BAIFA
BAY AREA INFRASTRUCTURE FINANCING AUTHORITY

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June 24, 2015

Addendum No. 2
To
Invitation For Bids (IFB)
Express Lanes Backhaul Communications Network
Fiber Optic Cable and Network Electronics Furnishing, Installation and Testing
Dated May 28, 2015, as amended on May 29, 2015

Dear Consultant:

This letter is Addendum No. 2 to the Invitation for Bids Express Lanes Backhaul Communication Network Project, dated May 28, 2015, as amended by Addendum No. 1 on May 29, 2015 ("IFB"). Where text is revised, deleted text is shown in strike-through format; added text is *italicized*. The IFB is revised as follows:

Addendum Item	Reference	Change
1.	IFB, Part 3, Instructions to Bidders, Section 1, Scope of Work, page 14, modified as follows:	I-680 Corridor • I-580/I-680 Interchange (Dublin Hub) • I-680/State Route 24 Interchange (Walnut Creek Hub) • BAIFA Oakland Hub (BOH) (adjacent to the BART facility) • Caltrans District 4 TMC • ~~Walnut Creek BART Station (Contractor to utilize Caltrans-furnished racks and power infrastructure)~~ • ~~19th Street BART Station~~ I-880 Corridor • Hegenberger Hub • ~~Fremont BART Station and City Traffic Operations Center Cross Connection~~ • Auto Mall Hub • Calaveras Hub
2.	IFB, Part 10, Division I, Section 5-1.20C, page 149, remove the following text:	**~~Replace "Reserved" in Section 5-1.20C with:~~** ~~This project does not include work on railroad properties but railroads are shown on the general plan sheet within the project limits. Do not trespass on the railroad properties within the project limits.~~

<table>
<tr><th>Addendum Item</th><th>Reference</th><th>Change</th></tr>
<tr><td>3.</td><td>IFB, Part 10, Division II, Section 12, page 153, insert as new item</td><td>Add to section 12-3.12C:
Place the portable changeable message sign in advance of the 1st warning sign for each:
1. Stationary lane closure
2. Off-ramp closure
3. Connector closure
4. Shoulder closure</td></tr>
<tr><td>4.</td><td>IFB, Part 10, Division II, Section 12-4.02a, Page 154, delete the following text</td><td><s>Replace the 6th paragraph of section 12-4.02A with:</s>
<s>If a minor deviation from the requirements of this section regarding hours of work is required, submit a request at least 15 days before the proposed date of closure. If no significant increase in cost is accrued to the Department and the work can be expedited and better serve the traffic, the deviation may be authorized.</s></td></tr>
<tr><td>5.</td><td>IFB, Part 10, Division II, Section 12, page 155, delete and add the following language in the Table in the RSS for Section 12-4.03B on page 155:</td><td>
<table>
<tr><th>Type of facility</th><th>Route</th><th>Direction or Segment</th><th>Period</th><th>Liquidated damages/interval ($)</th></tr>
<tr><td>Mainline (Lane Closure)</td><td>I-680</td><td>Northbound</td><td>1st half hour
2nd half hour
2nd hour and beyond</td><td>$1,800 / 10 minutes
$3,700 / 10 minutes
$8,700 / 10 minutes
<s>$4,300 / 10 minutes</s>
<s>$6,500 / 10 minutes</s>
<s>$8,700 / 10 minutes</s></td></tr>
<tr><td>Mainline (Lane Closure)</td><td>I-680</td><td>Southbound</td><td>1st half hour
2nd half hour
2nd hour and beyond</td><td>$550 / 10 minutes
$1,100 / 10 minutes
$3,800 / 10 minutes
<s>$1,800 / 10 minutes</s>
<s>$2,800 / 10 minutes</s>
<s>$3,800 / 10 minutes</s></td></tr>
<tr><td>Ramp</td><td></td><td>Off- ramp</td><td>1st half hour
2nd half hour
2nd hour and beyond</td><td>$1,000 / 10 minutes
$1,000 / 10 minutes
$1,000 / 10 minutes</td></tr>
</table>
</td></tr>
</table>

6.	IFB, Part 10, Division II, Section 12-4.02A, pages 154-155	IFB, Part 10, Division II, "Add to Section 12-4.02A" is deleted and replaced, in its entirety, with the following text: ***Add to section 12-4.02A:*** *If work including installing, maintaining, and removing Type K temporary railing is to be performed within 6 feet of the adjacent traffic lane, close the adjacent traffic lane.* *Except as listed above, closure of the adjacent traffic lane is not required for installing, maintaining, and removing traffic control devices.* *If a designated holiday falls on a Sunday, the following Monday is a designated holiday. If November 11th falls on a Saturday, the preceding Friday is a designated holiday.* *Special day is the third Monday in January.* *Not more than 2 stationary lane closures will be allowed in each direction of travel at one time. Concurrent stationary closures in the same direction of travel must be spaced no closer than 2 miles apart. Closures in the same direction of travel on alternating inside lane/outside lanes must be spaced by an additional 2 miles.* *Freeway closure charts are for the installation of fiber optic cable, electrical conduit, pull boxes, and other authorized work.* *Personal vehicles of your employees must not be parked on the traveled way or shoulders, including sections closed to traffic.* *If work vehicles or equipment are parked within 6 feet of a traffic lane, close the shoulder area as shown.*
7.	IFB, Part 10, Division II, Section 12-4.05, pages 157-164	IFB Part 10, Division II, Section 12-4.05B is deleted and replaced, in its entirety, with Attachment 1, IFB Part 10, Construction Details, Division II, Section 12-4.05B (Revised) and new Section 12-4.05D, 12-4.05E, and 12-4.05H, attached hereto.
8.	IFB, Part 10, Section 12, page 165, delete and add the section heading for Section 12-5:	~~Replace "Reserved" in section 12-5 with:~~ *Replace section 12-5 with:* *12-5 TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE*

9.	IFB, Part 10, Section 12-5.04, page 166, delete the following text:	~~Flagging costs are paid for as specified in section 12-1.03.~~ ~~Traffic control system for lane closure is paid for as traffic control system.~~ ~~Flagging costs are paid for as specified in section 12-1.03~~.
10.	IFB, Part 10, Division IX, Section 86, pages 172-267	IFB, Part 10, Division IX, Section 86 is deleted in its entirety and replaced with the Attachment 2, IFB, Part 10, Construction Details, Division IX, Section 86, Revised.
11.	IFB, Appendix A, Contract Drawings and Plans, Segment I – Route 680 Backhaul Bid Set.	Replacement Sheets: Appendix A, Contract Drawings and Plans, Project Plan Sheets: Project Plan Sheets 1, 3, 68, 69, 75, 107, 108, 109, 110, 111, 112, 113, 114, 115, 118, 122, 124, 128, 129, 130, 131, 132, 133, 139, 146, 147, 155, and 175 are deleted and replaced with the attached Appendix A, Contract Drawings and Plans, Replacement Sheets.
12.	IFB, Appendix A, Contract Drawings and Plans Segment I – Route 680 Backhaul Bid Set.	Added Sheets: Appendix A, Contract Drawings and Plans, Project Plan Sheets: Project Plan Sheets 66A, 66B, 66C, 66D, 66E, 66F, 66G, 66H, 66I, 66J, 66K, 66L, 66M, 66N, 66O, 66P, 66Q, and 154A are added as attached in Appendix A, Contract Drawings and Plans, Added Sheets.
13.	IFB, Appendix C, Logical Network Details.	Replacement Diagrams: Appendix C, Logical Network Details, Backhaul Overview Diagram, Automall Physical Interconnections, Calaveras Physical Interconnections and BOH Physical Interconnections are deleted and replaced with the attached Appendix C, Logical Network Details, Replacement Diagrams.

The remaining provisions of the IFB remain unchanged. In the event of a conflict between this Addendum and the previous version(s), this Addendum takes precedence.

Any questions concerning this Addendum to the IFB should be directed to Michael Brinton, Contracts Specialist, at (510) 817-5727 or mbrinton@mtc.ca.gov.

Sincerely,

Andy Fremier

Andrew B. Fremier
Deputy Executive Director, Operations

AF: mb
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Attachment 1

IFB Part 10, Construction Details

Division II

Section 12-4.05B (Revised) and new Section 12-4.05D, 12-4.05E, and 12-4.05H

Replace "Reserved" in section 12-4.05B with:

Chart No. 1
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: ALA-680 PM 20.08 to CC-680 PM 0.19

Closure Limits: NB Mainline between 1500' south of WB Route 580/ NB Route 680 Connector On-Ramp and postmile 0.19 (Alcosta Blvd overcrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2					S	3	3	S	S	S					3	3	2	2	2	
Fridays	2	2	2	2	2					S	S	S	S							S	3	3	2	2	
Saturdays	2	2	2	2	2	2	2	3	3	S	S								S	3	3	3	3	2	
Sundays	2	2	2	2	2	2	2	2	2	3	S	S	S	S	S	S	S	S	S	S	3	2	2	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 2
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 0.19 to CC-680 PM 10.37

Closure Limits: NB Mainline between postmile 0.19 (Alcosta Blvd overcrossing) and postmile 10.37 (Stone Valley Road undercrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2						S	S	S							S	3	2	2	2	
Fridays	2	2	2	2	2					S	S									S	3	3	2	2	
Saturdays	2	2	2	2	2	2	2	2	3	S									S	3	3	3	3	2	
Sundays	2	2	2	2	2	2	2	2	2	3	S	S	S	S	S	S	S	S	S	3	3	2	2	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 3
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 10.37 to CC-680 PM 12.61

Closure Limits: NB Mainline between postmile 10.37 (Stone Valley Road undercrossing) and postmile 12.61 (Rudgear Road undercrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	3	3	3	3	3																S	S	3	3	
Fridays	3	2	2	2	3																S	S	S	3	
Saturdays	3	3	2	2	2	3	3	S													S	S	S	S	
Sundays	3	3	3	3	3	3	3	3	S											S	S	S	3	3	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 4
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 12.61 to CC-680 PM 22.70

Closure Limits: NB Mainline between postmile 12.61 (Rudgear Road undercrossing) and postmile 22.70 (Arthur Road undercrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2						S	S								S	S	4	3	3	
Fridays	2	2	2	2	2					S	S										S	S	4	3	
Saturdays	2	2	2	2	2	2	2	2	S	S									S	S	4	4	4	4	
Sundays	3	2	2	2	2	2	2	2	3	4	S	S	S					S	S	S	4	4	3	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
4	Provide at least four through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 5
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 22.70 to CC-680 PM 25.04

Closure Limits: NB Mainline between postmile 22.70 (Arthur Road undercrossing) and postmile 25.04 (Benicia Bridge Toll Plaza)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays											3	3	3	3	3										
Fridays											3	3	3	S	S										
Saturdays							1	2	2	3	3	S	3	3	3	S	3	3							
Sundays							1	1	2	2	3	3	3	3	3	3	3	3							

Legend:

1	Provide at least one through freeway lane open in direction of travel
2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. No night work permitted. Provide 2 weeks' notice to Benicia-Martinez Toll Bridge Captain, 925-957-2027, prior to work.

Chart No. 6
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 25.04 to CC-680 PM 22.70

Closure Limits: SB Mainline between postmile 25.04 (Benicia Bridge Toll Plaza) and postmile 22.70 (Arthur Road undercrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays										3	3	3	3	3	3										
Fridays										3	3	3	3	3	3										
Saturdays							2	2	2	2	2	2	2	2	2	2	2	2							
Sundays							2	2	2	2	2	3	3	3	2	2	3	3							

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. No night work permitted.

Chart No. 7
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 22.70 to CC-680 PM 13.37

Closure Limits: SB Mainline between postmile 22.70 (Arthur Road undercrossing) and postmile 13.93 (Olympic Boulevard undercrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	3					S	S	S	S	S	S					4	3	3	2	2	
Fridays	2	2	2	2	3					S	S	S	S	S						4	3	3	3	2	
Saturdays	2	2	2	2	2	2	3	4	5	S	S	S	S	S	S	S		S	S	4	4	3	3	2	
Sundays	2	2	2	2	2	2	2	3	3	5	5	S	S	S	S	S	S	S	5	4	3	3	2	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
4	Provide at least four through freeway lane open in direction of travel
5	Provide at least five through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 8
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 13.37 to CC-680 PM 10.93

Closure Limits: SB Mainline between postmile 13.93 (Olympic Boulevard undercrossing) and postmile 10.37 (Stone Valley Road undercrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2															S	3	2	2	2	
Fridays	2	2	2	2	2															S	3	3	2	2	
Saturdays	2	2	2	2	2	2	2	3	3	S	S								S	3	3	3	3	2	
Sundays	2	2	2	2	2	2	2	2	2	3	S	S	S	S	S	S		S	S	3	3	2	2	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 9
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 10.93 to CC-680 PM 0.19

Closure Limits: SB Mainline between postmile 10.37 (Stone Valley Road undercrossing) and postmile 0.19 (Alcosta Blvd overcrossing)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2							S	S	S						4	3	2	2	2	
Fridays	2	2	2	2	2															3	3	2	2	2	
Saturdays	2	2	2	2	2	2	2	3	3	S	S								S	3	3	3	2	2	
Sundays	2	2	2	2	2	2	2	2	2	3	S	S						S	S	3	3	2	2	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 10
Freeway/Expressway Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 0.19 to ALA-680 PM 20.08

Closure Limits: SB Mainline between postmile 0.19 (Alcosta Blvd overcrossing) and 1500' south of WB Route 580/NB Route 680 Connector On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	2	2	2	2	2							S	S	S	S					4	4	3	2	2	
Fridays	2	2	2	2	2							S	S	S						5	4	3	3	2	
Saturdays	2	2	2	2	2	2	2	2	4	5	S	S	S	S	S	S	S	S	S	4	3	3	3	2	
Sundays	2	2	2	2	2	2	2	2	3	4	5	S	S	S	S	S	S	S	5	4	3	3	2	2	

Legend:

2	Provide at least two through freeway lane open in direction of travel
3	Provide at least three through freeway lane open in direction of travel
4	Provide at least four through freeway lane open in direction of travel
5	Provide at least five through freeway lane open in direction of travel
S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Replace "Reserved" in section 12-4.05D with:

Chart No. 11
Connector Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 13.94

Closure Limits: EB Route 24/ SB Route 680 Connector Ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1															1	1	1	1	1	
Fridays	1	1	1	1	1													1	1	1	1	1	1	1	
Saturdays	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	
Sundays	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

Legend:

1	Provide at least one ramp lane, not less than 11 feet in width, open in direction of travel
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable and pull boxes in the left and right shoulder.

Chart No. 12
Connector Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 21.11

Closure Limits: NB 680 diagonal Connector Ramp/WB Route 4

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S															S	S	S	S	S	
Fridays	S	S	S	S	S																S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Replace "Reserved" in section 12-4.05E with:

Chart No. 13
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 7.98

Closure Limits: El Cerro Blvd NB diagonal On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S	S							S	S	S	S	S	
Fridays	S	S	S	S	S					S	S								S	S	S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	

Legend:
S Shoulder closure permitted (right/left)

Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 14
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 8.44

Closure Limits: El Cerro Blvd SB diagonal On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S							S	S	S						S	S	S	S	S	
Fridays	S	S	S	S	S															S	S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S	S								S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S						S	S	S	S	S	S	S	

Legend:
S Shoulder closure permitted (right/left)

Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 15
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 11.22

Closure Limits: Livorna Rd SB diagonal On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S															S	S	S	S	S	
Fridays	S	S	S	S	S															S	S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S	S								S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			S	S	S	S	S	S	

Legend:
S Shoulder closure permitted (right/left)

Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 16
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 11.5

Closure Limits: Livorna Rd NB diagonal On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S																S	S	S	S	
Fridays	S	S	S	S	S																S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S													S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S											S	S	S	S	S	

Legend:
S Shoulder closure permitted (right/left)

Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 17
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 13.0

Closure Limits: S Main St SB loop On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S					S	S	S	S	S	S					S	S	S	S	S	
Fridays	S	S	S	S	S					S	S	S	S	S				S	S	S	S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		S	S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. Install traffic handling devices per TH-1 and TH-2.

Chart No. 18
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 13.95

Closure Limits: Olympic Blvd NB diagonal On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1															1	1	1	1	1	
Fridays	1	1	1	1	1																1	1	1	1	
Saturdays	1	1	1	1	1	1	1	1	1	1									1	1	1	1	1	1	
Sundays	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1	1	1	1	

Legend:

1	Provide at least one ramp lane open in direction of travel
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the right shoulders. This closure must be concurrent with mainline lane closure chart No. 4. Install traffic handling devices per TH-5 and TH-6.

Chart No. 19
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Southbound	PM: CC-680 PM 14.1

Closure Limits: Olympic Blvd SB diagonal On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S					S	S	S	S	S	S					S	S	S	S	S	
Fridays	S	S	S	S	S					S	S	S	S	S				S	S	S	S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S		S	S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. This closure must be concurrent with ramp closure chart No. 21. Install traffic handling devices per TH-4 and TH-5.

Chart No. 20
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 14.27

Closure Limits: Ygnacio Valley NB diagonal Off-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	1	1	1	1	1						S	S								1	1	1	1	1	
Fridays	1	1	1	1	1					S	S										1	1	1	1	
Saturdays	1	1	1	1	1	1	1	1	1	1									1	1	1	1	1	1	
Sundays	1	1	1	1	1	1	1	1	1	1	1	1	1					1	1	1	1	1	1	1	

Legend:

1	Provide at least one ramp lane open in direction of travel
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. This closure must be concurrent with ramp closure chart No. 20 Install traffic handling devices per TH-6 and TH-7.

Chart No. 21
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 15.45

Closure Limits: N Main St N loop Off-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S										S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders.

Chart No. 22
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 15.82

Closure Limits: Lawrence Way NB hook On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S									S	S	S	S	S
Fridays	S	S	S	S	S					S	S											S	S	S	S
Saturdays	S	S	S	S	S	S	S	S	S	S										S	S	S	S	S	S
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	S

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable and pull boxes in the left and right shoulders.

Chart No. 23
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 16.05

Closure Limits: Geary Rd/Treat Blvd NB diagonal Off-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the right shoulders.

Chart No. 24
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 16.4

Closure Limits: Treat Blvd/Buskirk Ave NB slip On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. Install traffic handling devices per TH-10.

Chart No. 25
Truck Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 16.41

Closure Limits: Truck Scale On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable and pull boxes in the right shoulder.

Chart No. 26
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 16.81

Closure Limits: Buskirk Ave/Oak Rd NB hook On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. Install traffic handling devices per TH-10 and TH-11.

Chart No. 27
Complete Ramp Closure Hours

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 17.01

Closure Limits: Contra Costa Blvd NB diagonal/fly-over Off-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C															C	C	C	C	C	
Fridays	C	C	C	C	C																C	C	C	C	
Saturdays	C	C	C	C	C	C	C	C	C	C									C	C	C	C	C	C	
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C					C	C	C	C	C	C	C	

Legend:

C	Ramp may be closed completely
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Detour traffic per DE-1. No two consecutive off-ramp or on-ramp may be closed in the same direction at the same time. Use this chart for the purpose of work consisting of installing fiber optic conduit, fiber optic cable and pull boxes in the left and right shoulders. Install traffic handling devices per TH-11.

Chart No. 28a
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 17.39

Closure Limits: Monument Blvd NB diagonal Off-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. This closure must be concurrent with mainline lane closure chart No. 4. Install traffic handling devices per TH-12 and TH-13.

Chart No. 28b
Ramp Lane Requirements

County: Alameda and Contra Costa	Route/Direction: I-680 Northbound	PM: CC-680 PM 19.09

Closure Limits: Monument Blvd NB diagonal Off-ramp (concurrent with Contra Costa Blvd NB diagonal/fly-over Off-ramp closure)

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S						S	S								S	S	S	S	S	
Fridays	S	S	S	S	S					S	S										S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable, conduit, and pull boxes in the left and right shoulders. This closure must be concurrent with mainline lane closure chart No. 4 and Contra Costa Blvd NB Diagonal/fly-over off-ramp closure, per DE-1. Install traffic handling devices per TH-12 and TH-13. No two consecutive off-ramp or on-ramp may be closed in the same direction at the same time.

