or Pacific Islander	132
	American Indian	3
	Filipino	0
	White	231
	<i>Female (included above)</i>	150
Total No. of Employees		732

COUNTY CERTIFICATION	
CBE	N/A
LSBE	N/A
OTHER CERTIFYING AGENCY	N/A

*Information provided by proposers in response to the Request for Proposal. On final analysis and consideration of award, vendors were selected without regard to race, creed, gender, or color.



William S. Kehoe
CHIEF INFORMATION OFFICER

DRAFT

Enclosure C

CIO ANALYSIS

BOARD AGENDA DATE:

2/16/2021

SUBJECT:

**TRANSPORTATION CORE SERVICE AREA AWARD SERVICES CONTRACT FOR
LACO-4E TRAFFIC SIGNAL CONTROLLER FIRMWARE DEVELOPMENT AND SUPPORT**

CONTRACT TYPE:

☒ New Contract ☐ Sole Source ☐ Amendment to Contract #:

SUMMARY:

Description:

The Department of Public Works (DPW) is requesting the Board to award and authorize the Director of DPW or his designee to execute a time and materials contract with Parsons Transportation Group Inc. (Parsons) for as-needed enhancements, repairs and support to their County owned LACO-4E traffic signal controller firmware. Parsons was selected via a competitive solicitation and will replace the current contractor whose contract expires on March 3, 2021. The proposed contract term includes a base term of two years and optional extensions totaling four years and six months.

LACO-4E is the latest version of traffic signal controller firmware that developed and implemented by DPW in 2005. It provides an interface between 170-type traffic signal controllers hardware and DPW's Kimley-Horn Integrated Transportation System (KITS) operated in their Traffic Management Center in Alhambra, and provides a direct connection to 800 intersections with traffic signals to remotely manage signal operations, adjust signal coordination and timing, diagnose and resolve signal malfunctions, and provide maintenance. The LACO-4E firmware is also being used to support the Los Angeles County's Metropolitan Transit Authority's Bus Signal Priority Program.

DPW is also requesting authorization to exercise the optional renewals and extensions, and amend the contract for changes to the contract's scope of work. In addition, DPW is requesting authorization to increase the contract amount up to an additional 10 percent to cover any additional work, if required. Finally, DPW is recommending the Board find the agreement is exempt from the California Environmental Quality Act.

Estimated Contract Amount: \$440,000.

FINANCIAL ANALYSIS:

DRAFT

Estimated Contract costs:

Project Management Services	\$	60,000 ¹
Troubleshooting, Repairs, and Enhancements	\$	340,000 ²
Contingency	\$	40,000 ³

Total Maximum Contract Sum:..... \$ 440,000

Notes:

¹ Reflects an estimated 241 hours @ \$248.88 per hour. DPW used analogous estimating to determine the estimated number of hours, which is based on annual services utilization from the prior contractor.

² Reflects an estimated 2,420 hours @ \$140.46 per hour. DPW used analogous estimating to determine the estimated number of hours, which is based on annual services utilization from the prior contractor.

³Contingency for unforeseen work and COLA approved by DPW in accordance with the terms of the agreement

RISKS:

- **Project Management** – A dedicated project manager (PM) is needed to ensure adherence to schedule and budget, to manage scope changes, and to manage contract performance. DPW represents that this project will be managed by a project manager within DPW's Traffic Safety and Mobility Division.
- **Time and Material (T&M) Contract** – DPW elected to utilize a T&M contract for troubleshooting, repairs and enhancements to their LACO-4E firmware, which is appropriate given that extent or duration of the work required cannot be determined in advance. However, there is a risk because it provides no incentive for the contractor for cost control or labor efficiency. DPW is mitigating this risk by requiring the contractor to prepare a detailed scope of work, fee, and schedule estimate for requested tasks for review and approval before work is initiated. Also, DPW will perform quality assurance and testing to verify implementation of request changes and is using payment withholds to ensure successful completion of tasks.
- **Potential Contractor Employee Malicious Code** – Intelligent Transportation Systems, like KITS, are highly visible and attacks against them have high impact. There is a risk that an employee of selected contractor could install malicious code in LACO-4E firmware that could potentially harm the County's signal operations. DPW is mitigating this risk by conducting a peer review of source changes as well as quality assurance and testing. Also, updated production code will be installed by DPW employees and physical security of the modules where the code will be updated is restricted to only selected DPW employees. Finally, the proposed contract has a provision Technology Errors & Omissions (E&O) Insurance coverage starting at \$10 million that covers these acts.
- **Information Security** – The County's Chief Information Security Officer (CISO) has reviewed DPW's contract and determined that no confidential and/or sensitive information is being used or handled during the contract term.
- **Contract Risks** – No contract risks have been identified. County Counsel participated in its negotiation and approved the Contract as to form.

DRAFT

PREPARED BY:

GREG MELENDEZ, DEPUTY CHIEF INFORMATION OFFICER

DATE

APPROVED:

WILLIAM S. KEHOE, COUNTY CHIEF INFORMATION OFFICER

DATE

[Home \(/LACoBids/\)](#)**Solicitation Detail**

Solicitation Number:	PW-BRCD041			
Title:	LACO 4E Traffic Signal Controller Firmware Development and Support			
Department:	Public Works			
Bid Type:	Service	Bid Amount:	\$300,000.00	
Commodity:	TRAFFIC SIGNALS AND EQUIPMENT - ELECTRIC SYSTEMS			



PLEASE TAKE NOTICE that Public Works requests proposals for the contract for LACO-4E Traffic Signal Controller F Development (LACO-4E) (C0000120). This contract has a potential maximum contract term of 6 years, consisting initial 2-year term and two potential additional 2 year option renewals. The total contract amount of this service is estimated to be \$300,000 for the entire contract term, including option years. The Request for Proposals (RFP) with contract specifications, and instructions for preparing and submitting proposals may be accessed at <https://pw.lacounty.gov/brcd/servicecontracts/> or may be requested from Ms. Anna Leung at (626) 458-4072 or aleung@pw.lacounty.gov or Ms. Ani Karapetyan at (626) 458 4050, akarapetyan@pw.lacounty.gov, Monday through Friday, 7 a.m. to 5 p.m.

PLEASE CHECK THE WEBSITE FREQUENTLY FOR ANY CHANGES TO THIS SOLICITATION. ALL ADDENDA AND INFORMATIONAL UPDATES WILL BE POSTED AT <http://pw.lacounty.gov/contracts>.

Public Works' "Do Business With Public Works" Website Registration

All interested proposers for this RFP are strongly encouraged to register at <http://pw.lacounty.gov/general/contracts/opportunities/>. Only those firms registered for this RFP through the website will receive automatic notification when any update to this RFP is made. The County does not have an obligation to notify proposers other than through the Public Works website's automatic notification system.

Doing Business with Local Small Business Enterprise, Disabled Veteran Business Enterprise, and Social Enterprise

The County strongly encourages participation from firms, primes, and subcontractors, which are certified in the County's Small Business Enterprise (LSBE), Disabled Veteran Business Enterprise (DVBE), and Social Enterprise (SE) Preference Programs. The County's LSBE, DVBE, and SE Preference Programs require firms to complete a certification process to receive certain benefits allowed only for LSBE, DVBE, and SE, such as a 15 percent price preference, not to exceed \$150,000, applicable, and LSBE Prompt Payment Program. The following link provides additional information on being County certified as LSBE, DVBE, and SE: <http://dcba.lacounty.gov>

Minimum Requirements: At the time of proposal submission, proposers must meet all minimum requirements set forth in the RFP document including, but not limited to:

Note: No subcontracting is allowed for this service. If a proposer makes reference to using a subcontractor or if a proposal includes a list of subcontractors to perform the contracted work, the bid will be immediately disqualified as nonresponsive.

1. Proposers' employees performing the requested services must have a minimum of 5 years of experience providing the following services:
 - Working with RS-232 AB3418E communications
 - Working with Model 170 Traffic Signal Controller architecture
 - Working with an In-Circuit Emulator for the Motorola/Freescale WC68HC11F1
 - Writing traffic signal controller applications in any programming language
 - Writing applications using the Freescale's MC68HC11 in Assembly language.
2. Proposer must have access to an In-Circuit Emulator for the Motorola/Freescale MC68HC11F1.
3. Proposer must have access and provide their own Type 170 Controller in full controller cabinet environment.
4. Proposer must possess a Software Development Compiler program that is fully compatible with Cosmic "C Cross Compiler/Assembler for Freescale HC11" Version 4.6.8 (or newer) or provide a copy of the vendor's compiler program to the County.

There will be no proposers' conference held for this solicitation. The deadline to submit written questions for a response is Monday, May 4, 2020, by or before 5:30 p.m. Please direct your questions to Ms. Leung or Ms. Karapetyan. The deadline to submit proposals is Monday, May 18, 2020, at 5:30 p.m.

IMPORTANT NOTICE

Due to the closure of Public Works Headquarters for non-County employees, submission of proposals will only be accepted electronically. Submission of hard copy proposals will not be accepted.

PROPOSAL MUST BE SUBMITTED ELECTRONICALLY USING ONE OF THE TWO FOLLOWING METHODS:

Electronic Submission of Proposal

1. In lieu of submitting proposal via e-mail, you may submit proposals electronically on www.bidexpress.com, a secure bidding service website.




To submit your proposals electronically, register with BidExpress, by the due date above. A new registration page must be signed, notarized, and received by BidExpress Customer Support for processing before the due date. There is a nominal fee to use BidExpress.

(/LACoBids/)

Please note, each upload of file in BidExpress is limited to 10 MB per file up to 50 files for a total of 500 MB. Proposer: please allow sufficient time to account for the file size limitation before the proposal submission deadline to complete uploading of proposal files.

2. Proposals may be submitted via e-mail to Ms. Anna Leung at aleung@pw.lacounty.gov, or Ms. Ani Karapetyan at akarapetyan@pw.lacounty.gov, by or before the bid submission deadline.

Open Day:	4/20/2020	Close Date:	5/18/2020 5:30:00 PM
Contact Name:	Anna Leung	Contact Phone:	(626) 458-4072
Contact Email:	aleung@pw.lacounty.gov		
Last Changed On:	4/20/2020 9:41:21 AM		
Attachment File (0) :	 Click here to download attachment files.		