Chart No. 29
Complete Ramp Closure Hours

County: Alameda and Contra Costa | Route/Direction: I-680 Northbound | PM: CC-680 PM 19.09

Closure Limits: Willow Pass Rd NB diagonal Off-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	C	C	C	C	C															C	C	C	C	C	
Fridays	C	C	C	C	C																C	C	C	C	
Saturdays	C	C	C	C	C	C	C	C	C	C									C	C	C	C	C	C	
Sundays	C	C	C	C	C	C	C	C	C	C	C	C	C					C	C	C	C	C	C	C	

Legend:

C	Ramp may be closed completely
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Detour traffic per DE-2. No two consecutive off-ramp or on-ramp may be closed in the same direction at the same time. Use this chart for the purpose of work consisting of installing fiber optic cable and pull boxes in the left and right shoulders.

Chart No. 30
Ramp Lane Requirements

County: Alameda and Contra Costa | Route/Direction: I-680 Northbound | PM: CC-680 PM 20.05

Closure Limits: Concord Ave NB hook On-ramp

FROM HOUR TO HOUR	24	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Mondays through Thursdays	S	S	S	S	S															S	S	S	S	S	
Fridays	S	S	S	S	S																S	S	S	S	
Saturdays	S	S	S	S	S	S	S	S	S	S									S	S	S	S	S	S	
Sundays	S	S	S	S	S	S	S	S	S	S	S	S	S					S	S	S	S	S	S	S	

Legend:

S	Shoulder closure permitted (right/left)
	Work allowed within the highway where shoulder or lane closure is not required

REMARKS: Use this chart for the purpose of work consisting of installing fiber optic cable and pull boxes in the right shoulder.

Replace "Reserved" in section 12-4.05H with:

The following table is applicable for local agency traffic control:

Agency	Restrictions	Notes
City of Walnut Creek	Daytime closures on Ygnacio Valley Road between the hours of 9AM – 3PM. No more than 1 lane of traffic in each direction may be closed. Daytime work zone setup (non lane closures) along Ygnacio Valley Road may only occur between the hours of 7AM – 6PM. Night time lane (10PM-5AM) closures and work zone setup along Ygnacio Valley Road will require a special permit. More than 1 lane of traffic in each direction may be closed.	Mandatory pre-construction meeting with City prior to commencement of work. Contractor shall be responsible for obtaining all necessary construction permits.

The following lane closure requirements pertain to Segment II, Route 880:

Outside shoulder closures are permitted between 9am and 3 pm, Monday through Thursday. The lane adjacent to the shoulder may be closed to facilitate operations in the construction area if construction activities, vehicles, and/or construction equipment are within 6 feet of moving vehicles, where necessary during the same hours, Monday through Thursday, excluding holidays. No lane closures permitted any other time.

Center median shoulder closures are permitted between 9pm and 5am, Sunday through Thursday. The lane adjacent to the center median may be closed where necessary during the same hours, Sunday through Thursday, excluding holidays. No lane closures permitted any other time.

Ramp shoulder closures are permitted at all times except from 6am to 10am and 3pm to 7pm.

Attachment 2

IFB Part 10, Construction Details

Division IX, Section 86, Revised

86 ELECTRICAL SYSTEMS

Add to the end of the 1st paragraph of the RSS for section 86-1.01:

This work is shown on plan sheets labeled E. The work involved in each bid item is shown on a sheet with a title matching the bid item description except for the following bid items:

1. Maintaining the existing traffic management system during construction.

Add to the list in the 5th paragraph of the RSS for section 86-1.03:

14. Fiber optic pull boxes
15. Fiber optic splice vault
16. Splice Closures

Replace "Reserved" in section 86-1.06B with:

Traffic Management System (TMS) elements include, but are not limited to ramp metering (RM) system, communication system, traffic monitoring stations, video image vehicle detection system (VIVDS), microwave vehicle detection system (MVDS), loop detection system, changeable message sign (CMS) system, extinguishable message sign (EMS) system, highway advisory radio (HAR) system, closed circuit television (CCTV) camera system, roadway weather information system (RWIS), visibility sensor, and fiber optic system.

Existing TMS elements, including detection systems, shown and located within the project limits must remain in place and be protected from damage. If the construction activities require existing TMS elements to be nonoperational or off line, and if temporary or portable TMS elements are not shown, the Contractor must provide for temporary or portable TMS elements. The Contractor must receive authorization on the type of temporary or portable TMS elements and installation method.

Before work is performed, the Engineer, the Contractor, and the Department's Traffic Operations Electrical representatives must jointly conduct a pre-construction operational status check of all existing TMS elements and each element's communication status with the Traffic Management Center (TMC), including existing TMS elements not shown and elements that may not be impacted by the Contractor's activities. The Department's Traffic Operations Electrical representatives will certify the TMS elements' location and status, and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components.

The Contractor must obtain authorization at least 72 hours before interrupting existing TMS elements' communication with the TMC that will result in the elements being nonoperational or off line. The Contractor must notify the Engineer at least 72 hours before starting excavation activities.

Traffic monitoring stations and their associated communication systems, which were verified to be operational during the pre-construction operational status check, must remain operational on freeway/highway mainline at all times, except:

1. For a duration of up to 15 days on any continuous segment of the freeway/highway longer than 3 miles

2. For a duration of up to 60 days on any continuous segment of the freeway/highway shorter than 3 miles

If the construction activities require existing detection systems to be nonoperational or off line for a longer time period or the spacing between traffic monitoring stations is more than the specified criteria above, and temporary or portable detection operations are not shown, the Contractor must provide provisions for temporary or portable detection operations. The Contractor must receive authorization on the type of detection and installation before installing the temporary or portable detection.

If existing TMS elements shown or identified during the pre-construction operational status check, except traffic monitoring stations, are damaged or fail due to the Contractor's activity, where the elements are not fully functional, the Engineer must be notified immediately. If the Contractor is notified by the Engineer that existing TMS elements have been damaged, have failed or are not fully functional due to the Contractor's activity, the damaged or failed TMS elements, excluding structure-related elements, must be repaired or replaced, at the Contractor's expense, within 24 hours. For a structure-related elements, the Contractor must install temporary or portable TMS elements within 24 hours. For nonstructure-related TMS elements, the Engineer may authorize temporary or portable TMS elements for use during the construction activities.

If fiber optic cables are damaged due to the Contractor's activities, the Contractor must install new fiber optic cables from an original splice point or termination to an original splice point or termination, unless otherwise authorized. Fiber optic cable must be spliced at the splice vaults if available. The amount of new fiber optic cable slack in splice vaults and the number of new fiber optic cable splices must be equivalent to the amount of slack and number of splices existing before the damage or as directed by the Engineer. Fusion splicing will be required.

The Contractor must demonstrate that repaired or replaced elements operate in a manner equal to or better than the replaced equipment. If the Contractor fails to perform required repairs or replacement work, the Department may perform the repair or replacement work and the cost will be deducted from monies due to the Contractor.

A TMS element must be considered nonoperational or off line for the duration of time that active communications with the TMC is disrupted, resulting in messages and commands not transmitted from or to the TMS element.

The Contractor must provide provisions for replacing existing TMS elements within the project limits, including detection systems that were not identified on the plans or during the pre-construction operational status check that became damaged due to the Contractor's activities.

If the pre-construction operational status check identified existing TMS elements, then the Contractor, the Engineer, and the Department's Traffic Operations Electrical representatives must jointly conduct a post construction operational status check of all existing TMS elements and each element's communication status with the TMC. The Department's Traffic Operations Electrical representatives will certify the TMS elements' status and provide a copy of the certified list of the existing TMS elements within the project limits to the Contractor. The status list will include the operational, defined as having full functionality, and the nonoperational components. TMS elements that cease to be functional between pre and post construction status checks must be repaired at the Contractor's expense.

The Engineer will authorize the schedule for final replacement, the replacement methods and the replacement elements, including element types and installation methods before repair or

replacement work is performed. The final TMS elements must be new and of equal or better quality than the existing TMS elements.

Furnishing and installing temporary or portable TMS elements that are not shown, but are required when an existing TMS element becomes nonoperational or off line due to construction activities, is change order work.

Furnishing and installing temporary or portable TMS elements and replacing TMS elements that are not shown nor identified during the pre-construction operational status check and were damaged by construction activities is change order work.

If the Contractor is required to submit provisions for the replacement of TMS elements that were not identified, submitting the provisions is change order work.

Add to section 86-2.05A:

Conduit installed underground must be Type 1 or Type 3.

Add to section 86-2.05B:

The conduit in a foundation and between a foundation and the nearest pull box must be Type 1 or Type 3.

Add to section 86-2.05C:

If a standard coupling cannot be used for joining Type 1 conduit, use a UL-listed threaded union coupling under section 86-2.05C, a concrete-tight split coupling, or a concrete-tight set screw coupling.

If Type 3 conduit is placed in a trench, not in the pavement or under concrete sidewalk, after the bedding material is placed and the conduit is installed, backfill the trench to not less than 4 inches above the conduit with minor concrete under section 90-2, except the concrete must contain not less than 421 pounds of cementitious material per cubic yard. Backfill the remaining trench to finished grade with backfill material.

After conductors have been installed, the ends of the conduits terminating in pull boxes, service equipment enclosures, and controller cabinets must be sealed with an authorized type of sealing compound.

At those locations where conduit is required to be installed under pavement and underground facilities designated as high priority subsurface installation under Govt Code § 4216 et seq. exist, conduit must be placed by the trenching in pavement method under section 86-2.05C.

At other locations where conduit is required to be installed under pavement and if a delay to vehicles will not exceed 5 minutes, conduit may be installed by the trenching in pavement method.

The final 2 feet of conduit entering a pull box in a reinforced concrete structure may be Type 4.

Add to end of Section 86-2.05C:

Install conduit by the directional boring method with the approval of the Engineer as shown or as specified in these special provisions.

Notify the Engineer 2 working days before starting directional boring operations.

Include the location and the equipment to be used in the advance notice to the Engineer.

Perform directional boring operations in the presence of the Engineer unless otherwise notified by the Engineer.

Conduit installed by the directional bore method must comply with section 86-2.05A.

Install conduit to a minimum depth of 3 ft. below finished grade.

The diameter of the boring tool must be 1.5 times the outside diameter of the conduit. Use only mineral slurry or wetting solution to lubricate the boring tool and to stabilize the soil surrounding the boring path. Mineral slurry or wetting solution must be water based and environmentally safe.

Comply with Section 86-5.01A (4) for disposing residue from directional boring operations.

The directional boring equipment must have directional control of the boring tool and must have an electronic tool location detection system. During operation, the directional bore equipment must be able to determine the location of the tool both horizontally and vertically.

The directional boring equipment must be equipped with a tension measuring device that indicates the amount of tension exerted on conduit during conduit pulling operations.

Provide a layout and a profile plot to the Engineer showing the location of the bore to a resolution of 6 inches.

You must have direct charge and control of the directional bore operation at all times.

Do not use slurry cement backfill where the directional boring method is used.

Reform schedule 40 conduit with a mandrel after installation.

Add to section 86-2.05C:

Install conduit by the directional boring method when cellular concrete or expanded polystyrene as indicated on the plans. You must use a drill head that can cleanly cut through this material.

Slurry seal must be injected into the drilled hole once conduit has been installed.

Slurry Seal shall consist of a mixture as approved by the Engineer. Slurry seal mixture shall be designed to maintain the overall strength of the cellular concrete and expanded polystyrene blocks and shall be of equal or greater strength.

Use practices to prevent the discharge of slurry cement material into storm drain systems and receiving waters. Cover drainage inlets during the application of slurry seal. You shall remove any debris associated with the performance of the work on a daily basis.

Replace the 3rd paragraph in section 86-2.06A (2) of the RSS for section 86-2.06 with:

In a ground or sidewalk area, embed the bottom of a pull box in crushed rock.

Replace "Reserved" in section 86-2.06B of the RSS for section 86-2.06 with:

86-2.06B(1) General

86-2.06B(1)(a) Summary

Section 86-2.06B includes specifications for installing non-traffic-rated pull boxes.

86-2.06B(1)(b) Submittals

Before shipping pull boxes to the job site, submit a list of materials used to fabricate the pull boxes to METS. Include:

1. Contract number
2. Manufacturer's name
3. Manufacturer's installation instructions
4. Your contact information

Submit reports for pull boxes from an NRTL-accredited laboratory.

Before installing a pull box and cover, submit the manufacturer's replacement warranty for them.

86-2.06B(1)(c) Quality Control and Assurance

86-2.06B(1)(c)(i) Functional Testing

The pull box and cover must be tested under ANSI/SCTE 77, "Specification for Underground Enclosure Integrity."

86-2.06B(1)(c)(ii) Warranty

Provide a 2-year manufacturer's replacement warranty for the pull box and cover. The warranty period starts on the date of Contract acceptance.

Deliver replacement parts within 5 business days after you receive notification of a failed pull box, cover, or both to the Department's Maintenance Electrical Shop at:

CALTRANS MAINTENANCE STATION
30 RICKARD STREET
SAN FRANCISCO, CA 94134

86-2.06B(2) Materials

The pull box and cover must comply with ANSI/SCTE 77, "Specification for Underground Enclosure Integrity," for tier 22 load rating and must be gray or brown.

Each pull box cover must have an electronic marker cast inside.

A pull box extension must be made of the same material as the pull box and attached to the box to maintain the minimum combined depths.

Include recesses for a hanger if a transformer or other device must be placed in a pull box.

The bolts, nuts, and washers must be a captive design.

The captive bolt must be capable of withstanding a torque from 55 to 60 ft-lb and a minimum pull-out strength of 750 lb. Perform the test with the cover in place and the bolts torqued. The pull box and cover must not be damaged while performing the test.

Hardware must be stainless steel with 18 percent chromium and 8 percent nickel content.

Galvanize ferrous metal parts under section 75-1.05.

The manufacturer's instructions must include:

1. Quantity and size of entries that can be made without degrading the strength of the pull box below the tier 22 load rating
2. Locations where side entries cannot be made
3. Acceptable method for creating the entry

The tier 22 load rating must be labeled or stenciled by the manufacturer on the inside and outside of the pull box and on the underside of the cover.

86-2.06B(3) Construction

Do not install a pull box in curb ramps or driveways.

A pull box for a post or a pole standard must be located within 5 feet of the standard. Place the pull box adjacent to the back of the curb or edge of the shoulder. If this is impractical, place the pull box in a suitable, protected, and accessible location.

Cover the pull box with a plastic sheet and then bury it in soil from 6 to 8 inches below grade.

Plastic sheets must be 20 mil thick and made of HDPE or PVC virgin compounds.

Add to section 86-2.08A:

Wrap conductors around the projecting end of conduit in pull boxes as shown. Secure conductors and cables to the projecting end of the conduit in pull boxes.

Add to section 86-2.09B:

Before the installation of the new conductors and cables, all new and existing conduits must be cleaned with a mandrel or cylindrical wire brush and blown out with compressed air to ensure that no blockage or damage is caused to conduits.

Add to section 86-2.11A:

Continuous welding of exterior seams in service equipment enclosures is not required.

Circuit breakers must be the cable-in/cable-out type mounted on non-energized clips. All circuit breakers must be mounted vertically with the up position of the handle being the "ON" position.

Each service must be provided with up to 2 main circuit breakers that will disconnect ungrounded service entrance conductors. Where the "Main" circuit breaker consists of 2 circuit breakers as described, each of the circuit breakers must have a minimum interrupting capacity of 10,000 A, rms.

Replace section 86-2.18 with:

Replace 1st paragraph of section 86-2.18 with:

Place numbers on the equipment as ordered.

Add to section 86-2:

86-2.19 FIBER OPTIC SYSTEM

86-2.19(A) Fiber Optic Glossary

Active Component Link Loss Budget -- The active component link loss budget is the difference between the average transmitter launch power (in dBm) and the receiver maximum sensitivity (in dBm).

Backbone -- Fiber cable that provides connections between the TMC and hubs, as well as between equipment rooms or buildings, and between hubs. The term is used interchangeably with "trunk" cable.

Breakout -- The cable "breakout" is produced by (1) removing the jacket just beyond the last tie-wrap point, (2) exposing 3 to 6 feet of the cable buffers, aramid strength yarn and central fiberglass strength member, and (3) cutting aramid yarn, central strength member and the buffer tubes to expose the individual glass fibers for splicing or connection to the appropriate device.

Connector -- A mechanical device used to align and join two fibers together to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (i.e., patch panel).

Connectorized -- A term that describes the termination point of a fiber after connectors have been affixed.

Connector Module Housing (CMH) -- A patch panel used in the FDU to terminate single mode fibers with most common connector types. It may include a jumper storage shelf and a hinged door.

Couplers -- Couplers are devices which mate two fiber optic connectors to facilitate the transition of optical light signals from one connector into another. Couplers may also be referred to as: adapters, feed-throughs, and barrels. They are normally located within FDUs mounted in panels. They may also be used unmounted, to join two simplex fiber runs.

Distribution Cable -- Fiber cable that provides connections between hubs. Drop cables are typically spliced into a distribution cable.

End-to-End Loss -- The maximum permissible end-to-end system attenuation is the total loss in a given link. This loss could be the actual measured loss, or calculated using typical (or specified) values. A designer should use typical values to calculate the end-to-end loss for a proposed link. This number will determine the amount of optical power (in dB) needed to meet the System Performance Margin.

Fan Out Termination -- Permits the branching of fibers contained in an optical cable into individual cables and can be done at field locations; thus, allowing the cables to be connectorized or terminated per system requirements. A kit provides pull-out protection for individual bare fibers to support termination. It provides three layers of protection consisting of a Teflon inner tube, a dielectric strength member, and an outer protective PVC jacket.

FBC -- Fiber Backbone Cable.

Fiber Distribution Unit (FDU) -- A rack mountable enclosure containing both a Connector Module Housing (CMH) and a Splice Module Housing (SMH).

Fiber Storage Enclosure (FSE) -- Designed for holding excess cable slack for protection. The FSE allows the user flexibility in equipment location and the ability to pull cable back for resplicing.

F/O -- Fiber optic.

FOIP -- Fiber optic inside plant cable.

FOOP -- Fiber optic outside plant cable.

FOTP -- Fiber optic test procedure(s) as defined by TIA/EIA standards.

FPC -- Fiber Pigtail Cable

FTC -- Fiber Trunkline Cable

Light Source -- A portable fiber optic test equipment that, in conjunction with a power meter, is used to perform end-to-end attenuation testing. It contains a stabilized light source operating at the designed wavelength of the system under test. It also couples light from the source into the fiber to be received at the far end by the receiver.

Link -- A passive section of the system, the ends of which are connectorized. A link may include splices and couplers. For example, a video data link may be from video F/O transmitter to video F/O receiver.

Link Loss Budget -- A calculation of the overall permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector).

Loose Tube Cable -- Type of cable construction in which fibers are placed in buffer tubes to isolate them from outside forces (stress). A flooding compound or material is applied to the interstitial cable core to prevent water migration and penetration. This type of cable is primarily for outdoor applications.

Mid-span Access Method -- Description of a procedure in which fibers from a single buffer tube are accessed and spliced to an adjoining cable without cutting the unused fibers in the buffer tube, or disturbing the remaining buffer tubes in the cable.

MMFO -- Multimode Fiber Optic Cable.

Optical Time Domain Reflectometer (OTDR) -- Fiber optic test equipment similar in appearance to an oscilloscope that is used to measure the total amount of power loss in a F/O cable between two points. It provides a visual and printed display of the losses associated with system components such as fiber, splices and connectors.

Optical Attenuator -- An optical element that reduces the intensity of a signal passing through it.

Patch Cord -- A short jumper used to join two Connector Module Housing (CMH) couplers, and or a CMH and an active optical electronic device.