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BOARD LETTER/MEMO – FACT SHEET OPERATIONS CLUSTER

☒ Board Letter

☐ Board Memo

☐ Other

OPS CLUSTER AGENDA REVIEW DATE	1/27/2021	
BOARD MEETING	2/16/2021	
DELEGATED AUTHORITY BOARD LETTER	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
SUPERVISORIAL DISTRICT AFFECTED	District 5	
DEPARTMENT	ISD	
SUBJECT	Request approval to accept grant funds and execute contracts for electric vehicle charging station infrastructure (EVSE) and installation from the Antelope Valley Air Quality Management District (AVAQMD).	
PROGRAM	Electric Vehicle Program	
SOLE SOURCE CONTRACT	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, please explain why:	
DEADLINES/ TIME CONSTRAINTS	ISD has submitted and will continue to submit grant funding applications to AVAQMD to cover costs of EVSE projects at locations throughout the Antelope Valley area (District 5). AVAQMD will approve grants on the 3 rd Tuesday of each month and execute contracts a week after approval. ISD needs to allocate current Fiscal Year funds, countersign these contracts in a timely manner, and contract out the projects before the end of the Fiscal Year.	
COST & FUNDING	Total cost: \$200,000	Funding source: ISD EV Cost Pool
	TERMS (if applicable):	
	Explanation: There are no costs to accepting grant funding. However, ISD will cover approximate project costs not covered by the AVAQMD grants.	
PURPOSE OF REQUEST	The purpose of this request is to allow ISD to accept grant funds in order to increase access to chargers within the AVAQMD (District 5). The AVAQMD has an open solicitation to cover the cost of EVSE equipment and labor, up to \$150,000 per location. ISD is submitting applications for two locations on January 19 th (Lancaster Library and the Department of Mental Health's Behavioral Health Urgent Care Center). ISD will additionally submit applications for two libraries in February and continue to submit applications for locations as they are identified. ISD requests Board approval to accept and execute contracts for any AVAQMD approved applications.	
BACKGROUND (include internal/external issues that may exist)	To date, the County has installed over 500 EVSEs at 70 locations. District 5 has only 63 EVSEs at 13 locations and publicly available EVSEs are limited throughout the Antelope Valley area, parts of which are identified as disadvantaged communities per the CaliEnviroScreen. AVAQMD grants create an opportunity to expand the number of chargers available to employees and residents in this district. ISD has been working with several County Departments, including Library, DPSS, DCFS, DPW, WDCAS, and DMH, to identify and scope potential EVSE projects. Over the past several years, ISD has used utility incentives and grant funding to cover the equipment and labor costs for EVSE projects. Without such funding, ISD would not have sufficient funding to install EVSE and meet the County's Sustainability target of installing 15,000 charging stations by 2035. Grant funding through this targeted program by AVAQMD would support ISD's ongoing efforts to provide EVSEs and promote EV adoption for County departments and visiting public.	
DEPARTMENTAL AND OTHER CONTACTS	Name, Title, Phone # & Email: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> Minh Le General Manager 562-367-5153 msle@isd.lacounty.gov </div> <div style="width: 45%;"> Laura Iannaccone Administrative Manager X 562-417-6077 liannaccone@isd.lacounty.gov </div> </div>	



SELWYN HOLLINS
Director

County of Los Angeles
INTERNAL SERVICES DEPARTMENT

1100 North Eastern Avenue
Los Angeles, California 90063

Telephone: (323) 267-2101
FAX: (323) 264-7135

"Trusted Partner and Provider of Choice"

February 16, 2021

Honorable Board of Supervisors
County of Los Angeles
383 Kenneth Hahn Hall of Administration 500 West Temple Street
Los Angeles, CA 90012

Dear Supervisors:

**AUTHORIZATION TO ACCEPT (IF AWARDED), AND EXECUTE
CONTRACTUAL DOCUMENTS ON BEHALF OF THE COUNTY IN SUPPORT OF
THE ANTELOPE VALLEY AIR QUALITY MANAGEMENT DISTRICT'S ELECTRIC
VEHICLE CHARGING STATIONS PROGRAM GRANTS
(ALL SUPERVISORIAL DISTRICTS - 3 VOTES)**

SUBJECT

Grant applications and possible grants of up to \$1,000,000 total from the Antelope Valley Air Quality Management District for electric vehicle charging stations in the Antelope Valley at County locations in District 5. Requesting approval to authorize the Internal Service Department (ISD) to: apply for and, if awarded, accept grants on behalf of the County; and (2) exercise delegated authority to execute documents and undertake any and all activities to execute and deliver the grants; (3) accept AVAQMD grant funds up to \$1,000,000; (4) allocate necessary authorized County funds to be used as grant-match funding, (5) amend this authorization should the county receive additional rewards for the same purpose, and (6) find that the proposed projects are exempt from the California Environmental Quality Act

IT IS RECOMMENDED THAT YOUR BOARD

1. Delegate authority to the Director of ISD (or designee) to execute all required contractual and program documents to secure grant funding through the AVAQMD Electric Vehicle Charging Stations Program to support electric vehicle charging station equipment acquisition and charging infrastructure installations;
2. Authorize the Director of ISD (or designee) to accept grant funds in amounts up to \$1,000,000 to support ISD's electric vehicle charging station

program at County locations throughout the Antelope Valley, District 5 region and to execute all necessary contractual and program documents (including without limitation, application, scope of work, amendments or change orders, and, subject to available funds, alterations in the grant amount); and to sign and submit requests for payment of funds.

3. Find that the proposed projects are categorically exempt from the provisions of CEQA pursuant to Section 15301(a), (d), and (f).

PURPOSE/JUSTIFICATION OF RECOMMENDED ACTION

On August 6, 2019, your Board adopted the County Sustainability Plan, OurCounty, which sets a target of installing 5,000 electric vehicle charging stations by 2025 and 15,000 by 2035. On May 26, 2020, your Board established ISD as the lead County department for deploying charging station infrastructure and collecting data on clean transportation ([May 26, 2020](#)).

Vehicle emissions are responsible for more than 36 percent of the region's air pollution. Local petroleum refiners are responsible for almost 14 percent of regional air pollution. Together, these two sources generate almost half the region's air pollution. Many of the County's worksites in District 5 serve disadvantaged communities, as identified by the California Environmental Protection Agency CalEnviroScreen 3.0. These communities disproportionately suffer the health impacts from air pollution caused by emissions from vehicles and local refineries. Zero-emission vehicles reduce air pollution, petroleum consumption and dependence, Greenhouse Gases (GHG), and the related air pollution health impacts. There is limited EVSE infrastructure in the Antelope Valley and only one County location has August 6, 101 EVSEs on site.

ISD has identified county-operated parking lots in the AVAQMD in District 5 that serve large numbers of employees, the public, and nearby residents of multi-family dwellings. AVAQMD accepts applications on a rolling basis until all funds are exhausted. They cover up to \$150,000 for each location. ISD is working with recipient departments and has coordinated this request with those departments. ISD will submit applications for locations as the feasibility of EVSE installation is determined.

In addition, ISD will use existing Net County Costs and secure separate Utility incentive rebates to fund these projects, as more fully set forth below in Fiscal Impact/Financing.

County departments are eligible for a dollar for dollar reimbursement of up to \$150,000 per project location. This AVAQMD opportunity enables the County to augment its budgeted funding and to make progress towards the County goal of installing 5,000 chargers by 2025 and expanding EVSE infrastructure on County properties in District 5. Pursuing this grant funding advances implementation of the electric vehicle charging

station strategies in the County's Sustainability Plan OurCounty, while pursuing projects in District 5.

IMPLEMENTATION OF STRATEGIC PLAN GOALS

The recommended actions support the County's Strategic Plan Goal II, Foster Vibrant and Resilient Communities via strategy II.3.5: Support a clean, flexible, and integrated multi-modal transportation system that improves mobility.

FISCAL IMPACT/FINANCING

Projects will be funded from within the current and coming fiscal years' Net County Cost budgets received from the CEO as well as possible funds from EVSE user fees for up to the five-year term of the grants. Project costs will be offset by applicable AVAQMD grant funds up to \$150,000 per location.

All projects must be completed within 36 months of the fully executed grant agreement. It is anticipated that the grant documents will be fully executed during the first quarter of 2021. Once the grant has been awarded to ISD, an Appropriation Adjustment will be submitted to increase the Capital Assets or Services and Supplies (for EVSE) budget, as applicable, for each of the current and all actionable subsequent fiscal years.

FACTS AND PROVISIONS/LEGAL REQUIREMENTS

On July 11, 2000, the Board approved guidelines for the acceptance of grants in amount of \$100,000 or more. These guidelines include a requirement that County departments prepare a grant management statement for review before carrying out the activities covered under the grant. Subsequent to the Board's delegation to the Director of ISD to accept grants in amounts up to \$2 million, a grant management statement will be prepared and approved by the Director or his designee for each grant received. The grant agreement will be reviewed and approved as to form by County Counsel.

ENVIRONMENTAL DOCUMENTATION

These projects are categorically exempt from the provisions of CEQA pursuant to Section 15301(a), (d), and (f) of CEQA guidelines.

CONTRACTING PROCESS

The EVSE charging infrastructure will be furnished through ISD Energy Efficiency Projects Master Agreement and will be installed either by County staff, or by the agreement vendor(s). ISD will administer the AVAQMD Grant Agreement for all departments.

IMPACT ON CURRENT SERVICES (OR PROJECTS)

The EVSE procurements are routine and there will be no impact to current services. The installation of EVSE at various sites may cause some limited disruption at each site, but will be coordinated fully, in advance, with facilities managers, required technicians, and incumbent utilities.

CONCLUSION

The County's participation in the AVAQMD Electric Vehicle Charging Stations Program grant will enable the County to hasten your Board's goals; more specifically, to accelerate the adoption of zero emission vehicles, reduce toxic vehicle emissions, increase GHG emissions reduction, and lessen the associated health impacts. Expanded charging infrastructure for fleet, employees, and the public, advances the County's delivery of environmental and social benefits from zero emission vehicles, especially in disadvantaged communities, and promotes interest in and awareness of zero-emission vehicles. Implementation of this proposal will enable an increase in the number of zero emission- miles driven and improve air quality in this area. These proposed projects will bring much needed electrification infrastructure to District 5 of the County, which currently only has a total of 4 chargers operated by the County.