Pigtail -- Relatively short length of fiber optic cable that is connectorized on only one end. All pigtails shall be tight buffer cable.

Power Meter -- A portable fiber optic test equipment that, when coupled with a light source, is used to perform end-to-end attenuation testing. It contains a detector that is sensitive to light at the designed wavelength of the system under test. Its display indicates the amount of power injected by the light source that arrives at the receiving end of the link. Segment - A section of

F/O cable that is not connected to any active device and may or may not have splices per the design.

Segment -- A section of fiber optic cable that is not connected to any active device and may or may not have splices per the design.

SMFO -- Single mode Fiber Optic Cable.

Splice -- The permanent joining of two fiber ends using a fusion splicer.

Splice Closure -- A environmentally sealed container used to organize and protect splice trays. The container allows splitting or routing of fiber cables from multiple locations. Normally installed in a splice vault.

Splice Module Housing (SMH) -- A unit that stores splice trays as well as pigtails and short cable lengths. The unit allows splitting or routing of fiber cables from and to multiple locations.

Splice Tray -- A container used to organize and protect spliced fibers.

Splice Vault -- An underground container used to house excess cable and splice closures.

System Performance Margin -- A calculation of the overall "End to End" permissible attenuation from the fiber optic transmitter (source) to the fiber optic receiver (detector). The system performance margin should be at least 6 dB. This includes the difference between the active component link loss budget, the passive cable attenuation (total fiber loss) and the total connector/splice loss.

Tight Buffer Cable -- Type of non-breakout cable construction where each glass fiber is tightly buffered (directly coated) with a protective thermoplastic coating to 900 µm with the exception of the protective thermoplastic coating. The tight buffer cable shall meet all the characteristics of the fiber in the fiber optic outside plant cable specified elsewhere in these specifications.

86-2.19(B) Fiber Optic Cable

General

Each fiber optic outside plant cable (FOOP) for this project shall be all dielectric, gel filled or water-blocking material, duct type, with loose buffer tube construction with a maximum outside diameter of 0.55 inch and shall conform to these special provisions. Cables shall contain single mode (SM) dual-window (1310 nm and 1550 nm) fibers with the numbers described below and as shown on the plans:

Cable Sizes

Cable Size	Number and Type of Fibers

288 SMFO	288 SM Fibers
144 SMFO	144 SM Fibers
72 SMFO	72 SM Fibers
48 SMFO	48 SM Fibers
24 SMFO	24 SM Fibers
12 SMFO	12 SM Fibers
6 SMFO	6 SM Fibers

The optical fibers shall be contained within loose buffer tubes. The loose buffer tubes shall be stranded around an all-dielectric central member. Aramid yarn shall be used as a primary strength member, and a polyethylene outside jacket shall provide for overall protection.

All F/O cable of each specific type shall be from the same manufacturer, who is regularly engaged in the production of this material.

The cable shall be qualified as compliant with Chapter XV11, Title 7, Part 1755.900 of the Code of Federal Regulations, "REA Specification for Filled Fiber Optic Cables"

Fiber Characteristics

Each optical fiber shall be made of glass and consists of a doped silica core surrounded by concentric silica cladding. All fibers in the buffer tube shall be usable fibers, and shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of these specifications. The required fiber grade shall reflect the maximum individual fiber attenuation, to guarantee the required performance of each and every fiber in the cable.

The coating shall be a dual layered, UV cured acrylate and shall be mechanically or chemically strippable without damaging the fiber.

The cable shall comply with the optical and mechanical requirements over an operating temperature range of -40° to +158°F. The cable shall be tested in accordance with EIA-455-3A (FOTP-3), "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components”. The change in attenuation at extreme operational temperatures (-40° to +158°F) for single mode fiber shall not be greater than 0.20 dB/km, with 80 percent of the measured values no greater than 0.10 dB/km. The single mode fiber attenuation shall be measured at 1550 nm.

For all fibers, the attenuation specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable. Fibers within the finished cable shall meet the requirements in the following table:

Parameters	**Characteristic**
Type	Step Index
Core diameter	8.3 μm (nominal)
Cladding diameter	125 μm ±1.0 μm
Core to Cladding Offset	≤1.0 μm
Coating Diameter	250 μm ±15 μm
Cladding Non-circularity defined as: [1-(min. cladding diameter ÷max. cladding dia.)]x100	≤2.0%
Proof/Tensile Test	50 kpsi, min.
Attenuation: @1310 nm @1550 nm	 ≤0.4 dB/km ≤0.3 dB/km
Attenuation at the Water Peak	≤2.1 dB/km @
Bandwidth: @ 850 nm @1310 nm (SM)	 N/A N/A
Chromatic Dispersion: Zero Dispersion Wavelength Zero Dispersion Slope	 1301.5 to 1321.5 nm ≤0.092 ps/(nm2*km)
Maximum Dispersion:	≤3.3 ps/(nm*km) for 1285 - 1330 nm <18 ps/(nm*km) for 1550 nm
Cut-Off Wavelength	<1250 nm
Mode Field Diameter (Petermann II)	9.3 ±0.5 μm at 1300 nm 10.5 ±1.0 μm at 1550 nm

Color Coding
In buffer tubes containing multiple fibers, each fiber shall be distinguishable from others in the same tube by means of color coding according to the following:

Fiber Optic Strand Color Assignment

Fiber No.	Fiber Color
1	Blue (BL)
2	Orange (OR)
3	Green (GR)
4	Brown (BR)
5	Slate (SL)
6	White (WH)
7	Red (RD)
8	Black (BK)
9	Yellow (YL)
10	Violet (VL)
11	Rose (RS)
12	Aqua (AQ)

Buffer tubes containing fibers shall also be color coded with distinct and recognizable colors according to the same table listed above for fibers.

The colors shall be targeted in accordance with the Munsell color shades and shall meet EIA/TIA 598 "Color Coding of Fiber Optic Cables".

The color formulation shall be compatible with the fiber coating and the buffer tube filling compound, and be heat stable. It shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

Cable Construction
Fiber optic cable samples, 12 feet in length, with part numbers, catalogue information, and documents from manufacturer shall be submitted to the Engineer.

The fiber optic cable shall consist of, but not be limited to, the following components:

1. Buffer tubes
2. Central member
3. Filler rods
4. Stranding
5. Core and cable flooding
6. Tensile strength member
7. Ripcord
8. Outer jacket

Buffer Tubes: Clearance shall be provided in the loose buffer tubes between the fibers and the inside of the tube to allow for expansion without constraining the fiber. The fibers shall be loose or suspended within the tubes. The fibers shall not adhere to the inside of the buffer tube.
Each buffer tube shall contain one, six, or a maximum of 12 fibers.

The loose buffer tubes shall be extruded from a material having a coefficient of friction sufficiently low to allow free movement of the fibers. The material shall be tough and abrasion resistant to provide mechanical and environmental protection of the fibers, yet designed to permit safe intentional "scoring" and breakout, without damaging or degrading the internal fibers.

For water migration resistance, each loose buffer tube shall contain a water-swellable yarn or a homogeneous hydrocarbon-based gel with anti-oxidant additives. The filling compound shall be non-toxic and dermatologically safe to exposed skin. It shall be chemically and mechanically compatible with all cable components, non-nutritive to fungus, non-hygroscopic and electrically non-conductive. The filling compound shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

Buffer tubes shall be stranded around a central member by a method that will prevent stress on the fibers when the cable jacket is placed under strain, such as the reverse oscillation stranding process.

Each buffer tube shall be distinguishable from other buffer tubes in the cable by means of the color coding as specified above for the fibers.

Central Member: The central member, which functions as an anti-buckling element, shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers and buffer tubes. A linear overcoat of low density polyethylene shall be applied to the central member to achieve the optimum diameter to provide the proper spacing between buffer tubes during stranding.

Filler Rods: Filler rods may be included in the cable to maintain the symmetry of the cable cross-section. Filler rods shall be solid medium or high-density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.

Stranding: Completed buffer tubes shall be stranded around the overcoated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

Core and Cable Flooding: The cable core shall contain a water-blocking material or the cable core interstices shall be filled with a polyolefin based compound to prevent water ingress and migration. The water blocking material or the flooding compound shall be homogeneous, non-hygroscopic, electrically non-conductive, and non-nutritive to fungus. The core shall be free from dirt and foreign matter and shall be readily removable with conventional nontoxic solvents.

The compound shall also be nontoxic, dermatologically safe and compatible with all other cable components.

Tensile Strength Member: Tensile strength shall be provided by high tensile strength aramid yarns and fiberglass which shall be helically stranded evenly around the cable core and shall not adhere to other cable components.

Ripcord: The cable shall contain at least one ripcord under the jacket for easy sheath removal.

Outer Jacket: The jacket shall be free of holes, splits, and blisters and shall be medium or high density polyethylene (PE), or medium density cross-linked polyethylene with minimum nominal

jacket thickness of 1000 µm ±76 µm. Jacketing material shall be applied directly over the tensile strength members and flooding compound and shall not adhere to the aramid strength material. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The jacket or sheath shall be marked with the manufacturer's name, the words "Optical Cable", the number of fibers, "SM," year of manufacture, and sequential measurement markings every meter. The actual length of the cable shall be within -0/+1 percent of the length marking.

The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be approximately 0.1 inch.

Strand Steel Messenger: (for temporary aerial fiber optic cable): The messenger shall be covered by a rugged, durable, and easy strap polyethylene jacket. The jacket shall be free of holes, splits, and blisters.

The fiber optic cable samples (3 foot length) as well as its catalogue shall be submitted to the Engineer.

General Cable Performance Specifications

The F/O cable shall withstand water penetration when tested with a 3 feet static head or equivalent continuous pressure applied at one end of a 3 feet length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with EIA-455-82 (FOTP-82), "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable."

A representative sample of cable shall be tested in accordance with EIA-455-81A, "Compound Flow (Drip) Test for Filled Fiber Optic Cable." The test sample shall be prepared in accordance with Method A. The cable shall exhibit no flow (drip or leak) at 80°C as defined in the test method.

Crush resistance of the finished F/O cables shall be 115 lbs/in applied uniformly over the length of the cable without showing evidence of cracking or splitting when tested in accordance with EIA-455-41 (FOTP-41) "Compressive Loading Resistance of Fiber Optic Cables". The average increase in attenuation for the fibers shall be ≤0.10 dB at 1550 nm for a cable subjected to this load. The cable shall not exhibit any measurable increase in attenuation after removal of load. Testing shall be in accordance with EIA-455-41 (FOTP-41), except that the load shall be applied at the rate of 0.12" to 0.74" per minute and maintained for 10 minutes.

The cable shall withstand 25 cycles of mechanical flexing at a rate of 30 ±1 cycles/minute. The average increase in attenuation for the fibers shall be ≤0.20 dB at 1550 nm at the completion of the test. Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure. The test shall be conducted in accordance with EIA-455-104 (FOTP-104), "Fiber Optic Cable Cyclic Flexing Test", with the sheave diameter a maximum of 20 times the outside diameter of the cable. The cable shall be tested in accordance with Test Conditions I and II of (FOTP-104).

Impact testing shall be conducted in accordance with EIA-455-25 (FOTP-25) "Impact Testing of Fiber Optic Cables and Cable Assemblies". The cable shall withstand 20 impact cycles. The

average increase in attenuation for the fibers shall be ≤0.20 dB at 1550 nm. The cable jacket shall not exhibit evidence of cracking or splitting.

The finished cable shall withstand a tensile load of 600 lbfs without exhibiting an average increase in attenuation of greater than 0.20 dB. The test shall be conducted in accordance with EIA-455-33 (FOTP-33), "Fiber Optic Cable Tensile Loading and Bending Test". The load shall be applied for one-half hour in Test Condition II of the EIA-455-33 (FOTP-33) procedure.

Packaging and Shipping Requirements

Documentation of compliance to the required specifications shall be provided to the Engineer prior to ordering the material.

Attention is directed to "Fiber Optic Testing," elsewhere in these special provisions.

The completed cable shall be packaged for shipment on reels. The cable shall be wrapped in a weather and temperature resistant covering. Both ends of the cable shall be sealed to prevent the ingress of moisture.

Each end of the cable shall be securely fastened to the reel to prevent the cable from coming loose during transit. Two meters of cable length on each end of the cable shall be accessible for testing.

Each cable reel shall have a durable weatherproof label or tag showing the manufacturer's name, the cable type, the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number. A shipping record shall be provided to the Engineer in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation, bandwidth, etc.), factory test results, cable identification number and any other pertinent information

The minimum hub diameter of the reel shall be at least thirty times the diameter of the cable. The F/O cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

86-2.19(C) Fiber Optic Installation

Fiber optic cable shall be installed in conduit system as show on the plans. Fiber optic conduit system shall consist of conduits, fiber optic pull boxes and fiber optic splice vaults or cabinets.

There shall be no re-use fiber optic cable for the installation.

Installation procedures shall be in conformance with the procedures specified by the cable manufacturer for the specific cable being installed. The Contractor shall submit to the engineer the manufacturer's recommended procedures for pulling fiber optic cable at least 20 working days prior to installing cable. Mechanical aids may be used, provided that a tension measuring device is placed in tension to the end of the cable. The tension applied shall not exceed 500 lb-force or the manufacturers recommended pulling tension, whichever is less.

The F/O cable shall be installed using a cable pulling lubricant recommended by the cable manufacture and a non-abrasive pull tape conforming to the provisions described under "Conduit" elsewhere in these special provisions. Contractor's personnel shall be stationed at each

pull box, vault and cabinet through which the cable is pulled to lubricate and prevent kinking or other damage.

During cable installation, the bend radius shall be maintained at not less than twenty times the outside diameter of the cable. .The cable grips for installing the fiber optic cable shall have a ball bearing swivel to prevent the cable from twisting during installation. At the Contractor's option, the fiber cable may be installed using the air blown method. If integral innerduct is used, the duct splice points or any temporary splices of innerduct used for installation must withstand a static air pressure of 110 psi.

The fiber installation equipment must incorporate a mechanical drive unit or pusher, which feeds cable into the pressurized innerduct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow. The unit must be equipped with controls to regulate the flow rate of compressed air entering the duct and any hydraulic or pneumatic pressure applied to the cable. It must accommodate longitudinally ribbed or smooth wall ducts from nominal 0.625-inchto 2-inch inner diameter. Mid assist or cascading of equipment must be for the installation of long cable runs. The equipment must incorporate safety shutoff valves to disable the system in the event of sudden changes in pneumatic or hydraulic pressure.

The equipment must not require the use of a piston or any other air capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct. It must incorporate the use of a counting device to determine the speed of the cable during installation and the length of the cable installed. The cable shall be installed without splices except where specifically allowed on the plans or described in these special provisions. Minimum slack of the cable as shown on the plans shall be provided at each cable access location without a cable splice. At fiber optic splice location, a minimum of 30 feet slack of each cable shall be stored in the splice location.

The Contractor shall furnish and install conduit dividers to allow the fiber-optic cable to be installed over the existing cables or conductors. Conduit dividers shall have a minimum of two cells and be installed according to the manufacturer's recommendations. The conduit divider shall be installed on top of existing cables or conductors, and the fiber-optic cable installed in one of the cells. Conduit dividers shall be MaxCell by TVC Communications, or approved equal. Rigid or semi-rigid innerduct is not allowed. Conduit dividers are not required for empty conduits. Furnishing and installation of conduit dividers shall be considered incidental to the installation of fiber optic cable.

86-2.19(D) Colored Concrete Backfill

The concrete backfill for the installation of fiber optic conduits in trench shall be a medium to dark, red color to clearly distinguish the concrete backfill from other concrete and soil. The concrete shall be pigmented by the addition of commercial quality cement pigment to the concrete mix. The red concrete pigment shall be LM Scofield Company; Orange Chromix

Colorant; Davis Colors; or equal. The concrete shall conform to the provisions in said Section 90-10, "Minor Concrete."

For trenches in pavement areas, only the top 4 inch of concrete backfill will be required to be pigmented concrete. At the option of the Contractor, the full depth may have the pigment.

86-2.19(E) Fiber Optic Pull Box

Each fiber optic pull box must conform to the requirements in Section 86-2.06, "Pull Boxes," of the Standard Specifications for No. 6 with extensions and as shown on the plans. Pull box cover and extensions may be constructed of reinforced portland cement concrete or of non-PCC material with concrete gray color.

Conduits must not protrude more than 2 inches inside the pull box and shall enter the pull box at about 20 degrees in both the vertical and horizontal directions. Watertight sealing plugs as specified elsewhere in these special provisions are required around all conduits.

86-2.19(F) Fiber Optic Splice Vault

Fiber optic splice vaults shall be 52" (L) x 34" (W) x 30" (D) nominal inside dimensions. Covers shall be in one or two sections. Hold down bolts or cap screws and nuts shall be of brass, stainless steel or other non-corroding metal material. Each cover portion shall have inset lifting pull slots. Cover marking shall be “BAIFA TOS COMMUNICATION” on the cover. Vault, cover and extensions may be constructed of reinforced portland cement concrete or of non-PCC material with concrete gray color.

Non-PCC vaults and covers shall be of sufficient rigidity that when a 100 lb concentrated point force is applied perpendicularly to the midpoint of one of the long sides at the top while the opposite long side is supported by a rigid surface, it shall be possible to remove the cover without the use of tools. When a vertical force of 1500 lb is applied, through a 0.5" x 3" x 6" steel plate, to a non-PCC cover in place on a splice vault, the cover shall not fail and shall not deflect more than 0.25".

Fiber optic vaults shall be installed as detailed and as shown on the plans. All fiber optic vaults and covers shall have an AASHTO HS 20-44 rating. Fiber optic vaults shall be installed at grade. Metallic or non-metallic cable racks shall be installed on the interior of both long sides of the fiber optic vaults. The racks shall be capable of supporting a load of 100 lb, minimum, per rack arm. Racks shall be supplied in lengths appropriate to the box in which they will be placed.

All metallic cable racks shall be fabricated from ASTM Designation: A36 steel plate and shall be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing shall be in accordance with the requirements of Section 75, “Miscellaneous Metal,” of the Standard Specifications. Metallic cable racks shall be bonded and grounded. All metallic or non-metallic cable racks shall be installed on the interior of both long sides of the fiber optic vaults. The racks shall be capable of supporting a load of 100 lb., minimum, per rack arm. Racks shall be supplied in lengths appropriate to the box in which they will be placed. All metallic cable racks shall be fabricated from ASTM Designation: A36 steel plate and shall be hot-dip galvanized after fabrication. Steel plate, hardware and galvanizing shall be in accordance with the requirements of Section 75, “Miscellaneous Metal”, of the Standard Specifications. Metallic cable racks shall be bonded and grounded.

Unless otherwise shown on the plans or as directed by the Engineer, vaults shall be located outside the pavement with the lid centerline five feet from the edge of the pavement or back of

the dike. Vaults may be moved farther from the roadway to accommodate buried objects, existing conduits, or similar items that prevent installation 5 feet from the pavement, but no part of the vault, concrete encasement ring, or backfill material shall be less than 18 inches from the edge of the pavement or back of the dike, to allow for future electrical conduit installations between the vault and roadway. The top of the vault lid shall match the final grade within one inch +/-0.5 inch.

Some locations along the roadway may have existing conduits, pipes, or drains parallel to the roadway and next to the shoulder, which may make it impossible to route conduits to the vault. At other locations, buried objects, steep drop-offs, or other object may make installation of a vault outside the pavement impossible. At these locations or as directed by the Engineer, vaults may be installed in the pavement of the shoulder or in the pavement of chain on/off areas. Vaults placed inside the pavement shall be installed with the centerline of the vault not more 3 feet from the edge of pavement or back of dike, and with the entire top of vault lid 0.1 inch +/- 0.05 inch below the surface of the pavement, when all pavement work specified in the job is completed.