Upon Board approval, please return three individually certified copies of the adopted Board Letter to ISD.

Respectfully submitted,

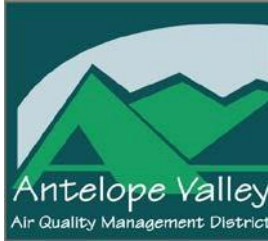
Selwyn Hollins
Director

Enclosures (1)

c: Executive Office, Board of Supervisors
Chief Executive Officer

ATTACHMENTS

1 – AVAQMD Brochure



ELECTRIC VEHICLE CHARGING STATIONS PROGRAM

Electric Vehicle Charging Stations Program is an incentive based program to encourage local entities within the Antelope Valley Air Quality Management District (AVAQMD) to install electric vehicle charging stations to offer public options for electric vehicle charging. This program will reimburse District Board approved projects up to 80 percent of the total costs of infrastructure, charging equipment and installation where the maximum funding amount is determined by meeting general criteria.

Program Eligibility:

- Own, lease, or operate sites able to accommodate public access electric vehicle charging such as, but not limited to retail centers, multi-unit dwellings, workplaces, hospitals, public transit stations, and park & rides.
- Site must accommodate a minimum of two (2) Level-2 Charging Stations single or dual port; or one (1) Level-2 Charging Station and one (1) Level-3/DC Fast Charging Station single or dual port (exceptions are considered on a case-by-case by the District).

General Criteria:

- The project must be installed and located within the AVAQMD (refer to list of District zip codes).
- Project site area, safety, accessibility, convenience, and anticipated usage are considered to determine funding amount.
- Publicly accessible station must at a minimum be accessible to the public daily during regular business hours (24-hour access station is preferred).
- Equipment and parts must be new and the work performed by licensed contractor.

Applicant/Grantee Requirements:

- Applicant shall complete District application forms and submit along with an estimate

from a District approved vendor.

- Applicant must be able to demonstrate to the air district that the applicant can obtain all required land use permits from agencies needed to install and operate the station.
 - Applicant must demonstrate that they either own the land on which the project will be located, or control it through a long-term lease, easement or other legal arrangement for placement and operation of the stations and for the duration of the project life.
 - Applicant must be able to provide documentation that power is being provided to the site (e.g. application, payment to the local utility company for power installation, or contract).
 - For publically accessible stations, the Applicant must provide a description of the geographic location, including an aerial map (i.e. satellite view from an internet based map or city/county map) and specific street address of the proposed station.
 - Applicant must include anticipated usage in terms of average duration and number of vehicles that will be using the station for the project life.
 - Applicant shall accommodate for pre and post inspection of project site by District staff.
-
- Grantee must not start any work or order any equipment until the proposed project is approved by District Board and Agreement is signed by the parties.
 - Grantee must enter into Agreement with the AVAQMD for a minimum project life of three (3) years.
 - Grantee shall promote the Charging Station as a public access station and provide website links and/or outreach materials to the AVAQMD.
 - Grantee shall provide the District with operation and public access details including but not limited to minimum/maximum charging times and charging costs.
 - Grantee shall provide electric vehicle charging signage and enforcement methods.
 - Grantee must maintain warranty and insurance against loss, destruction, vandalism, and breach of warranty including coverage for personal injury and property damage for the project life.
 - Grantee shall upon request from the District organize a press release and/or media event to help promote the charging stations and District's support for clean air projects.
 - Grantee shall agree to monitor operation, usage and maintenance and submit annual reports to the District for the life of the project.

Eligible Costs:

Eligible costs are limited to the purchase and installation of the equipment for power delivery or fueling directly related to the infrastructure project. The eligible costs listed below must utilize commercially available technologies.

- Cost of design and engineering, (i.e., labor, site preparation, Americans with Disabilities Act accessibility, signage/enforcement).
- Cost of equipment (e.g., charging/fueling units, electrical parts, energy storage equipment, materials).
- Cost of installation directly related to the construction of the station.
- Meter/data loggers.
- Federal, sales, and other taxes. Shipping and delivery costs.
- Permits
- Site preparation

- License fees
- Environmental fees
- Commissioning fees (safety testing)

Ineligible Costs:

- Existing station upgrade.
- Fuel and energy costs.
- Non-essential equipment hardware.
- Operation Cost (e.g., operational fees, maintenance, repairs, improvements, spare parts).
- Extended warranty.
- Insurance.
- Data collection and reporting.
- Grantee administrative costs.
- Travel/lodging.
- Employee training and salaries.
- Legal fees.
- Real estate property purchases/leases.
- Performance bond costs.
- Construction management.
- Storm water plan costs.
- Security costs.
- Testing and soil sampling.
- Hazardous materials, including permitting, handling and disposal.

Project Eligibility Criteria:

- Chargers must be a level 2 and higher to support non-residential stations.
- Publicly accessible light-duty charging stations must use a valid and universally accepted charge connector protocol (e.g. Society of Automotive Engineers (SAE), CHAdeMO).
- Charger must be certified by a Nationally Recognized Testing Laboratory (e.g., Underwriter's Laboratories, Intertek) located at <https://www.osha.gov/dts/otpc/nrtllist.html>.
- Equipment must have at least a one year warranty.
- The project must comply with all applicable federal, State, local laws and requirements including environmental laws, and State building, environmental and fire codes. For instance, air districts may need to perform CEQA review and obtain approval prior to funding a project.
- Equipment and parts must be new. Remanufactured or refurbished equipment and parts are not eligible.



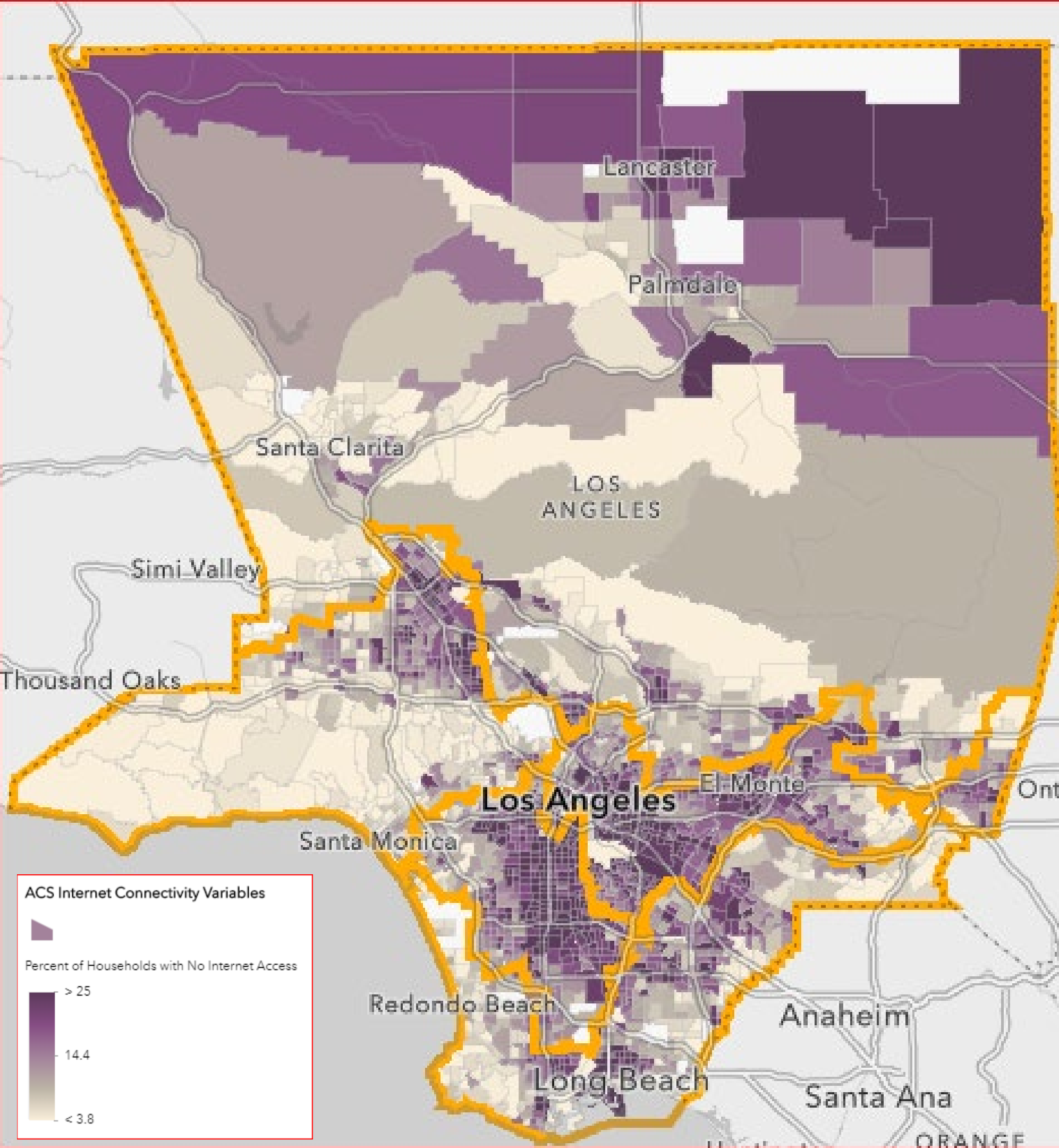
OFFICE OF THE CIO

Digital Divide Strategic Plan

Jan, 2021

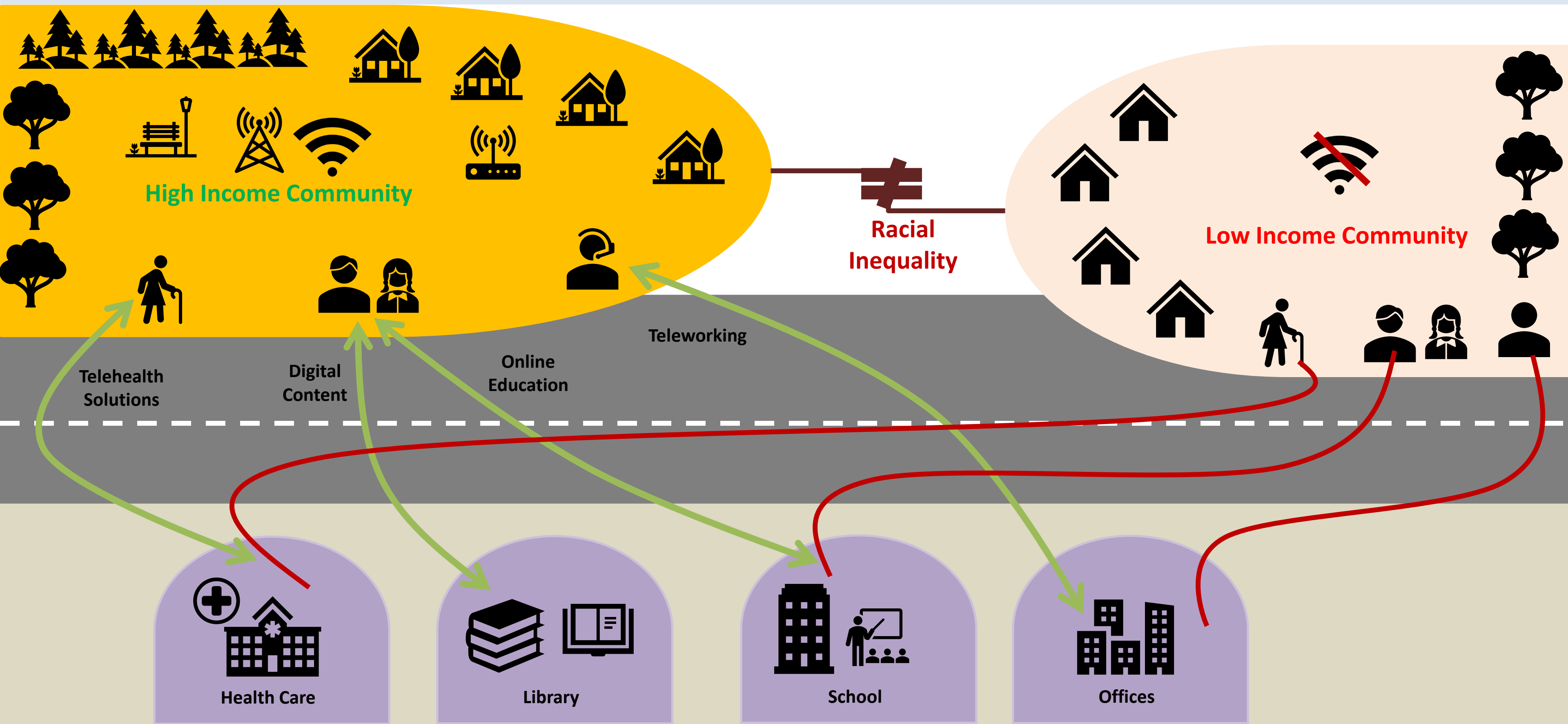
County of Los Angeles Network & Technology Accessibility Dashboard

- 5.5% of households do not have a computer or internet access