Vaults located at bridges where exposed conduit must be used, such as at undercrossings, shall be located as close as possible to the end of the structure unless otherwise specified on the plans, If not specified otherwise in the plans, the location of vaults at bridge structures shall be between the first and second guardrail posts. Unless otherwise directed by the Engineer, the top of the vault lid at these locations shall be located entirely behind the guardrail and shall conform to the final grade of the surrounding fill at the vault location. No part of the vault or vault lid shall be exposed or extend past the edge of the hinge point for the bridge, or otherwise deform the earth fill at the vault location.

Conduits shall enter the fiber optic vault through the sidewall at not more than 6 inches from the bottom of the vault. Conduits shall not enter through the bottom of the vault. Conduits shall not protrude more than two inches inside the pull box and shall enter the vault at about 20 degrees in both the vertical and horizontal directions. Watertight sealing plugs as specified elsewhere in these special provisions are required around all conduits.

86-2.19(G) Communication Conduit Anchors

Anchors used to attach communication conduits (electrical conduits) to the exterior surfaces of existing concrete structures and walls consist of metal straps and anchoring devices. Metal straps must be made of steel and must be fabricated to the details and dimensions shown on the plans. Anchoring devices must consist of mechanical expansion stud anchors. Anchors must conform to the provisions in Section 75-1.03, "Miscellaneous Bridge Metal," of the Standard Specifications.

When communication conduits are installed vertically on a structure for a distance of 2 feet or more, but less than 10 feet, an anchor must be installed at the top and bottom of the pipe within 0.5-foot of the elbows. Vertical distances of 10 feet or more must have anchors installed at 10 feet on centers unless otherwise shown on the plans. Anchors used to support vertically installed pipe and conduit must be installed as shown on the plans.

Holes for anchorage devices must conform to the following:

A. Reinforcing steel must be located by nondestructive means before drilling holes for anchors. Holes must not be drilled closer than 0.5-foot to the edge of a concrete structure.
B. Holes must be drilled with rotary drills. Impact drills must not be used. Coring is not allowed.

C. Holes must be relocated if reinforcing steel is encountered. Abandoned holes must be filled with portland cement concrete mortar conforming to the provisions in Section 51-1.135, "Mortar," of the Standard Specifications.
D. Holes must be drilled to a minimum depth of 8 times the diameter of the anchor bolt or stud anchor.
E. Anchors must be on the Department approved list for Mechanical Expansion Anchors and installed per recommendations by manufacturer:

http://www.dot.ca.gov/hq/esc/approved_products_list/

86-2.19(H) Conduit Sealing Plugs

Sealing plugs must be removable and reusable. Sealing plugs must be the split type that permits installation or removal without removing cables. Sealing plugs must seal the conduit simultaneously with one self contained assembly having an adjustable resilient filler of neoprene or silicone rubber clamped between backing ends and compressed with stainless steel hardware.

To provide suitable sealing between future varying size cables and the plugs, split neoprene or silicone adapting sleeves used singularly or in multiples must be inserted within the body of the plugs. Sealing plugs used to seal the fiber optic conduit must be capable of withstanding a pressure of 5 psi. A sealing plug that seals an empty conduit must have an eye or other type of capturing device on the side of the plug that enters the conduit to attach onto the pull tape so that the pull tape will be easily accessible when the plug is removed.

86-2.19(I) Warning Tape

Warning tape must be furnished, and installed in the trench over new conduits for fiber optic cable as shown on the plans.

The warning tape must have:

DESCRIPTION	PARAMETERS
Thickness	Minimum 4 mil
Width	4 inches
Material	Orange color polyolefin film
Tensile strength of material	Minimum of 2800 psi
Elongation	Minimum of 500 percent elongation before breakage
Printed message content	CAUTION: BURIED FIBER OPTIC CABLE CALTRANS RADIO ROOM (510) 286-4444
Printed message text height and color	1 inch, black color text over bright orange background
Message spacing intervals	3 feet

The printed message content warning must not be removed by the normal handling and burial of the tape and must be rated to last the service life of the tape. Warning tape must not delaminate when it is wet. It must be resistant to insects, acid, alkaline and other corrosive elements in the soil.

Full compensation for furnishing and installing the warning tape must be considered as included in the contract lump sum price paid for Traffic Operations System and no additional compensation will be allowed therefore.

Warning tape must be as manufactured by Condux International, Inc.; Allen System, Inc.; Reef Industries, Inc. or approved equal.

86-2.19(J) Cable Marker

Cable markers must be as shown on the plans or placed at 50 feet spacing for fiber optic conduits constructed in unpaved locations. These markers shall conform to Standard Plan A73C, Class 1, Type F, flexible post delineators, except that the marker shall be non-reflective. The following text shall be written on each marker: "WARNING, FIBER OPTIC CABLE, call 72 Hours before You Dig, 1-510-286-4444, COMMUNICATIONS" See details on the plans.

86-2.19(K) Tracer Wire

Tracer wire shall be provided and placed in the conduits containing fiber optic cable.

Tracer wire shall be No. 8 stranded, minimum, copper conductor with type TW, THW, RHW, or USE insulation. The tracer wire shall form a mechanically and electrically continuous line throughout the length of the trench. A minimum of five feet of slack shall be extended into each pull box and splice vault from each direction. The wires shall be carefully placed so as not to be damaged by backfilling operations.

Conduit entering or exiting a reinforced concrete structure will not require tracer wire to the first pull box or fiber optic splice box. Tracer wire may be spliced at intervals of not less than 500 feet and in pull boxes. Splices shall conform to the provisions in Section 86-2.09, "Wiring", of the Standard Specifications.

86-2.19(L) Cable Splicing

Field splices shall be done either in splice vaults or cabinets as shown on the plans. All splices in splice vaults shall be done in splice trays, housed in splice closures. All splices in cabinets shall be done in splice trays housed in FDU's.

Unless otherwise specified, fiber splices shall be the fusion type. The mean splice loss shall not exceed 0.1 dB per splice. The mean splice loss shall be obtained by measuring the loss through the splice in both directions and then averaging the resultant values.

The mid-span access method shall be used to access the individual fibers in a cable for splicing to another cable as shown on the plans. Cable manufacturers recommended procedures and approved tools shall be used when performing a mid-span access. Only the fibers to be spliced may be cut. All measures shall be taken to avoid damaging buffer tubes and individual fibers not being including those not used in the mid-span access.

The individual fibers shall be looped one full turn within the splice tray to avoid micro bending. A two-inch minimum bend radius shall be maintained during installation and after final assembly in the optical fiber splice tray. Each bare fiber shall be individually restrained in a splice tray. The optical fibers in buffer tubes and the placement of the bare optical fibers in the splice tray shall be such that there is no discernable tensile force on the optical fiber.

All splices shall be protected with a metal reinforced thermal shrink sleeve.

The Contractor will be allowed to splice a total of two fibers to repair any damage done during mid-span access splicing without penalty. The Contractor will be assessed a fine of $300.00 for each additional and unplanned splice. Any single fiber may not have more than three unplanned splices. If any fiber requires more than three unplanned splices, the entire length of F/O cable shall be replaced at the Contractor's expense.

86-2.19(M) Fiber Optic Splice Enclosure

The F/O field splices shall be enclosed in splice closures, which shall be complete with splice organizer trays, brackets, clips, cable ties, seals, and sealant, as needed. The splice closure shall be suitable for a direct burial or pull box application. Manufacturer's installation instructions shall be supplied to the Engineer prior to the installation of any splice closures. Location of the splice closures shall be where a splice is required as shown on the plans, designated by the Engineer, or described in these special provisions. The fiber optic splice closure shall consist of an outer closure, an inner closure and splice trays, and shall conform to the following special provisions. The fiber optic splice closure shall be suitable for a temperature range of 0° to 50°C.

The size of the closure shall allow all the fibers of the largest fiber optic cable to be spliced to a second cable of the same size, plus two additional 12-24 fiber pigtail cables. The closure shall be not more than 17 inches in length and not more than eight inches in diameter. Two outer closures shall fit into the fiber optic splice vault and shall leave sufficient space for routing of the fiber optic communication cables, without exceeding the minimum bending radius of any cable. The closures shall be designed for butt splicing.

The splice closure shall conform to the following specifications:

1. Non-filled thermoplastic case
2. Rodent proof, waterproof, re-enterable and moisture proof
3. Accommodate a minimum of two express (trunk) cables and two to six drop cables
4. Cable entry ports shall accommodate 0.38-inch to 0.98-inch diameter cables
5. Multiple grounding straps
6. Accommodate up to eight splice trays
7. Suitable for "butt" or "through" cable entry configurations
8. Place no stress on finished splices within the splice trays
9. Meet latest Telcordia GR-771 requirements for splice closures

All materials in the closures shall be nonreactive and shall not support galvanic cell action.

The outer closure shall be compatible with the other closure components, the inner closure, splice trays, and cables.

The end plate shall consist of two sections and shall have capacity for two fiber optic trunk communication cables and a minimum of two fiber optic drop communication cables.

The outer closure shall protect the splices from mechanical damage, shall provide strain relief for the cable, and shall be resistant to salt corrosion.

The outer closure shall be waterproof, re-enterable and shall be sealed with a gasket. The outer closure shall be flash-tested at 14.9 psi.

The inner closure shall be of metallic construction. The inner closure shall be compatible with the outer closure and the splice trays and shall allow access to and removal of individual splice

trays. The splice trays shall be compatible with the inner closure and shall be constructed of rigid plastic or metal.

Each splice shall be individually mounted and mechanically protected in the splice tray.

The Contractor shall install the fiber splice closure in the splice vaults where splicing is required. The fiber optic splice closures shall be securely fastened to the splice vault using standard hardware found in communication manholes.

The Contractor shall provide all mounting hardware required to securely mount the closures to the splice vault.

The fiber splice closure shall be mounted horizontally in a manner that allows the cables to enter at the end of the closure. Not less than 50 feet of each cable shall be coiled in the vault to allow the fiber splice closure to be removed for future splicing.

The unprotected fibers exposed for splicing within the closure shall be protected from mechanical damage using the fiber support tube or tubes and shall be secured within the fiber splice closure.

Upon completion of the splices, the splice trays shall be secured to the inner closure.

The closure shall be sealed using a procedure recommended by the manufacturer that will provide a waterproof environment for the splices. Encapsulant shall be injected between the inner and outer closures.

Care shall be taken at the cable entry points to ensure a tight salt resistant and waterproof seal is made which will not leak upon aging. It is acceptable to have multiple pigtails enter the fiber splice closure through one hole as long as all spaces between the cables are adequately sealed.

The fiber optic splice closure model SCF canister type from Corning/Siecor, model Fiber Dome from 3M, and Dome Closures from Coyote are recommended.

86-2.19(N) Fiber Optic Cable Terminations

Distribution Breakout -- The jacketed cable shall be lashed with tie wraps to the rack prior to entering the FDU. The cable shall also be tie-wrapped to the inside of the FDU near the point of entry. The glass fibers shall not be damaged during cutting and removal of the buffer tubes.

The jacketed area and bare fibers shall be cleaned to remove the moisture blocking gel. The transition from the buffer tube to the bundle of jacketed fibers shall be treated by an accepted procedure for sleeve tubing, shrink tubing and silicone blocking of the transition to prevent future gel leak. A subsequent transition shall be made, with flexible tubing, to isolate the fiber bundles of each buffer tube to serve as a transition from the bundle to the separation point and to protect the individual coated fibers. The last transition point (bundle to single fiber) shall consist of inserting the individual fibers into No. 26 AWG clear teflon tubing, to protect the fiber as it is routed toward the splice tray and to allow clear color identification of fibers for proper distribution. The final transition from bundle to individual fiber tube shall be secured with an adhesive heat shrink sleeve. The individual fibers shall then be stripped and prepared for splicing.

All fibers inside a fiber optic cable entering a FDU shall be properly terminated, whether they are lit or dark.

Distribution Interconnect Package -- Distribution involves connecting the fibers to the active electronic components. The distribution equipment consists of FDUs with connector panels,

couplers, splice trays, fiber optic pigtails and cable assemblies with connectors. The distribution interconnect package shall be assembled and tested by a company who is regularly engaged in the assembly of these packages. Attention is directed to "Fiber Optic Testing" elsewhere in these special provisions. All distribution components shall be products of the same manufacturers, who are regularly engaged in the production of these components, and the respective manufacturers shall have quality assurance programs.

86-2.19(O) Fiber Optic Cable Assemblies and Pigtails

General-- Cable assemblies and pigtails shall be products of the same manufacturer. The cable used for cable assemblies and pigtails shall be made of fiber meeting the performance requirements of these special provisions for the F/O cable being connected.

The cable assemblies and components manufacturer shall be ISO 9001 registered.

Pigtails-- Pigtails shall be of simplex (one fiber) construction, in 900 µm tight buffer form, surrounded by aramid for strength, with a PVC jacket with manufacturer identification information and a normal outer jacket with diameter of 0.12 inch. Singlemode cable jackets shall be yellow in color. All pigtails shall be factory terminated and tested and at least 3 feet in length.

Patch cords-- Patch cords may be of simplex or duplex design. Duplex jumpers shall be of duplex round cable construction, and shall not have zipcord (siamese) construction. The patch cord shall be terminated with ST compatible super physical contact singlemode connector at both ends. The fiber strands shall meet the specifications as those of the fiber cable and the connectors shall meet the specifications as specified elsewhere in these special provisions. All patch cords shall be at least 6 feet in length, sufficient to avoid stress and orderly routing. The outer jacket of duplex patch cords shall be colored yellow. The two inner simplex jackets shall be color coded white and slate, respectively, to provide easy visual identification for polarity.

Connectors-- Connectors shall be of the ceramic ferrule ST "push-pull" type. Indoor ST connector housings shall be either nickel plated zinc or glass reinforced polymer construction. Outdoor connector body housing shall be glass reinforced polymer.

The associated coupler shall be same material as the connector housing.

All F/O connectors shall be 0.1 inch ST connector ferrule type with Zirconia Ceramic material with a physical contact pre-radiused tip.

The ST connector operating temperature range shall be from -40°C to +70°C. Insertion loss shall not exceed 0.4 dB and the return reflection loss on singlemode connectors shall be at least 40 dB. Connection durability shall be less than 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). All terminations shall provide a minimum 50 lb force pull out strength. Factory test results shall be documented and submitted to the Engineer prior to installing any of the connectors. Singlemode connectors shall have a yellow color on the body or the boot.

Field terminations shall be limited to splicing of adjoining cable ends or cables to ST pigtails.

ST Couplers-- The ST couplers shall be made of nickel plated zinc or glass reinforced polymer that is consistent with the material forming the associated ST connector body. The design mechanism for mounting the coupler to FDU connector module panel may be flanged or threaded but shall coincide with FDU panel punch-outs. All coupler sleeves shall be ceramic of the split clamshell or clover leaf design. The temperature range for the couplers shall be the same as that specified for the ST connectors.

86-2.19(P) Fiber Optic Distribution Unit
Fiber distribution unit (FDU) shall be EIA-310 standard mount type as shown on the plans. FDU shall consist of a connector module housing (CMH) and a splice module housing (SMH). The CMH shall have sufficient number of connection panels to handle the associated fiber terminations. The SMH shall have the capacity to secure and store the required splice trays and break out cables.

Connector module housing (CMH) shall have a Lexan front cover so as not expose fiber optic connections. Each connection panel shall have a minimum of six coupler capacity and all panel positions shall be filled with couplers. All spare couplers shall have dust covers on both sides. Each connection panel shall be secured to the CMH frame with two plastic push snap fastener on each side of the panel.

Splice module housing (SMH) shall have sufficient number of splice trays to handle the transition splices between the field cables and their respective breakouts. Cable accesses to the SMH shall have grommets. SMH shall have a rear metal cover of the same gauge and color as the remainder of the FDU rack

The front and back covers of the FDU shall be retractable or removable to facilitate internal installation.

86-2.19(Q) Fiber Optic Labeling

General
The Contractor shall label all fiber optic cabling in a permanent consistent manner. All tags shall be of a material designed for long term permanent labeling of fiber optic cables and shall be marked with permanent ink on non-metal types, or embossed lettering on metal tags. Metal tags shall be constructed of stainless steel. Non-metal label materials shall be approved by the Engineer. Labels shall be affixed to the cable per the manufacturer's recommendations and shall not be affixed in a manner which will cause damage to the fiber. Handwritten labels will not be allowed.

Label Identification
Labeling of Cables -- Labeling of the backbone, distribution, and drop fiber optic cables shall conform to the following unique identification code elements:

Labeling Schemes

Unique Identification Code Elements For Backbone, Distribution Or Drop Cables

No.	Description	Code	Number Of Characters
1	Cable Type	Fiber: S: Single mode	1
2	Fiber Count	Number of fibers or conductor pairs (example: 72 fibers)	3
3	Begin Function	T: TMC; H: Hub; V: Video Node; D: Data Node; C: Cable Node; TV: CCTV Camera; CM: CMS; E: Traffic Signal; RM: Ramp Meter; TM: Traffic Monitoring/Count Station/Vehicle Count Station (VDS, TMS); SV: Splice Vault SC: Splice	1 or 2
4	County	County Number; Example: 033 (for Alameda)	3
5	Route Number	Hwy, Rte (example: 005)	3
6	Post Mile	Example: xxxxx	4
7	End Function	T: TMC; H: Hub; V: Video Node; D: Data Node; C: Cable Node; TV: CCTV Camera; CM: CMS; E: Traffic Signal; RM: Ramp Meter; TM: Traffic Monitoring/Count Station/Vehicle Count Station (VDS, TMS); SV: Splice Vault SC: Splice	1 or 2
8	County	County Number; Example: 033 (for Alameda)	3
9	Route Number	Hwy, Rte (example: 005)	3
10	Post Mile	Example: xxxxx	5
11	Unique ID	Identifies when two or more fiber cables are involved (example: xx)	2

Caltrans District 4 county system numbers are as following:

County Numbers

County	County System Number
Alameda	33
Contra Costa	28
Marin	27
Napa	21
San Francisco	34
San Mateo	35
Santa Clara	37
Santa Cruz	36
Sonoma	20
Solano	23

Example: S 048 SV 033 080 00569 SV 033 080 00610 03.

The label in the example can be translated as a single mode (S) 48 strand cable (048) that starts from a splice vault (SV) in Alameda County (033) on I-80 (080) post mile 5.69 (00569) ends at another splice vault (SV) in Alameda County (033) on I-80 (080) at postmile 6.10 (00610). This fiber optic cable is uniquely identified as 03. This means the cable is the 3rd of the fiber optic cables in the pull box or the vault.

Each cable shall display a unique identification, regardless of where the cable is viewed. The begin function and end function correspond to the end points of each cable. The order of the begin and end function follow a hierarchy as listed below, where the lowest number corresponding to the begin/end function is listed first.

Function Coding

No.	Function
1	TMC
2	HUB
3	Video Node (VN)
4	Data Node (DN)
5	Cable Node
6	CCTV Camera

7	CMS
8	Traffic Signal
9	Ramp Meter
10	Traffic Monitoring Count Station
11	HAR
12	EMS
13	Weather Station
14	Weigh in Motion
15	Splice Vault or Cabinet

This scheme will work as follows:

A cable between the TMC and a HUB will always have the TMC listed as the start function and the HUB as the end function. Between a CMS and a Splice Vault, the start function will always be listed as the CMS, and so on. If a cable is connected between HUBs, for example HUB-01 and HUB-03, the lowest number, in this case HUB-01, will be listed as the start function and HUB-03 as the end function.

At each FDU or ITU the Contractor shall provide a listing of the cable or cables terminated and where each fiber appears on the connector panel, a list of all jumpers and the equipment that they are connected to, and a geographical layout of all the equipment installed by the Contractor. In field cabinets, these shall be placed in a waterproof pouch mounted on the cabinet door.

Label Placement

Abbreviations

Purpose	Abbreviation
TMC	TXXX.XX
HUB	HXXX.XX
Vault	SVXXX.XX
Pullbox	PBXXX.XX
Camera	TVXXX.XX
CMS	CMXXX.XX
TMS	TMXXX.XX
Ramp Meter	RMXXX.XX
Traffic Signal	EXXX.XX
HAR	HRXXX.XX

EMS	FMXXX.XX
Weather Station	WSXXX.XX
Weigh in Motion	WTXXX.XX

The X's denote the post mile of the above elements.