- 11.9% lack a broadband internet subscription



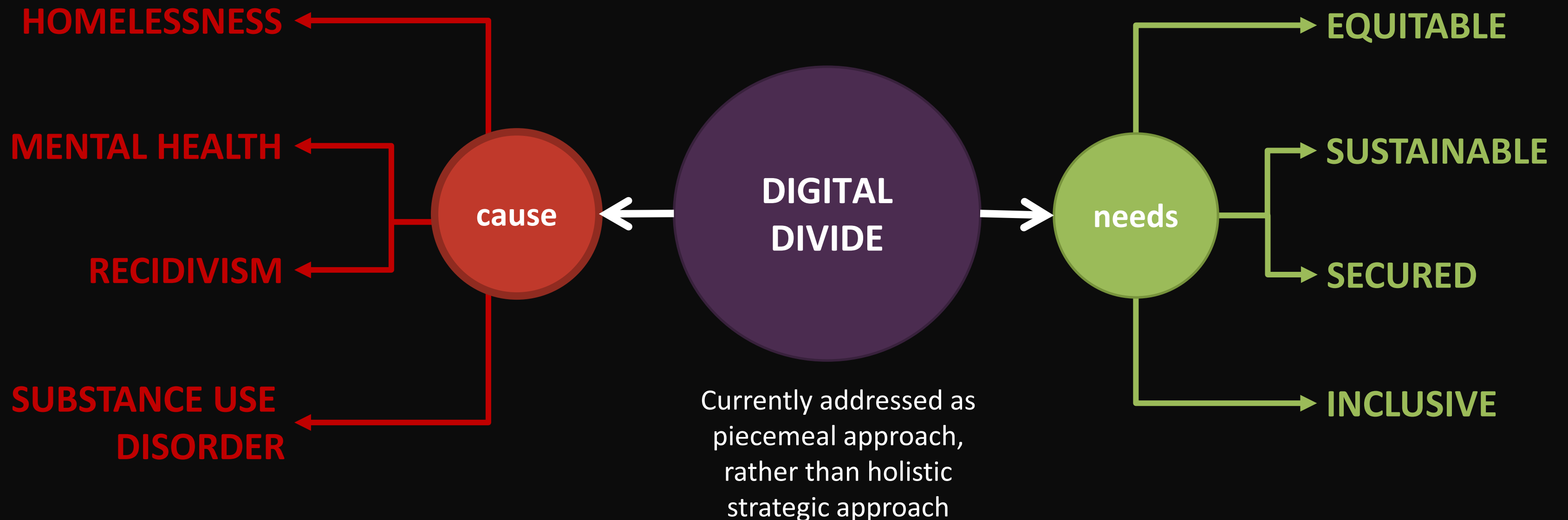
Digital Community

Digital Divide - Disparities across communities leading to the racial inequality



Need for holistic “Digital Divide Strategy”