Cables - All cables shall be clearly labeled with the unique identification code element method described elsewhere in these special provisions, at all terminations, even if no connections or splices are made, and at all splice vault entrance and exit points.

Cable to Cable Splices - All cable jackets entering the splice enclosure shall be labeled in accordance with the identification method described elsewhere in these special provisions.

Cable to Fiber Distribution Units - The cable jackets shall be clearly labeled at entry to the FDU in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber and pigtail shall be labeled at the connector with the Fiber ID. The FDU shall be clearly labeled with the Cable ID on the face of the FDU. If multiple cables are connected to the FDU, each block of connectors relating to each individual cable shall be clearly identified by a single label with the Cable ID. Individual connections shall be clearly marked on the face of the FDU in the designated area with the Fiber ID.

Fiber - Fibers labels shall be placed next to the connectors of the individual fibers.

Patch Panels - The cable jackets shall be clearly labeled at entry to the Patch Panel in accordance with the unique identification code element method described elsewhere in these special provisions. In addition, each fiber and pigtail shall be labeled at the connector with the Fiber ID. The patch panel shall be clearly labeled with the Cable ID on the face of the Panel. If multiple cables are connected to the Patch Panel, each block of connectors relating to each individual cable shall be clearly identified by a single label with the Cable ID. Individual connections shall be clearly marked on the face of the Panel in the designated area with the Fiber ID.

Splice Trays - A label shall be placed on each splice tray explaining the splices in each tray.

86-2.19(R) BAIFA Communications Hub Equipment

Furnish and install air-conditioned cabinets to house Ethernet core or distribution switches. Size the cabinet appropriately to fit all the equipment installed within the cabinet at the particular location. Size the cabinet to ensure ease of access to equipment and provide proper ventilation in order to maintain an internal operating environment that does not exceed the environmental operating ranges for devices placed within the cabinet. Furnish and install cabinet base extenders with all necessary hardware for the cabinets.

Prototype equipment is not acceptable. All equipment shall be current standard production units and shall have been in use for a minimum of six months. Rebuilt or reconditioned equipment will not be allowed.

86-2.19(R)(1) Physical Requirements

Ensure that the hub cabinets comply with the following standards:

1. ANSI
2. ASTM
3. IMSA
4. ISO 9001
5. NEC
6. NEMA TS-2
7. UL listed

86-2.19(R)(2) Environmental Requirements

Ensure the cabinet assembly can maintain the temperature and humidity within the environmental requirements of the hub switches.

86-10.01(R)(3) Submittals
Not used.

86-2.19(R)(4) Quality Control and Assurance

Documentation of all test results shall be provided to the Engineer within 2 working days after the test involved.

86-2.19(R)(5) Materials

86-2.19(R)(5)(i) Functional
Furnish Type 333 base-mounted hub cabinets meeting the following minimum requirements:

1. Side-by-side, double doors on both front and rear of cabinet
2. Fiber-optic distribution centers (paid separately)
3. Grounding bus bar
4. 19-inch rack system for mounting of all devices in the cabinet
5. Pull-out shelf for laptop and maintenance use
6. Maintenance access connections
7. Fluorescent lighting
8. Ventilation fans
9. 120VAC power supply
10. 120VAC ground fault circuit interrupter (GFCI)-protected duplex outlets for tools
11. 120VAC surge-protected duplex outlets for equipment
12. Sunshields
13. Lightning and surge protection on incoming and outgoing electrical lines (power and data)
14. Power strip along vertical rail
15. Air conditioner for cooling of the Ethernet switch

86-2.19(R)(5)(ii) Physical Features
Provide cabinets that are completely weatherproof to prevent the entry of water. Provide cabinet and door exterior seams that are continuously welded and all exterior welds are smooth. Provide cabinets with two full-size doors with three hinges, or a full-length stainless steel piano hinge, with stainless steel pins spot-welded at the top. Provide hinges that utilize stainless steel hinge pins. Provide hinges that are mounted so that they cannot be removed from the door or cabinet

without first opening the door. Provide door and hinges braced to withstand a 100-pound per vertical foot of door height load applied vertically to the outer edge of the door when standing open. Ensure that there is no permanent deformation or impairment of any part of the door or cabinet body when the load is removed. Provide cabinet door fitted with a #2 Corbin lock. Provide two keys for each cabinet. Provide cabinet doors that are also pad lockable. Provide door openings that are double flanged on all four sides.

Provide cabinets constructed of unpainted sheet aluminum alloy H5052-H32 with a minimum thickness of 0.125 inch.

Provide the communications hub cabinet with sunshields outside to deflect solar heat away from the cabinet. The sunshields must be offset a minimum of one inch from the exterior cabinet walls. Ensure that the sunshields are fabricated from 5052-H32 aluminum sheet that is 0.125 inch thick, and that sunshield corners are rounded and smoothed for safety. Mount the sunshields on standoffs at the top and each side of the cabinet.

Provide doorstops at 90 and 180-degree positions. Ensure that both the door and the doorstop mechanism are of sufficient strength to withstand a simulated wind load of five pounds per square foot of door area applied to the both inside and outside surfaces without failure, permanent deformation, or compromising of door position and normal operation. Do not provide auxiliary police doors.

Ensure that cabinet doors include a gasket to provide a dust and weather-resistant seal when closed. Ensure that the gasket material is closed-cell neoprene and maintains its resiliency after exposure to the outdoor environment. Ensure that the gasket shows no sign of rolling or sagging, and provide a uniform dust and weather-resistant seal around the entire door facing.

Provide cabinets that include predrilled holes of standard diameter and bolt pattern with four (4) anchor bolts with each cabinet unit as part of the unit price bid. Provide a panel with each cabinet that matches the rest of the cabinet; and is held in place by four bolts provided with the panel. Drill or punch the panel to accommodate the bolts; the drill holes shall match the bolt pattern of the base cabinet of the cabinet. Provide a panel designed to be fitted in the interior of the cabinet and fabricated of the same material and thickness as the cabinet bottom.

Provide rails to create a cage to mount hardware, wiring panels and miscellaneous mounting brackets. Provide rails constructed of .1345-inch steel or .105-inch stainless steel. Provide rails with a keyhole design with slots 2 inches on center with a top opening of 5/8 inch in diameter to allow the insertion of a .625-inch by 1-inch carriage bolt. Ensure that the rails are 1.5 to 2 inches wide by .5 inches deep. Drill and tap the rails for 10-32 screws or rack screws with EIA universal spacing.

Provide rack assemblies that have a removable, standard 19-inch EIA compliant rack. The rack shall have a clearance between the rails of 17.5 inches.

Equip each cabinet with an aluminum storage compartment mounted in the rack assembly with the following dimensions (±0.5 inch): 16 inches wide, 14 inches long, and 1.75 inches deep. Provide compartment with ball-bearing telescoping drawer guides to allow full extension from the rack assembly. Ensure that when extended, the storage compartment opens to provide storage space for cabinet documentation and other miscellaneous items. Ensure that the storage compartment is of adequate construction to support a weight of 20 pounds when extended without sagging. Provide a top to the storage compartment that is hinged aluminum. Provide two (2) removable metal shelves with each cabinet.

Furnish a cabinet base extender with each hub cabinet that complies with these Project Special Provisions.

86-2.19(R)(5)(iii) Lighting
Provide the field cabinet with two 20-watt fluorescent lamps and clear shatterproof shield assemblies which are mounted on the inside front and rear top of the cabinet. Ensure that these lamps are unobstructed and able to cast light on the equipment. Equip the field cabinet with door-actuated switches so that the lamps automatically turn on when either cabinet door is opened and go off when the doors are closed.

86-2.19(R)(5)(iv) Electrical
Provide a service panel assembly to function as the entry point for AC power to the cabinet and the location for power filtering, transient suppression, and equipment grounding. Provide AC isolation within the cabinet. Configure cabinet to accept 120 VAC from the utility company.

Provide circuit breakers that are UL listed and have an interrupt capacity of 5,000 amperes and insulation resistance of 100 MΩ at 500 VDC. Provide power distribution blocks that are suitable for use as power feed and as junction points for two and three wire circuits. Ensure that the line side of each block is capable of handling up to 2/0 AWG conductors. Ensure that the AC neutral and equipment ground wiring and terminal blocks are isolated from the line wiring by an insulation resistance of at least 10 MΩ when measured at the AC neutral.

Provide UL listed surge protection devices according to the UL 1449, 2nd edition standard that comply with the NEMA requirements as detailed in the NEMA LS 1 (1992) standard.

Provide branch circuits, surge protection devices, and grounding for the ITS device-connected load served by the cabinet, including ventilation fans, internal lights, electrical receptacles, etc., as shown on the Plans. Terminate field wiring on terminal blocks with the voltage and current rating of the terminal block is greater than the voltage and current rating of the wire fastened to it.

Furnish a power distribution assembly that fits in the EIA 19-inch rack and provides for protection and distribution of 120VAC power.

Ensure that ground bus bars are fabricated from a copper alloy material compatible with copper wire. Use ground bus bars that have at least two positions where a #6 AWG stranded copper wire can be attached.

Mount the ground bus bar on the side of the cabinet wall adjacent to the service panel assembly for the connection of AC neutral wires and chassis ground wires. If more than one ground bus bar is used in a cabinet, use a minimum of a #10 AWG copper wire to interconnect them.

Wire into the cabinet’s circuitry the connector harnesses for the ITS devices and other accessory equipment to be housed therein.

Terminate conductors on terminal blocks using insulated terminal lugs large enough to accommodate the conductor to be terminated. When two or more conductors are terminated on field wiring terminal block screws, use a terminal ring lug for termination of those conductors. Number all terminal block circuits and cover the blocks with a clear insulating material to prevent inadvertent contact.

86-2.19(R)(5)(v) Ventilation

Ensure the cabinet assembly can maintain the temperature and humidity within the environmental requirements of the hub switches.

Include two cooling fans with 100 CFM, minimum capacity. Provide thermostats to be incorporated into the ventilation system. Mount fans in the top of the cabinet.

Provide the cabinets with vent openings in the lower portion of the door to allow convection cooling of electronic components. Cover them fully on the inside with a commercially available disposable three layer graded type filter. All air entering the cabinet must pass through the air filter.

86-2.19(R)(5)(vi) Air Conditioner

Furnish each hub cabinet with a rack mounted air-cooled air conditioner that operates on 120VAC. The air conditioner shall be fit within a 19-inch EIA communications rack and shall not be external mounted on the cabinet. The air conditioner shall be mounted in the bottom of the cabinet to avoid damage to any communications equipment.

The air conditioners shall have a built-in condensate evaporator and condensate drain fitting and hose to the outside of the cabinet. The air conditioner shall be rated for a minimum of 3500 BTU. There shall be low temperature control to prevent overcooling.

Provide EMI/RFI transient spike protection. Equip the cabinet and air conditioner with remote monitoring of high temperature and low airflow conditions. Intake air shall enter through cabinet door vent and be exhausted through top cabinet vents. Air conditioners shall be CFC free or low ODP (R-22) refrigerant and shall use closed loop cooling. Insulate all cold components (coolant lines, compressor, evaporator, etc.) with high-performance insulation.

Blower motors shall be UL listed. Ensure the blower motors are equipped with automatic reset thermal overload protection. Provide double sealed and double shielded ball bearings.

The air conditioners shall have permanent corrugated aluminum or stainless steel air filters. The filters shall be removable and washable.

All grilles shall be stainless steel.

86-2.19(R)(5)(vii) Base Extenders

Fabricate extenders from the same materials and with the same finish as cabinet housing. Fabricate base extender in the same manner as controller cabinets. Provide base extenders that have a minimum height of 12".

86-2.19(R)(5)(viii) Construction

Ensure all cabinet wiring is tagged and identified by the use of insulated pre-printed sleeves and follows the project’s cable identification scheme. Ensure that the wire markers identify usage in plain words with sufficient details without abbreviations or codes.

Use stranded copper for all conductors, including those in jacketed cables. Neatly arrange all wiring, firmly lace or bundle it, and mechanically secure the wiring without the use of adhesive fasteners. Route and secure all wiring and cabling to avoid sharp edges and to avoid conflicts with other equipment or cabling. Terminate all wiring on a terminal block, strip, bus bar, device clamp, lug, or connector. Do not splice any wiring. Label all wiring, cables, terminal strips, and

distribution blocks with permanent and waterproof tags. Provide strain relief for all cabling with connectors, all cabling entering knockouts or ports at the equipment, and where appropriate.

Fasten all components of the cabinet assembly to be mounted on cabinet side panels with hex-head or Phillips-head machine screws. Install the screws into tapped and threaded holes in the panels. The components include, but are not limited to, terminal blocks; bus bars, panel and socket mounted TVSS, circuit breakers, accessory and equipment outlets, and DC power supply chassis.

Fasten all other cabinet components with hex-head or Phillips-head machine screws installed with nuts (with locking washer or insert) or into tapped and threaded holes. Fasten stud-mounted components to a mounting bracket providing complete access to the studs and mounting nuts. Ensure that all fastener heads and nuts (when used) are fully accessible within a complete cabinet assembly, and any component is removable without requiring removal of other components, panels or mounting rails. Do not use self-tapping or self-threading fasteners.

Mount the air conditioner in the bottom of the cabinet and but do not obstruct any cable entry into the cabinet. Install condensate drains to drain condensation water out of the cabinet. Ensure the cabinet has provisions to route conduit to the existing cabinet as shown in the drawings.

Provide a cabinet that is ISO 9001 certified at the time of bid letting.

Equip cabinets with lightning and surge protection described separately in these Project Special Provisions.

Locate cabinets so as not to obstruct sight distance of vehicles turning on red.

Install base mounted cabinets as shown on the Plans and as approved by the Engineer. Install only the required number of conduits as shown on the Plans plus one additional spare stub out conduit. Position the ends of conduits approximately 2 inches above the finished surface of the concrete base. Mount the hub cabinets on cabinet base extenders.

Mount surge protection devices in the cabinet for the particular field devices that will be connected to that cabinet.

Terminate power service wire, video, and data cabling on the appropriate terminal strips, surge protection devices or jacks in the cabinet with insulated terminal lugs or connectors. Use a calibrated ratchet-type crimping tool to install the insulated terminal lugs onto the field wires.

Label spare circuits of the data cables and connect them to the cabinet ground bus bar.

Neatly bundle and identify all field wiring cables in the cabinet with permanent waterproof tags.

Ground all hub cabinets in accordance with the requirements of these Project Special Provisions. Keep the ground wire from the cabinet ground bus bar to the ground rod assembly or array as short as possible. Ensure the ground wire is not in contact with any other part of the cabinet.

86-2.19(S) Communications Rack

Furnish and install freestanding enclosed communications racks in the communications hub buildings.

1. Provide enclosed communications racks meeting these minimum performance requirements:
2. All equipment shall comply with ANSI/EIA RS-310D,
3. Provide frame and external components with zinc coating per ASTM B633,

4. Paint interior and exterior components per RAL 7035, and
5. The thermostatically controlled fans shall provide up to 300 cubic feet per minute (cfm) of exhaust. Thermostats shall monitor both humidity and temperature.

Furnish and install air-conditioned cabinets to house Ethernet core or distribution switches. Size the cabinet appropriately to fit all the equipment installed within the cabinet at the particular location. Size the cabinet to ensure ease of access to equipment and provide proper ventilation in order to maintain an internal operating environment that does not exceed the environmental operating ranges for devices placed within the cabinet. Furnish and install cabinet base extenders with all necessary hardware for the cabinets.
Prototype equipment is not acceptable. All equipment shall be current standard production units and shall have been in use for a minimum of six months. Rebuilt or reconditioned equipment will not be allowed.

86-2.19(S)(1) Physical Requirements
Ensure that the communications hub building comply with the following standards:
1. ANSI
2. ASTM
3. IMSA
4. ISO 9001
5. NEC
6. NEMA TS-2
7. UL listed

86-2.19(S)(2) Environmental Requirements
Not Used.

86-10.01(S)(3) Submittals
Prior to beginning work, deliver manufacturer's warranties and guarantees for materials and instruction sheets and parts lists supplied with materials for approval.

86-2.19(S)(4) Quality Control and Assurance
Provide a three-year warranty.

86-2.19(S)(5) Materials
86-2.19(S)(5)(i) Functional
Provide enclosed communications racks meeting the following minimum material requirements:
1. 19-inch EIA single-bay
2. Nominal height of less base and wheels, full size rack cabinet 42 rack units high (approx. 78 inches)
3. Nominal 4-inch-high ventilated base
4. Nominal depth: 30 inches
5. All-metal components
6. Full-height locking window door on the front
7. Urethane gaskets for window sealing
8. ¼-inch-thick Plexiglas® window panes
9. Solid metal removable side panels with bottom vents
10. Full-height solid metal door for the back of each cabinet
11. Vented top with three integral, thermostatically controlled, prewired fans
12. Set of four (4) heavy-duty, locking casters on base

86-2.19(S)(5)(ii) Physical Features

Mechanical== Construct all rack frames from 12-gauge, cold-formed steel. Construct all side panels and door panels of 14-gauge steel. Construct the vented base from 16-gauge steel. Construct the 19-inch electrical rack angles from 12-gauge steel.

Doors== Equip all doors with grounding brackets and doorstop kits. Door hinges shall have a maximum opening range of 130-140 degrees. Hinge kits shall permit left or right side mounting. Furnish the racks with tamper-proof hinges and removable hinge pins.

Provide the rack with flush swing handles with tamper resistant locks on all doors. Key all locks to the same key with two sets of keys provided for each unit. Locks shall have a three-point latch mechanism.

Wall Panels== Provide removable solid side panels with hanger tabs for easy alignment and assembly. Provide vents on front and rear panels, along with wire entry access plates with dust-tight seals.

Finish == Furnish factory-applied paint or powder-coating that is black in color on the exterior and interior of all components.

Furnish and install one metal shelf kit per communications rack. Provide each shelf the full width and depth of the rack angles and attach directly to the rack angles. Furnish and install one metal keyboard slide out drawer per full-height communications rack.

86-2.19(S)(5)(viii) Construction

Furnish and install an outlet strip and 10-foot power cord along one rear vertical rack frame. Furnish and install strips that use 120 VAC 60 Hz power and shall contain at least 10 outlets over the 70 inches for full size racks. Furnish and install grounding bus bar system to ground the rack-mounted electrical equipment. Equip door with grounding studs.

Furnish and install cable management hardware for attachment vertically along the rack frame and horizontally between 19-inch rack angles. Cable management hardware shall run vertically up one rear rack frame and shall include six horizontal runs per rack. Provide hardware including cable organizers and clamps to provide strain relief and cable mounting.

Install the full-height communications rack cabinets in the hub buildings as shown in the Plans.

Install a keyboard shelf at a height comfortable for operator use when sitting on a stool. Provide tamper-resistant but removable screws through hinges and exterior panels. Furnish any special tools required to remove tamper resistant screws.

86-2.19(T) Fiber Optic Testing

General

Testing shall include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after delivery to the project site but prior to installation, (3) after installation but prior to connection to any other portion of the system, and (4) during final system testing. The active components shall be tested after installation. The Contractor shall provide all personnel,

equipment, instrumentation and materials necessary to perform all testing. The Engineer shall be notified two working days prior to all field tests. The notification shall include the exact location or portion of the system to be tested.

Factory Testing
Verification of the fiber specifications as listed in the Fiber Characteristics Table shall be supplied by the manufacturer with the appropriate documentation. Copies of the documentation shall be: 1) maintained on file by the manufacturer with a file identification number for a minimum of 7 years; 2) attached to the cable reel in a waterproof pouch; and 3) submitted by the Contractor to the Engineer.

Arrival On Site
The cable and reel shall be physically inspected on delivery and 100 percent of the fibers shall be attenuation tested to confirm that the cable meets requirements. Attenuation tests shall be performed with an OTDR capable of recording and displaying anomalies of0.02 dB as a minimum. Singlemode fibers (SM) shall be testedat 1310 nm and at 1550 nm. Test results shall be recorded, dated, compared and filed with the copy accompanying the shipping reel in a weather proof envelope. Attenuation deviations from the shipping records greater than 5 percent shall be brought to the attention of the Engineer. The cable shall not be installed until completion of this test sequence and the Engineer provides written approval. Copies of traces and test results shall be submitted to the Engineer. If the test results are unsatisfactory, the reel of FO cable shall be considered unacceptable and all records corresponding to that reel of cable shall be marked accordingly. The unsatisfactory reels of cable shall be replaced with new reels of cable at the Contractor's expense. The new reels of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

After Cable Installation
After the fiber optic cable has been pulled but before breakout and termination, 100 percent of all the fibers shall be tested with an OTDR for attenuation. Test results shall be recorded, dated, compared and filed with the previous copies of these tests. Copies of traces and test results shall be submitted to the Engineer. If the OTDR test results are unsatisfactory, the fiber optic cable segment will be unacceptable. The unsatisfactory segment of cable shall be replaced with a new segment, without additional splices, at the Contractor's expense. The new segment of cable shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer.

Attenuation tests shall be performed with an OTDR capable of recording and displaying anomalies of 0.02 dB as a minimum. Single mode fibers (SM) shall be tested at 1310 nm and at 1550 nm. Attenuation readings shall be recorded on a cable data sheet showing factory and after installation results.

The OTDR shall have a printer capable of producing a verifying test trace with fiber identification as shown in Appendix A "Link Loss Budget Work Sheet," numerical loss values, the date and the operator's name. It shall also have a DOS based 3.5" disk recording capability that has associated software to do comparisons and reproductions on 8.5" x 11" paper, via a personal computer.

Fiber Optic System Gain Margin
The installed system gain margin shall be at least 6 dB for each and every link. If the design system gain margin is less than 6 dB, the Engineer shall be notified and informed of the

Contractor's plan to meet that requirement. Test results shall be recorded and submitted to the Engineer for approval.

Interconnecting Parts Testing And Documentation

All the components of the passive interconnecting parts (FDUs, pigtails, couplers and splice trays) shall be from a manufacturer who is regularly engaged in the production of the fiber optic components described.

Each ST termination shall be tested for insertion attenuation loss with the use of an optical power meter and source. In addition, all single mode terminations shall be tested for return reflection loss. These values shall meet the loss requirements specified earlier and shall be recorded on a tag attached to the pigtail or jumper.

Once interconnecting assembly is complete, the contractor shall visually verify that all tagging, including loss values, is complete. Then as a final quality control measure, the Contractor shall do an "end to end" optical power meter/light source test from pigtail end to jumper lead end to assure continuity and overall attenuation loss values.

The final test results shall be recorded, along with previous individual component values, on a special form assigned to each FDU. The completed form shall be dated and signed by the Contractor. One copy of this form will be attached in a plastic envelope to the assembled FDU unit. Copies will be provided separately to the Contractor and to the Engineer.

Active Component Testing

The transmitters and receivers shall be tested with a power meter and light source, to record the transmitter average output power (dBm) and receiver sensitivity (dBm). These values shall be recorded in the Link Loss Budget Worksheet shown in Appendix A.

System Verification at Completion

Once the passive cabling system has been installed and is ready for activation, 100 percent of the fiber links shall be tested with the OTDR for attenuation at both wavelengths. Test results shall be recorded, dated, compared and filed with previous copies. A hard copy printout and a electronic copy of the traces and test results along with a licensed copy of the associated software on a minimum 4 GB USB version 2.0 flash drive or a Secure Digital card shall be submitted to the Engineer. If the OTDR test results are unsatisfactory the link shall be replaced at the Contractor's expense. The new link shall then be tested to demonstrate acceptability. Copies of the test results shall be submitted to the Engineer. The "Link Loss Budget Work Sheet" shown in Appendix A shall be completed for each link in the fiber optic system, using the data gathered throughout the installation process. The completed work sheets shall be included as part of the system documentation in the As-Built Plans.

The "Total System Gain" shall be calculated by subtracting the measured "Optical Receiver Sensitivity" (line 1B on the "Link Loss Budget Work Sheet") from the measured "Optical Transmitter Average Power" (line 1A), which were obtained using a power meter and source. The resulting difference shall be the maximum allowable loss between the transmitter and the receiver, within 0 percent to +10 percent of the manufacturers specified loss budget for the transmitter/receiver pair. The "Total System Gain" shall be recorded on line 1C.

The "Fiber Losses" for a link shall be calculated by multiplying the length of the fiber link (line 2A) by the normalized cable attenuation (dB/km, line 2B) at the operating wavelength. The normalized attenuation for this calculation shall be the maximum value throughout the operating temperature range of the cable. The product shall be recorded on line 2C.

The total connector losses shall be calculated by summing the individual attenuation values for each connector pair in the link, excluding the transmitter and receiver connectors. The sum shall be recorded on line 2D.

The total splice losses shall be calculated by summing the individual attenuation values for each splice in the link. The sum shall be recorded on line 2E.

The total of other losses shall be calculated by summing the individual attenuation values for each component in the link not previously addressed. The sum shall be recorded on line 2F. These items may include, but are not limited to, couplers, splitters, routers and switches.

The "Total System Loss" shall be recorded on line 2G of the "Link Loss Budget Work Sheet." The "Design System Gain Margin" shall be calculated by subtracting the Total System Loss (line 2G) from the Total System Gain (line 1C). The resulting difference shall be recorded on line 3A. The Contractor's attention is directed to "F/O System Gain Margin," elsewhere in these special provisions.

At the conclusion of the final OTDR testing, 100 percent of all fiber links shall be tested end to end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for the OTDR tests. These tests shall be conducted in both directions. Test results shall be recorded, compared and proven to be within the design link loss budgets, and filed with the other recordings of the same links. Test results shall be submitted to the Engineer.

If during any of these system verification tests, the results prove to be unsatisfactory, the F/O cable will not be accepted. The unsatisfactory segments of cable shall be replaced with a new segment of cable at the Contractor's expense. The new segment of cable shall undergo the same testing procedure to determine acceptability. Copies of the test results shall be submitted to the Engineer. The removal and replacement of a segment of cable shall be interpreted as the removal and replacement of a single contiguous length of cable connecting two splices, two connectors, or a splice and a connector. The removal of only the small section containing the failure and therefore introducing new unplanned splices, will not be allowed.

Link Loss Budget

Contract No. _____

Contractor: _____

Approved by Caltrans: _____

Date: _____ Operator: _____

Link Number: _____ Fiber Color: _____

Buffer Color: _____ Cable No.: _____

Test Wavelength (Circle One)	1310 nm	1550 nm
Section 1: Total System Gain	Value	Line No.
Measured Optical Transmitter Average Power:	_____dB	1A
Measured Optical Receiver Sensitivity (this should be a negative value):	_____dB	1B
Subtract line 1B from 1A to obtain Total System Gain:	_____dB	1C
Section 2: Total System Loss		
Measured length of the link:	_____km	2A
Measured loss per km of the fiber:	_____dB/km	2B
Multiply line 2A by 2B to obtain the Total Fiber Loss:	_____dB	2C
Sum of all Connector Losses in the link:	_____dB	2D
Sum of all Splice Losses in the link:		2E
Sum of all Other Losses from other components (couplers, splitters, routers, switches, etc.)	_____dB	2F
Add lines 2C, 2D, 2E and 2F to obtain Total System Loss:	_____dB	2G
Section 3: Design System Gain Margin		
Subtract line 2G from line 1C (This number must be at least 6 dB):	_____dB	3A

86-20 Logical Network Requirements

86-20.01 General

86-20.01A Summary

This section specifies the Work required for the design, manufacture, delivery and installation of equipment, and for the modification of existing equipment and facilities to provide a fully functional fiber optic-based network, as specified herein, in Section 86, Electrical Systems, of the Standard Specifications, and as shown on the Exhibits and Drawings.

Work to be performed under this Contract:

1. The construction component of this contract will provide a complete and functioning backhaul infrastructure for high speed optical Ethernet communications along the I-680, I-880, and I-80 Corridors. This project will also include the installation of pull boxes, fiber optic splice vaults and conduit for communications and electrical service, communications cabinets and cabinet racks, communications facilities and racks, termination of electrical service, and any ancillary equipment or materials for each Backhaul Hub location site.

2. You will furnish, install and test the fiber optic cable network and optical terminations in the participating facilities, made ready for the future connection of the network electronics. You will also provide all network electronics and software/firmware necessary to create the Backhaul network and integrate this communications system into existing networks, such as the ELN, BATAnet and External Communications Network (ECN) networks. You shall furnish, install, and test any ancillary equipment and/or materials required to complete the installation and make the networks ready for use by BAIFA. The only exceptions are items specified to be provided by BAIFA or others. You must provide all necessary equipment, material, and labor to provide and test the Backhaul network as specified herein. This includes furnishing all required network electronics, software, firmware, software licenses, cables, splicing, termination and all incidental components necessary for the new network. Items to be furnished include, but not limited to:

    - Core Ethernet switches – including Layer 3 and/or advance licenses for each
    - Distribution Ethernet switches – including Layer 3 and/or advance licenses for each
    - Access Ethernet switches
    - Network Firewalls – Including VPN and Intrusion Detection & Prevention System (IDPS) functionality with licenses for each
    - Remote Environmental Monitoring Appliances and Sensors
    - Uninterruptible Power Supplies and Battery Packs
    - IP Addressable Power Distribution Units
    - Power cables
    - Single-mode and multimode small form factor pluggable (SFP), and copper Gigabit Interface Converters (GBICs)
    - Single-mode fiber optic trunk and drop cable
    - Fiber optic splice centers and interconnect centers
    - Fiber optic cable
    - Fiber optic patch cords
    - Category 6 Ethernet patch cords

- Cable management as required
- Fiber optic cable splicing and termination
- Additional shelves for existing racks or cabinets as required
- Labeling devices including permanent cable tags for all cables
- Miscellaneous hardware or other parts required for a complete and functioning installation

3. Using existing network infrastructure, racks, facilities or cabinets, install all required network electronics, software, cables, and components necessary for the new network.
4. You shall coordinate with BAIFA, its partners and other contractors, including the toll system integrator (TSI) and civil contractor, communications solution providers and utility service providers to ensure sufficient fiber terminations, electrical power, outlets, and rack space are provided as part of this contract. Installation shall include but not be limited to:

    - Coordination with BAIFA and the utility service provider to ensure sufficient reliable (clean) power for all network electronics, with UPS power backup for Core, Distribution and Access switching platforms and network electronics
    - Install shelves and cable management as required
    - Install network electronics per manufactures specifications
    - Install Grounding of all Equipment and equipment Racks per National Electric Code (NEC)
    - Install fiber optic trunk and drop cables. All will be routed in a clean and neat manner
    - Install splice enclosures and splice interconnection centers
    - Install fiber optic patch cords from network electronics to the new and existing fiber optic patch panels
    - Install Category 6 Ethernet patch cords from network electronics to the patch panels using Velcro straps
    - Install power cables for all network electronics. These cables will be routed separately from all Ethernet cables
    - Install cable tags on all data cables. Include source and destination on all labels
    - Provide comprehensive documentation and instruction to BAIFA after performing the proper set up, use, security, troubleshooting and configuration of the network electronics and software, such as:
    - Narrative, flowcharts and screen captures for console and GUI-based administration
    - Directions and detailed chassis diagrams/pictures for replacement, addition, and removal of network electronic components, field-replaceable or hot-swappable component parts and modules
    - Identification, authentication and authorization information such as usernames; passwords; group memberships; roles, rights & permissions
    - VPN and encryption information such as certificates, shared keys, policy configurations and end points
    - Furnish test equipment and computers necessary to test the Backhaul
    - Test all aspects of the Backhaul after installation as specified by BAIFA
    - Provide follow-up and ongoing maintenance and support to the network
    - Furnish documentation submittals as specified

- Furnish and install materials as required for restoration
- All Contractor-furnished materials must not be stored on the premises of BAIFA
- You are responsible for providing the material storage area with locking container such as semi-trailer or shipping container for Your use
- You are responsible for providing the receiving area, staging area, and transport for Contractor-furnished materials. You may request commercial storage and staging area recommendations from BAIFA
- You are responsible for loading and transport of BAIFA-furnished materials
- You must submit material requisitions as needed, specifying material descriptions and quantities required

5. The Backhaul network shall be configured to provide complete logical separation of the Express Lane Network (ELN) from the rest of the Backhaul entities and users. This includes the use of separate routing tables for the ELN.

6. For the purposes of bidding, assume the following configuration guidelines will apply. The final design and configuration will be determined after meetings with all stakeholders.

    - Combination of BAIFA-owned fiber and service provider infrastructure
    - Approximately one hundred fifty five (155) virtual local area networks (VLANs) and IP subnets must be configured.
    - Use agency provided VLAN numbering and IP addressing scheme
    - OSPF routing with multiple areas for communication with the ELN
    - SNMP community strings and network device naming standard.

7. Prior to order and procurement of Backhaul logical network electronics hardware and network management system software, the following documentation must be reviewed and approved by BAIFA:

    - Project Management Plan as described in Part 7, GC-78, “Project Management”

8. Prior to testing, the following documentation must be reviewed and approved by BAIFA:

    - Calculations and certifications as described in Section 86-20.01D Submittals
    - Manufacturer Qualifications as described in Section 86-20.01D Submittals
    - PIDR and FIDR documentation as described in 86-20.01D Submittals
    - Test plans and procedures as described in Section 86-20.01D Submittals

9. Prior to system acceptance, the following must be reviewed and approved by BAIFA:

    - Qualification test results as described in Section 86-20.01D Submittals
    - Certification test results as described in Section 86-20.01D Submittals
    - As-Built documentation as described in this agreement
    - Training and O&M Manuals as described in Section 86-20.01D Submittals
    - Training provided to BAIFA as described in Section 86-20.01D Submittals

10. Maintenance payments will not commence until system acceptance is complete.

86-20.01A(1) Backhaul Locations
Work under this contract must be performed for the following locations:

1. Data Centers: Furnish, configure, install and test networking hardware and software at the following data center locations:

    - 375 Beale Street
    - Benicia Bridge Toll Plaza

2. Corridor Hubs: Furnish, configure, install and test networking hardware and software at the following Corridor Hub locations:

    - BAIFA Oakland Hub Facility, adjacent to CFH BART facility
    - Caltrans District 4 Traffic Management Center (D4 TMC)
    - Walnut Creek BART Station
    - Dublin BART Station
    - AutoMall
    - Hegenberger
    - I-80 West
    - I-80 East

86-20.01A(2) Corridor Fiber Trunk Optic Cable

Furnish, install, splice, terminate and test new single mode fiber optic trunk cables at the following locations and as shown in the Drawings:

3. In existing conduit along the I-680 Corridor from Benicia Bridge Toll Plaza to East Dublin
4. In existing conduit and new conduit installed as part of this Contract along the I-880 Corridor from Hegenberger to the AutoMall locations
5. Splice and/or patch into existing trunk fiber optic cable installed by others:

    - Between the Silicon Valley ITS Traffic Operations Facility and the AutoMall Hub
    - At and between each Backhaul BART station hub or facility and corresponding BART Train Control room
    - At and between 19th Street BART station hub or facility and Caltrans D4 TMC facility
    - At and between the BAIFA Oakland Hub and BART CFH facility and the corresponding BART Station facilities and BAIFA hub connections shown in the network Drawings

86-20.01A(3) Work by Others
BAIFA-Furnished Equipment and Materials:

- Racks at 375 Beale Street and Benicia Bridge Toll Plaza
- Utility-Furnished Equipment and Materials:
- AT&T Cellular Modems at each Backhaul Hub and Data Center Location

86-20.01B References
Applicable codes and standards
Your work must conform in all respects to applicable industry standards and sound engineering practice.
Contractor work and provided equipment must conform to the latest revision of the following standards and additionally Electrical Systems specification section 86-1.02 of the Contract package:

- Federal Communications Commission (FCC) 47 CFR Part 68 - Connection of Terminal Equipment to the Telephone Network
- Building Industry Consulting Services International (BICSI)
- National Fire Protection Association (NFPA)
- NFPA 70 - National Electric Code (NEC)
- NFPA 72 - National Fire Alarm Code
- Telecommunications Industries Association (TIA) TIA/EIA-606-A, Class 4 - Administration Standard for Commercial Telecommunications Infrastructure, current edition
- Underwriters Laboratories (UL)
- UL1459 - UL Standard for Safety ECB Equipment
- UL/CSA 60960 - Safety of Information Technology Equipment
- UL 50, Type 3R - Enclosures for Electrical Equipment
- Electrical & Electronics Manufacturers (EEMAC) Standards
- Institute of Electrical and Electronics Engineers (IEEE)
    - IEEE 802.1 Standards for Local and Metropolitan Area Networks
    - IEEE 802.3 Standards for Physical and Data Link Layer for Ethernet
- National Institute of Standards and Technology (NIST)
    - SP 800 – Series of NIST special publications related to network security
    - SP 500 (selected) – Selected publications in this series apply to network security
- Request For Comment (RFC)
    - RFC 2576 Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework
- Occupational Safety and Health Standards (OSHA)
- Manufacturer’s published instructions
- BAIFA and BATA Information Systems Standards and Policies

86-20.01C Definitions
Please see **Part 3, Instructions to Bidders**, 4.1, Definitions.

86-20.01D Submittals
Submittal format and content will comply with the general requirements of the Contract Specifications, Submittal Procedures, and the specific technical requirements further listed herein.

86-20.01D(1) Manufacturer Qualifications
You must submit complete product data including description and model number, shop drawings, catalog cuts, technical literature, and software descriptions for all equipment and software provided under this contract as part of your bid response package. Any manufacturer equipment specification which does not meet the performance requirements specified herein will require Owner prequalification and approval. Acceptability of the manufacturer will be based on the manufacturer's experience, qualifications, certifications (i.e. ISO-9001), equipment reliability, and compliance with standards specified herein and full compatibility with the existing system.

86-20.01D(2) Implementation Package
The implementation package includes plans that describe how the Backhaul network will be deployed, configured, installed, integrated and transitioned into an operational system. You must submit a draft implementation package as part of the BAIFA IFB response that will briefly describe the major tasks involved in the implementation, the implementation schedule, the overall resources needed to support the implementation effort (such as hardware, software, personnel, training necessary, facilities and materials) and site-specific implementation requirements, including assumptions on BAIFA and third party resource availability, coordination and support. You must update the implementation package during the preliminary and final implementation reviews. The implementation package must, at a minimum, include the following plans:

- Hardware and Software Implementation Plan – Contractor must describe how the Backhaul network hardware and software will be implemented, including deployment and installation across the environment.

- Network Implementation and Integration Plan – Contractor must describe how the Backhaul network protocols, services and features will be implemented, including hardware and software configuration and integration into the environment.

- Network Performance and Security Management Plan - Contractor must describe the service level monitoring and management; backup and recovery; hardware, software and firmware upgrade and update; risk assessment methodology, security monitoring and management; security incident management, availability and assurance; Public Key Infrastructure (PKI) plan for certificate services needed for Backhaul network; and reporting features associated with the Backhaul network when it is implemented. Conformance to BAIFA Network Management and Security Management policies should be discussed, when applicable.

- Additionally, you will perform an information security risk analysis of the Backhaul network as part of the preliminary and final implementation review. The risk analysis shall be used to inform the security controls implemented by You for the Backhaul network. All security controls must be reviewed and accepted by

BAIFA before implementation. The risk analysis methodology and control selection must follow generally accepted industry guidelines and practices, such as those in the NIST information security series of publications.