Requires actional strategy with clear guiding principles to also assist in reducing current social issues for the County



Digital Divide – Solution Components

Broadband
access to all
residents



Devices for all
residents



Training for all
residents



Approach

Need Short Term and Long Term Digital Divide Strategic Approach

 **Immediate
Action Plan**
Quick Wins



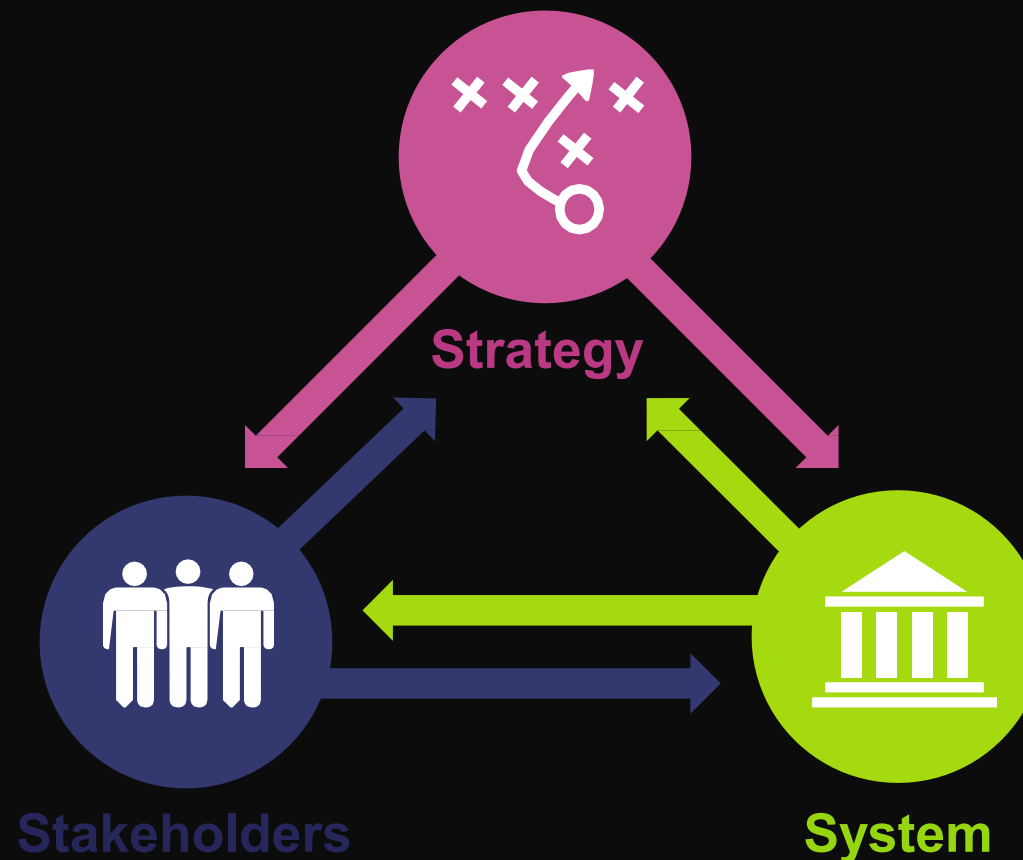
 **Sustained
Regional Strategy**
Holistic Strategic Plan

MIT REAP Program – Strategic Partner

Regional Entrepreneurship Accelerator Program (<https://reap.mit.edu>)

Independent entity enabling unbiased, inclusive consensus among diverse stakeholders

Innovation Program to
drive collective impact
toward ecosystem change



Proven framework engaging
51+ regions across the
world since 2012

Implement strategic policy & program intervention
with their regional stakeholder team

Timelines

Immediate action implementations and iterative approach for long term solutions



Immediate
Action
Plan

Planning & Assessment

Implementation

Sustained
Regional
Strategy

Planning

Strategic Workshops

Policy & Program Interventions

Digital Solutions & Start Ups

Periodic Board Updates

Next Steps

Immediate Action Plan

- Collate all Digital Divide efforts from ISD, DPW, DCBA, DRP, DHS/DPH/DMH* and other departments to have a consolidated countywide update for the Board
- Collaborate with respective departments to identify potential funding sources
- Provide oversight, best practices in identified solutions implementation

Regional Strategic Plan

- Seek approval of MIT REAP Program Funding from the Information Technology Investment Board Information Technology Fund (ITF)
- REAP team formation from local Los Angeles region-based stakeholders
- Engage with state and national efforts including NACO's Broadband Task Force
- Collaborate with other jurisdictions for best practices & synergies

*Includes partnerships with Center for Health Equity (DPH), Center for Financial Empowerment (DCBA)

Thank you

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