86-20.01D(3) Preliminary Implementation Review (PIDR) Requirements

Contractor must include the following information as part of the PIDR submittal package for the following:

1. Network architecture to be implemented, including design specifications provided by BAIFA under this Contract, including:

    - Shelf layout and inventory within equipment chassis
    - Network switch, router and firewall port mappings and configuration
    - Board level dipswitch or strap settings
    - Node identification information
    - IP address, Subnet mask and default gateway assignments
    - VLAN assignments
    - QoS Configuration
    - Layer 2 and Layer 3 High Availability configuration and topology (i.e. VRRP/HSRP, Switch Stacking/VSS, 802.3ad link aggregation groups/Etherchannel)
    - SNMP and network management configuration
    - SNTP configuration
    - Network Firewall and IPS configuration
    - All ACL lists & routing tables
    - RSTP/MSTP configuration and topology
    - Node name and network designation
    - Usernames and passwords for all access levels

2. OOB management connections
3. Network Management System (NMS) Hardware, Network and Software Configuration
4. Network security risk analysis and control selections
5. Network Security Configuration
6. Material Specification Data Sheets and Product Samples. The Construction Manager shall submit complete product data including description and model number, shop drawings, catalog cuts, technical literature, software descriptions, and samples (as requested by BAIFA), for all equipment and software provided under this contract.
7. Identification and specification of all external interfaces to existing network components, other subsystems provided under this contract, and to any work performed by other Contractors.
8. Descriptions of required modifications to existing equipment in order to interface new network
9. Preliminary fiber optic link loss budgets for all fiber optic spans as described in **Part 10, Construction Details.**

86-20.01D(4) Final Implementation Review (FIDR) Requirements
Contractor must include the following information as part of the FIDR Technical architecture submittal package for the following:

1. Network architecture to be implemented, including:
    - Updated PIDR information. All drawings, calculations and design information shall reflect a final design.
    - Actual fiber optic link loss budgets for all fiber optic spans installed under this contract, sufficient to show that all proposed spans meet published link loss budgets.
    - Cable pair and fiber strand usage diagrams
    - Local Distribution Frame (LDF) wiring and termination assignments
    - Fiber Distributions Panel (FDP) components and equipment
    - Interconnect and wiring diagrams to include Power supply and fuse panels
    - Complete wiring diagrams for all field equipment, including intermediate patch panels, protection, and interconnect equipment provided and installed under this contract
    - Complete wiring diagrams for all equipment installed in existing facilities, including intermediate patch panels, termination, protection, and interconnect equipment provided and installed under this contract
    - Complete terminal cabling and interconnection diagrams for all Outside Plant (OSP) fiber optic cable provided and installed under this contract
    - Proposed rack layouts and elevations for new or modified equipment, including assembly drawings, installation drawings, component level inventories and parts lists
    - Proposed revision of all equipment operating software with descriptive documentation, including, but not limited to:
    - Release Notes
    - Product Bulletins
    - Applicable Field Notices
    - Design Guides

86-20.01D(5) Calculations and Certifications
1. **Calculations**

Calculations must be performed and included as listed in the PIDR and FIDR.

- Fiber Loss Calculations as specified in Part 10, Construction Details.

2. **Certifications**
- All test equipment used shall have a current calibration certificate dated no more than one year prior to the test
- Manufacture and Personnel Certifications:
- Copy of the following certifications shall be included:
- ISO certification for all proposed manufacturers

- Equipment Manufacturer Certification Installation Training for any technician performing installation, test, or turn-up work on any equipment (i.e CCNA, EXFO, BICSI)
- Cable Certifications
- Submit cable qualification data, including the following:
- Listing of State Roadway and Transit Owner Customers: Provide a list of names of five (5) state roadway and transit properties to which the manufacturer has provided cables similar to those required by the Specifications
- Cable Manufacturer's Quality Plan
- Cable Manufacturer's Qualification Report
- Installation Qualification Test Documentation

86-20.01D(6) Test Plan and Procedures

General -- An acceptable test plan must include all information and testing matrix to clearly explain how equipment is to be tested to provide a complete and working system. This plan should include individual subsystems testing as well as complete overall system testing that proves the functionality of the finished product. This test plan should clearly explain and document how each subsystem and overall systems will be tested and verified. The final test plan will be reviewed and accepted by an appropriate BAIFA engineer before it will be implemented.

Objective -- The objective of your test plan will be to provide BAIFA with a series of test procedures for qualifying and certifying the product features and functionality of the components implemented as the BAIFA Backhaul network as they are implemented per corridor phase. A summarization of these tests follows:

- System Configuration Testing: The objective is to provide testing that shows the accessibility of the management interface(s) of the proposed network hardware and software. An introduction and familiarization of the configuration system(s) along with the user interface(s) will be included to augment this testing.
- Traffic Prioritization Testing: The objective is to provide testing of the network switching and routing equipment's hardware-based queues. This testing will highlight the network traffic prioritization capabilities, and Quality of Service (QoS) features.
- SNMP Management Capabilities Testing: The objective is to demonstrate how the BAIFA can use the network system hardware and software SNMP MIBs to provide remote platform management. This testing will also ensure that you will be able to provide their monitoring and management warranty services.
- IP Forwarding Functionality Testing: The objective is to verify the IP forwarding functionality and features. The test includes IP traffic forwarding, verification of traffic separation via separate VRF instances, route functionality and redundant route capabilities. This testing will use different packet types to verify that all possible traffic will be forwarded. You will coordinate with BAIFA and the TSI to ensure this suite of tests also include forwarding packets captured from the BAIFA Toll ELN System.
- Performance Testing: The objective is to show the connectivity and performance of the core and distributed switching architecture, including firewalled links, with standard Internet protocols simulated at expected traffic levels.

- Dependability and Availability Testing: The objective is to show the proper functionality of multiple interfaces and connections. The network hardware manufacturer implementation of Open Shortest Path First (OSPF), spanning tree (MSTP, RSTP, etc…), and link aggregation will be tested for accuracy and performance. The N+1 configuration of interfaces, switch fabrics and power supply modules will be faulted and tested. All this testing will be done while hot-swapping the individual modules. Redundant and stacked hardware configurations will be tested for local failover and redundancy. At a minimum, testing will simulate failures during the following hardware process states or functions: startup/bootstrap, run, upgrade and maintenance.
- Security Testing: The objective is to verify the BAIFA security policies for the Backhaul network have been implemented, is enforced and is auditable. The Contractor is not permitted test any existing production networks, such as BAIFA, TSI, stakeholder or 3rd party production networks which interface with the Backhaul. If necessary, You will apply additional coordination with BAIFA to ensure the security testing does not include, affect or interfere with existing production networks.
- Network Management Reporting: The objective of this test is to show the proper configuration, functionality and features of the implemented Backhaul Network Management System (NMS). NMS data collection, alerting and reporting capabilities and features will be tested, including the collection of data during commission testing. Following BAIFA acceptance of all commission testing, the testing data will be purged from the NMS system.

Test Approach
The test approach must at a minimum, consist of the following:

1. Qualification Testing:
    - Factory inspection and acceptance including 72 hour “burn-in” quality testing
    - Network Switch, Router and Firewall (NSRF) Configuration Management Access and access control.
    - Network Management System (NMS) Hardware and Software Configuration Management Access and access control.
    - End-user to NSRF & NMS hardware and software through two Network Switch platforms via 10GigE and simulated Metro-E Backbone.
    - SNMP MIB Management NSRF and NMS features.
    - IP Forwarding functions and features.
    - QoS/CoS Network functions and features.
    - IP Forwarding Performance and Capacity testing of Core and Distribution 10GigE and Gigabit interfaces.
    - Failover reliability of NSRF OSPF routing protocol implementations.
    - Fault-Tolerance, Redundancy and Hot-Swapability of all modules of applicable NSRF hardware.
    - Application Packet Transfer Testing.
    - Security Filtering, Malicious packet detection and prevention, logging and auditing implementations.
    - Certification Testing:
    - End-user to NSRF & NMS hardware and software through two Network Switch platforms via 10GigE and simulated Metro-E Backbone.

- SNMP MIB Management NSRF and NMS features.
- IP Forwarding functions and features.
- QoS/CoS Network functions and features.
- IP Forwarding Performance and Capacity testing of Core and Distribution 10GigE and Gigabit interfaces.
- Fail-Over Reliability of NSRF OSPF routing protocol implementations.
- Fault-Tolerance, Redundancy and Hot-Swapability of all modules of applicable NSRF hardware.
- Application Packet Transfer Testing.
- Security Filtering, vulnerability scanning and remediation, malicious packet detection and prevention, physical port level and console security, security incident logging, alerting and auditing at a data center and roadside location.
- System backup and restoration, configuration management

2. **Continuing Certification Testing:**

    - ICMP verification across the fiber and Metro-E leased lines from the primary and secondary data center locations.

You will provide qualified staff to support all tests required by these Specifications. You will submit the following test plans and procedures:

1. Test Program Plan: You will include all the required information in the Test Program Plan as required by these Specifications and in accordance with industry and manufacturer accepted testing guidelines
2. Factory Test and Offsite Lab Test Procedure: You will submit a complete factory test and offsite lab test procedure to satisfy all the requirements of this Specification.
3. Qualification Test Plan: You will provide a qualification plan for inspection, assessment of quality, condition and suitability of hardware, software and all subsystems prior to deployment. The qualification plan will also address factory acceptance, inspection, turn-up & burn-in, and pre-deployment lab testing. For the lab testing, simulated environment requirements will be included. Simulated data traffic at expected loads will be included.
4. Certification Test Plan: You will provide a certification testing plan for field testing and systems integration. Simulated data traffic at expected loads shall be included.
5. Field Test Procedure: You will submit a complete field test procedure to satisfy all the requirements of these Specifications.
6. You will coordinate and work with BAIFA and the TSI to support Toll System acceptance testing for each corridor. Changes to the Backhaul network made after acceptance of any test may require regression testing. Regression testing due to system changes necessary to correct misconfiguration by You shall be required at BAIFA's discretion and at no additional cost to BAIFA. Regression testing due to BAIFA directed changes unrelated to misconfigurations by You shall be at BAIFAs discretion and cost. You will coordinate with BAIFA and the TSI to provide on-site support during OFIT testing on the I-680 corridor and to provide remote off-site network support for Express Lanes Network testing of data traffic between the roadside ELN network to the data centers as required by BAIFA.
7. You will coordinate and work with BAIFA and Caltrans District 4 to support operational testing of the Caltrans Traffic Management System (TMS) ITS equipment impacted by the construction and installation of Backhaul conduit and fiber optic cable, including

submission of Backhaul fiber optic cable test results for approval by a Caltrans Engineer for the following:

- 72-Strands of Backhaul Fiber Optic Cable installed and tested as part of this Contract designated for Caltrans use
- Fiber optic drop cables installed, spliced and terminated into TMS ITS cabinets as part of this contract and designated for Caltrans use.

8. All test instruments and equipment required to conduct tests will be available and ready-for-use not less than one (1) week in advance of test date. The term ready-for-use means properly matched for test parameters, properly calibrated, sufficiently supplied with leads, probes, adapters, and stands, as required to conduct a particular test.
9. You will verify that all test equipment is properly calibrated by the manufacturer prior to use.
10. You will submit equipment calibration data for all equipment utilized to conduct test, as part of each specific test report.
11. Test equipment which cannot be verified as properly calibrated shall not be used for testing. Any test conducted utilizing improperly calibrated test equipment shall be rejected and retested at no additional cost to BAIFA.
12. Test Records: You must submit the Test Records for review ten (10) Working Days after the completion of each test.

Test data will be provided in Static and Dynamic Format:

- Static format will be compatible with all project specifications and requirements
- Dynamic format will be in native testing machine format suitable for additional analysis
- Provide all additional software as required to read native format.

86-20.01D(7) As-Built Requirements

You must submit all as-built drawings and configuration details, such as running/saved configurations, for inspection and approval prior to acceptance of the Work. As-built drawings will be an update of the installation details. As-built drawings must be drawn using Microsoft Office, Microsoft Visio and/or Bentley Microstation. Hand mark-ups (red-lines) shall not be acceptable.

As-Built Drawings and Configuration

You must supply all as-built drawings and configuration details for the network implementation within ten (10) working days of End-to-End Certification testing. These shall include, but not be limited to, the following items:

1. Schematic/Block diagram: Complete system block diagram indicating all components, interconnection and cabling.
2. Wiring diagram: System wire and cable designation schedules indicating origin, terminus, cable type and cable designation at each demarcation location.
3. Circuit diagram: A diagram document of how components are interconnected by functions, cable terminations, terminal identification and cable designation (under no circumstance will wiring schematic or typical wiring details be considered as circuit diagram.)
4. Provide elevation drawing of the rack layout.

5. Configuration scripts (i.e. running-configs) for network hardware and software
6. Detailed Network Layer 2 and Layer 3 logical topology
7. Security filtering matrix for firewall and switches, showing authorized protocols, source, destination and action
8. Configuration details for any VPNs configured as part of this contract
9. Configuration details for all Virtual Routing and Forwarding tables (VRFs) configured as part of this contract
10. NMS Host physical topology and Guest virtualized environment
11. Final configuration settings for all hardware and software
12. Conduit and cable schedule being used for this system
13. Cables label schedule
14. Fiber optic cable assignments, maps, diagrams and spreadsheets
15. Network System Design Documentation
16. Network and System Administration records including identification and authentication information such as local and centralized usernames, passwords, VPN encryption settings, and encryption keys.
17. Network and System Administration transition plan and procedures including steps to administer, monitor and verify physical and logical access controls, identification and authorization, remote connections such as VPNs, physical access to cabinet network electronics, and any other information necessary to complete a post-warranty network and system administration from You to BAIFA IT.

86-20.01D(8) Operation and Maintenance (O&M) Manuals

You must provide individual equipment manufacturer issued manuals containing all technical information on each type of equipment installed. In the event such manuals are not available from the manufacturer, You shall provide the same information and compile within the manual. These documents are to be provided in both paper and PDF formats.

Each manual shall contain a systems parts list, a parts list for individual components, detailed schematics and recommended maintenance procedures. Advertising brochures or operational instructions shall not be considered as technical manuals. You will deliver three (3) complete sets of all shop and circuit drawings, wiring schedules and single line block drawings in hard copy.

Additional content to be covered in the O&M manuals, at a minimum:

1. Operations and Monitoring Plan which supports BAIFA operations, supervision, monitoring, troubleshooting, evaluation and security of the Backhaul network. You will work with BAIFA IT during the development of the operations and monitoring plan to address BAIFA IT management concerns.
2. Full technical description of product including illustrated pictures of parts and operational concepts
3. Theory of operations
4. Procedures and guidelines for BAIFA policy-compliant operations of the Backhaul network
5. Network and system administration procedures
6. System Failure and Recovery Procedures
7. System and equipment specifications
8. Ordering information and part number identification
9. Configuration drawings for panels, racks and screens

10. Equipment options
11. System configurations (for example: DIP switch setting and software control settings)
12. Applications engineering (as appropriate)
13. Installation and commissioning test procedures
14. Operations of all user controlled functions
15. Software instructions and procedures
16. Preventative maintenance test procedures and schedules (daily, weekly, monthly, quarterly, and annually)
17. Trouble shooting guide and flow chart
18. Startup and shutdown procedures
19. Backup and Restoration procedures
20. Lockout/Tagout procedures (as appropriate)
21. Return and repair procedures with vendor technical support and wiring schematics
22. Mechanical drawings, block and level diagrams, and wiring schematics
23. Registration form for document tracking by vendor
24. Provisional parameters stating range, default setting, description and procedure
25. Alarm clearing procedures
26. Material and safety data sheets
27. Contact information for warranty support including; company name, address, telephone number, email address, and company representative
28. Contact information for non-warranty support including; company name, address, telephone number, email address, and company representative
29. Documentation of hardware/software maintenance contracts (and renewal)
30. Fiber assignment spreadsheet

86-20.01D(9) Quality Assurance

1. Applicable Standards and Codes

   Your design and installation shall comply with all applicable Standards and Codes as listed herein. All equipment shall comply with the latest version of standards as applicable herein.

2. Product and Workmanship Requirements

All equipment provided under this Section shall be UL listed.

- Discontinued product models, refurbished equipment, or products scheduled for end-of-life, end-of-sale, or end-of-service within one working year of the installation date shall not be used.
- All products specified herein shall be subject to approval based on your ability to demonstrate adherence to the specified requirement and approval of the manufacturer's quality process (i.e. ISO-9001).
- All products proposed shall have been proven in use demonstrating reliability and quality in rail, toll, ITS or similar transportation application for no less than two (2) years.
- Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediate

notification is required if work cannot be completed in a manner that meets the requirements as set out in the Specifications and Drawings.

- All products are to be new, of minimum or better quality than specified, and conforming to the standards of UL
- All grounding shall comply with requirements of the National Electrical Code, specifications, recommendations of the manufacturer, local design guidelines, and the direction of the local authority having jurisdiction. Immediate notification is required where these requirements differ. You shall adhere to the most stringent of these requirements, codes or standards.

3. Manufacture Pre-Qualification Requirements

- All manufactures of equipment must be shown to have been established in their current field of business for no less than ten (10) years.
- All new equipment provided and installed under this contract shall be compatible with existing equipment installed in field and data center locations.
- Manufacturers shall be ISO 9001 certified.
- All products proposed shall have been proven in use demonstrating reliability and quality in rail, toll, ITS or similar transportation application for no less than two (2) years.

4. Safety

   Personnel installing equipment shall be required to follow the CALTRANS District 4 safety rules and procedures while performing any field Work.

86-20.01D(10) BAIFA Review of Your Submitted Documentation
BAIFA shall be allowed two (2) review cycles of 10 days each in duration for review and approval of documents listed in this Section 86-20.01D, Submittals.

86-21 Network Management

86-21.02A Summary
You shall furnish and install a Network Management System (NMS) to monitor, alarm and remotely configure all communications devices that connect to the Communications Systems as well as provide global and device specific configuration and protocol management, troubleshooting and root-cause analysis, security, system performance, and health monitoring for the Backhaul communications network.

The NMS shall be chosen and installed according to the following criteria: Network Software and Configuration Management, Auditing Capability, Discovery and Monitoring, Change Management, Security Management, Performance Management, Security Management and Reporting, and additionally:

1. A web-based Graphical HMI for physical and logical system configuration to enhance troubleshooting of the Communications System. Any database software that is required to support the NMS shall be included as incidental with the NMS software
2. Utilize BATAnet-provided centralized AAA for user authentication
3. Provide multi-level or role-based access control
4. Utilize BATAnet-provided active directory for access control

5. Utilize BATAnet-provided RADIUS remote access service
6. Support any common network device that supports SNMP v1, SNMP v2, or SNMP v3. Configure the NMS to provide BAIFA read/write access for administration purposes.
7. Compatibility with existing BATAnet's network management solution, Solarwinds NPM.
8. Provide hardware management of servers, arrays, tape library and other network electronics.
9. The NMS subsystems, including the Security Management and Reporting subsystems must each be installed on separate guest virtual servers such that each guest virtual server is dedicated to one task or function, where possible. The Reporting subsystem must be located in a DMZ accessible only to BAIFA stakeholders. You shall work with BAIFA to identify, configure and provide secured network connections into the Reporting Subsystem DMZ for BAIFA and its stakeholders.
10. Provide resilience and failover in the event of NMS hardware failure.
11. Provide N+1 redundancy of physical Host servers.

86-21.02B Network Software and Configuration Management

1. Provide functions to capture, modify, print and save and restore running configurations on all Backhaul network communications devices
2. The NMS must provide functions to update and roll back firmware to all Backhaul network communications devices via TFTP and additionally, any of the following:

    - Secure File Transfer Protocol (SFTP)
    - SSH
    - Hypertext Transfer Protocol Secure (HTTPS)

3. Provide centralized configuration management functions for the following:

    - Naming and detailed description data for managed objects.
    - Track maintenance and work history
    - Assignment and tracking of scheduled and manual maintenance
    - Schedule automatic upgrade and update of software and firmware for Backhaul network, including network servers, network switches, routers, firewalls, management software and ancillary hardware such as UPS.
    - Manual upgrade and update of software and firmware for Backhaul network, including network servers, network switches, routers, firewalls, management software and ancillary hardware such as UPS.
    - Software and firmware repository for Backhaul network, including network servers, network switches, routers, firewalls, management software and ancillary hardware such as UPS.
    - Polling and validation of software and configuration for Backhaul network, including network servers, network switches, routers, and firewalls.

4. Provide a single management platform to centrally manage the configuration, security policies, perform forensic analysis and generate reports across existing BATAnet Firewalls and Backhaul Firewalls.

86-21.02C Auditing

1. Listing of all specified managed devices with model number, firmware and software loaded on each device with version number and patch number where appropriate.

2. Log of all failures associated with a device or incident to include date and time, alarm severity, alarm name, alarm description, and alarm or issue resolution.
3. Log of all user account access, NMS activity and changes to the NMS
4. Logging to default or user defined location and automatic archiving to remote location. Hardware and software necessary to support archiving store.
5. Date and time stamping of all NMS collected log data.
6. Syslog server functionality to record all SNMP traps and log all commands entered into each network device.

86-21.02D Discovery and Monitoring

1. Network management and monitoring must occur in-band wherever possible. You will identify which equipment will be monitored in-band, out-of-band, and which equipment, if any, cannot be monitored/managed via the network.
2. Layer 2 / 3 network discovery must be provided with licenses for up to one hundred forty (140) managed devices, including all interfaces, hardware and software subsystems. These devices are inclusive of the network devices described herein, but have the added requirement of automated network discovery and mapping capability.
3. The NMS must be scalable to allow for future growth of the BAIFA Backhaul system. The NMS must provide for the ability to expand the licenses in the future to continue to monitor new devices as they are added. The initial BAIFA deployment shall contain approximately one hundred forty (140) managed devices. You will license all network connected Backhaul devices for monitoring or one hundred forty (140), whichever is greater. The NMS must be expandable to handle four hundred (400) devices or more with no additional hardware requirements. For bidding purposes, the initial deployment shall be one hundred forty (140) managed devices, with the capability to expand to four hundred (400) devices through additional license purchases, which are not required as part of this bid.

86-21.02E Change Management

Centralized Change Management functions including the following:

1. Installation, modification and tracking of network configuration parameters (hardware and software) to enable the continuous operation of services. The NMS must be able to reconfigure the equipment electronically and remotely. All interface models, interface ports and system controller options and settings shall be configurable, without using hardware option settings. A replaced module shall have its options automatically downloaded from the database contained in the online memory.
2. Contingency reconfiguration. A power failure outside of equipment causing a loss of service must, upon power restoral, initiate a restoral to full service without operator intervention. The system must be fully operational (OS interfaces, alarm resets, PM processing) within ten (10) minutes of system restart. The system must be in service within two (2) minutes of a system restart.
3. Reporting of change-of-state of all communications equipment, where applicable
4. Network path and logical topology management with provisioning, modification and auditing capabilities
5. Remote provisioning of communications equipment, facilities and cross-connects. The following service provisioning functions shall be available both locally and remotely:
    -
    - Establishment/removal/rearrangement of connection

- Placement of equipment into service
- Removal of equipment from service
- Software downloads capability of new generic releases to communications equipment, where applicable.

86-21.02F Security Management

The network must be protected from unauthorized, incorrect or accidental use, modification or disclosure. A system administrator security system shall be available for implementation. Security requirements include the following features:

1. Backup and restore features to protect network switch/router/firewall configurations, network storage device configurations and BAIFA network management virtual environment critical server and Network Management console/workstation configurations. This will save a copy of the equipment or device's configuration information in order to restore a device, operating system, database or application later, if necessary, or to load an identical configuration to a new device or server, if necessary.
2. Control of network user access
3. Logging and secure storage of all NMS user activity for convenient access
4. Capture, log, monitor, analysis, correlation and reporting of security events on the Backhaul network.
5. Security violations alerting, notifications and reporting.
6. Security Dashboard views to support identification of patterns and activities that do not conform to standard network communications
7. Access to the Backhaul network management interfaces and the NMS shall be limited accordingly. The system must be designed to protect the sensitivity, availability, privacy and integrity of the information transported and processed.
8. Security vulnerability scanning and reporting:
   .
   - The NMS must support scheduled and manual vulnerability scans of the Backhaul network, including but not limited to: network switches, routers, firewalls, server and storage array hardware, operating systems, applications and databases deployed as part of the Backhaul system.

9. Secure storage and integrity verification of Backhaul Network logging data using cryptographic methods such as 128-bit or higher encryption of log files or cryptographic hashing.

86-21.02G Performance Management

Provide centralized performance management functions for the following:

1. Collection of network traffic statistics
2. Network alarms, performance and health status to NMS
3. Historical files of alarms, commands messages and operator actions
4. Message log retrieval for past events analysis
5. Event logging via syslog facilities
6. Monitoring and polling of Backhaul network managed objects
7. Real-time traps and alerting
8. Incident notification via email, SMS and NMS administration GUI
9. Root cause analysis
10. Generation of graphical data to support performance trend analysis
11. Monitor and report change-of-state of all communications equipment, where supported by communications equipment.

86-21.02H Fault Management

1. Fault Management must provide the detection, isolation and correction of abnormal network conditions, and include the monitoring of: 1) Automatic/manual diagnostics: 2) Diagnostics shall be performed on any Network Switch and other communications equipment, whether in service, redundant or out-of-service. All diagnostics shall be available on demand via a software command.

2. Provide centralized Fault Management functions for the following:

    - Work-flow based escalation of incidents reported to the NMS
    - Incident classification
    - Incident and event correlation
    - Configurable thresholds
    - Alert Notification via email, SMS and NMS administration GUI

3. Provide failure and maintenance recording with trend tracking and predictive failure analysis capability

86-21.02I Reporting

The NMS must be able to compile status and alarm data from the various registers into summary reports for recall and demand. At a minimum, the NMS must have the capability to compile this report up to 24 hours in duration. The NMS must include report customization based on the following criteria:

1. attributes of the object itself
2. network management system activity
3. group classifications
4. custom labels
5. time period (up to at least 395 days)
6. duration of event or incident
7. device or object
8. the event or incident
9. Operating system event logs and device syslog events

Provide centralized Reporting functions for the following:

10. Track and report BAIFA policy compliance
11. Schedule reports to be automatically generated, and optionally, emailed to staff
12. Manual and scheduled archiving. Archiving capacity must accommodate BAIFA's Backhaul data management policies (at least 395 days)
13. Summarization and filtering of data
14. Role-based access to operational and reporting data is restricted using the security principles of least access

86-21.02J Training Courses
General:

1. You shall provide training for BAIFA's network operations/maintenance personnel and/or BAIFA's authorized representatives. You shall develop a Network Training Plan prior to the development of training materials that meets the requirements of this section. The training must use the selected vendor's hardware and software furnished by you and generally consists of the following:

2. **Content:**
    - Training on the proper set up, use, security and configuration of the network equipment and software, including all management software used in the Backhaul network
    - Training on the proper set up, use, security and configuration of the Management Server Virtual Environment, including server and storage array hardware and software, operating system, virtualization, configuration and protocols
    - Training for any unique or special circumstances encountered during installation and configuration of the Backhaul network
    - Training incorporates all operations and maintenance manuals furnished by you as part of this contract

On-Site Training:

3. **General:**
    - You shall supply on-site, network-specific training.
    - You shall train a minimum of three (3) of BAIFA's network operations/maintenance personnel and a minimum of one (1) of BAIFA's authorized representatives.

4. **Before final system acceptance for Segment I, you will provide BAIFA training at the following locations:**

    - 375 Beale Street Data Center
    - Benicia Bridge Toll Plaza Data Center
    - BAIFA Oakland Hub (BOH) location
    - Caltrans D4 TMC
    - One other BAIFA-identified location

5. **Topics to be addressed are:**

- Proper installation procedures
- Basic troubleshooting to identify failed network electronics
- Steps to perform if any of the network electronics fails and has to be replaced
- Description of the features and architecture of the network electronics
- Installation, configuration, and maintenance of the network electronics
- Configuration of Layer 2/3 switching including VLANs, router ports, and 802.1Q
- Configuration of Link Aggregation (IEEE 802.3ad) / EtherChannel (Layer 3)
- Configuration of Switch Stacking / VSS
- Configuration of DHCP Relay and UDP Forwarding, if configured
- Description of Layer 3 routing support on the network electronics including Open Shortest Path First (OSPF), and Protocol Independent Multicast (PIM)
- Configuration and application of Virtual Routing and Forwarding (VRF)
- Configuration of Virtual Routing Redundancy Protocol (VRRP) / Hot Standby Routing Protocol (HSRP)
- Configuration of network links including GigE and 10GigE Ethernet ports
- Definition and discussion of the management and security options including SNMP, RMON/SMON, SYSLOG and RADIUS
- Configuration and application of Quality of Service (QoS) features
- Setup, configuration, monitoring, troubleshooting, backup and recovery of management server virtual environment
- Installation, configuration, operation and maintenance of Backhaul NMS hardware and software
- Procedures on how to generate, track and modify service requests with the Contractor, including use of contractor web-based service ticket portal
- Upon completion of all installations, You shall provide an overall review training session to address:

    a. Problems and corrective action taken during installation
    b. Configuration changes that differed from initial training
    c. Other questions or issues that arose after initial training or before final system acceptance of Segment I.

6. **Backhaul Specific Training:**

The topics to be covered must include:

- Operating and configuring the network devices
- Creating and modifying user's access rights, logins and passwords on Network Management and Security Management Software
- Managing the network environment
- Fault Isolation
- Out-of-Band Management
- Scheduled and ad-hoc report generation
- Interconnection of data switches
- Explanation of Backhaul Virtual LANs (VLANs) and IP addressing schemes
- Layer 2 and Layer 3 High Availability (i.e. OSPF, Etherchannel, VRRP/HSRP) routing and switching topologies and configurations
- VRF configurations and troubleshooting
- Determining IP routes

- IP traffic management on the core and distribution network electronic switching hardware using access lists
- IP traffic inspection and policy enforcement using the selected vendor's firewall feature set, including but not limited to:
- Explanation of the basic firewall technology, features, hardware, and licensing options of the security appliance
- Implementation and troubleshooting basic security appliance connectivity, VPN connectivity, and device management plane features
- Configuration and verification of security appliance network integration
- Configuration and verification of security appliance policies
- Configuration and verification of high availability and failover on security appliances
- Configuration and verification of IPSEC and SSL VPN tunnel connections on security appliances
- Configuration of content and software updates
- Configuration of reporting server, scheduling and manual generation of canned and customized reports
- Implementation, configuration and tuning of IPS
- Security Incident Response training to handle and respond to computer and network security incidents in the Backhaul network environment, including how to handle a variety of incidents (i.e. natural, man-made, insider and outsider attacks, accidental and malicious, etc…), forensics and evidence preservation, CIRT team roles, risk assessment methodologies, creation of incident response plans, policies and procedures, laws and regulations related to incident handling, and incident recovery.

86-21.03 General Work And Installation Criteria

86-21.03A Segment I

Contractor shall be responsible for:

1. All network electronics and software installation Work necessary to complete the indicated network, except as specified or indicated otherwise.
2. All Work must be done in a neat and professional manner, in accordance with all applicable standards and practices.
3. All installation and testing must be performed by qualified network technicians with a minimum of five (5) years of experience in the installation and testing of similar equipment.
4. All equipment must be installed, configured and tested in strict accordance with the original manufacturer's instructions.
5. All equipment must be placed into operation in accordance with specified function.
6. Install equipment in the locations specified or indicated.
7. All equipment chassis must be solidly grounded in accordance with NEC.
8. Install and wire all equipment in accordance with the Drawings. Any variations shall be noted on the site copy of contract Drawings and indicated on the as-builts.
9. All network electronics and software must be free of all known security vulnerabilities, worms and viruses at the time when testing begins.
10. You will submit detailed configuration, implementation and backout plans for approval by BAIFA before Work begins.

11. A Sequence of Work must be developed and provided to BAIFA for approval before Work begins, assuming the following priorities for BAIFA in order of importance:
12. Core and I-680 Hub and corridor connectivity (see plans for locations of communications Hubs):

    - Benicia Bridge Toll Plaza Data Center,
    - 375 Beale Street Data Center
    - Walnut Creek Hub,
    - BAIFA Oakland Hub (BOH) ,
    - Dublin Hub,
    - BART 19th Street Station and Caltrans D4 TMC Fiber Optic Cross-Over,
    - Caltrans D4 TMC,

13. Core and I-680 Network and Backhaul NMS Integration into BATAnet
14. Core and I-680 configuration and integration into Backhaul NMS
15. Core and I-680 Network Interface and routing for ELN Network Data Traffic
16. Core and I-680 Network Interface and routing for ECN and ITS Data Traffic

Contractor shall:

1. Install all items at the specified sites.
2. Mount equipment in racks or cabinets and bolt securely in place.
3. Install all power cables necessary to connect the network equipment to the local sources of power as indicated.

    - For each network electronics hardware with redundant power, plug redundant power into a different PDU.

4. Install all necessary fiber optic patch cords within individual racks to make all necessary network connections.
5. Install all necessary Ethernet data cables within individual racks to make all necessary network connections.
6. All wiring and cabling, including copper data and power cables, shall be neatly labeled, bundled, tie-wrapped, and secured. Wire labels shall be plastic permanent-type labels. Coordinate wiring and cabling labels with Your shop drawings.
7. Install owner-provided asset tags, including serialized assets tags for devices greater than $5000.
8. Utilize existing cable management where available. In existing racks that do not have cable management, provide horizontal and vertical slotted duct cable management (with removable covers).
9. Ensure new cable management is compatible with the existing rack.
10. Install and configure Network Management Server Virtual Environment.
11. Perform any upgrades, installation, or maintenance within the coordinated and specified time period as dictated by BAIFA.

86-21.03A(1) Configuration

86-21.03A(1)(i) General

Your configuration responsibilities will include:

1. Back up all network element configurations to both a hard disk on the BAIFA Management Server and a recordable DVD, the latter of which shall be submitted to BAIFA.
2. Perform configuration of the Core Managed Ethernet Switches, Distribution Managed Ethernet Switches, Access Managed Ethernet Switches, Firewall Appliances, Remote Environmental Monitoring Hardware and software, UPS hardware and software, IP-connected PDU hardware and software, Terminal Servers, Network Management Server Virtual Cluster Environment, Remote Access and Site-to-Site Backhaul VPNs, all Network management and Security management software and servers specified under this contract, Server Operating System Software, Firmware and any BAIFA-owned network equipment that is connected to the Backhaul to insure adequate operation and function.
3. Configure all network equipment with the correct names, VLANs, IP addresses, routing protocols, static routes, access control lists, QoS parameters, port trunking, link aggregation/EtherChannel (Layer 3), VSS/stacking configuration, High Availability (HA) protocol such as VRRP or HSRP, routing protocols such as OSPF, and any other specific network technology appropriate to conform to the contract specifications, design in the Drawings and BAIFA approved FIDR submittals.
4. Tune HA, layer 2 and layer 3 protocols to conform to industry standard / manufacturer recommended failover times.
5. Configure OSPF protocol on participating network electronics, including OSPF area(s), Designated Router, Backup Designated Router(s), area border routers and/or autonomous system border routers. Configure OSPF preferred paths based on link costs. Work with BAIFA and TSI contractor to tune OSPF timers and other parameters.
6. Configure Virtual Routing and Forwarding tables (VRFs) on Core and Distribution switches to provide logical isolation of the ELN from the remainder of the Backhaul network.
7. On the Core Ethernet Switches, Distribution Ethernet Switches, and any Ethernet switch with two (2) (TX/RX) or more connections to another Ethernet switch, build 1/10G gigabit Ethernet channels/groups across two (2) or more gigabit Ethernet modules or stacks on each corresponding switch. For example, each port in the two (2) 10 GigE bundles should connect to a separate 10GigE module in the switch.
8. Define IP multicast group addresses to any Backhaul network electronics that utilize multicast communications, such as cameras. On the Core Ethernet Switches, Distribution Ethernet Switches, and Access Ethernet Switches enable multicast management functions, including multicast routing protocols and IGMP snooping.
9. When supported, the logical description configured for each physical or virtual port on network switches, routers and firewalls must described the device type and name and connection type to which it is connected (i.e. an access layer switch port with a UPS connection into the port has a description configured which states that the port is an access port connected to the Ethernet port #1 on a local UPS device and the UPS device name). Unused must be disabled after testing and the unused port described as “Not Used/Disabled”.
10. Apply physical configurations, port connections, assignments, settings and security in a consistent manner for each Hub location and at the data centers.
11. Disable all copper and fiber optic ports that do not have a device connected. BAIFA, or BAIFA’s authorized representative, shall enable them as needed in the future. For installation testing, all Ethernet ports shall be enabled. When testing is complete, the non-used Ethernet ports must be disabled.

At each Corridor and data center Hub location

1. Configure each Ethernet port on the Core or Distribution Ethernet Switch(es) with the correct VLAN and QoS information that is specific to what will be connected to the Ethernet port, all as indicated in the Drawings, and Supporting Documents of this contract. For example, in the Dublin Hub, the Distribution Ethernet Switches will have several Ethernet ports that are dedicated and connected to the ELN TSI network equipment. These ports would be configured to be in the ELN TSI VLAN (specific to each station) and with the correct QoS information applicable to the ELN TSI network traffic.
2. Configure each 10GigE Ethernet uplink port that is connected to a Hub Ethernet Switch to be an IEEE 802.1Q trunk. This is configured to trunk multiple VLANs from the directly connected Hub Ethernet Switch to Backhaul core, distribution and access managed Ethernet switches and non-Backhaul Ethernet Switches as indicated in logical design documents to be provided by BAIFA and the BAIFA approved FIDR submittals.
3. Each Core and Distribution Hub Ethernet Switch will have the appropriate number of fiber optic 10GigE connections to the adjacent Hub Ethernet Switch as indicated in the Drawings, the BAIFA approved FIDR submittals and supporting documents of this contract. Configure each Core and Distribution Hub Ethernet Switch 10GigE port that connects to the adjacent Hub Ethernet Switch. Each of these ports must also be configured with the correct IP addressing and configured to be a “trusted” QoS port.
4. Each port connected to an ELN TSI network switch must be configured with the correct VLAN and IP addressing and configured to be a “trusted” QoS port. Each port connected to a non-Backhaul network, such as an external ITS network will be configured with the correct IP address and VLAN and configured with the correct QoS parameters.
5. Configure and connect each of the network electronics console ports to the Out-of-Band Terminal Server.
6. Configure and connect the Out-of-Band Terminal Server Ethernet and console port to the Cellular modem provided by others.
7. Configure and connect the Out-of-Band Terminal Server console ports to the network devices as indicated in the Drawings.
8. Configure and connect the remote environment monitoring hardware and sensors to provide monitoring of environment as indicated herein.
9. Coordinate with the MetroE solution provider to ensure connectivity from Backhaul Hubs in the Corridor to the Data Centers.
10. Coordinate with wireless solution provider to ensure connectivity from the 375 Beale data center to each hub station’s Out-Of-Band management terminal server.
11. Configure all other information relevant for correct operation as indicated in the Drawings, the BAIFA approved FIDR submittals and Supporting Documents of this contract.
12. At Hub locations that utilize partner agency fiber optic cable infrastructure:

    - Test and ensure 1/10GigE connectivity from partner agency demarcation point to designated Data Center Core switches, as appropriate
    - Coordinate with BAIFA and partner agency to ensure connectivity of BAIFA-designated fiber optic strands to Backhaul network electronics and installation of hardware within the facility.

13. At Hub locations that utilize dark fiber optic infrastructure:

- Coordinate with Dark Fiber solution provider to ensure connectivity of adjacent Backhaul Hubs. Provide fiber optic connections from Dark Fiber termination point to Backhaul network electronics.

14. Configure congestion management based on RFC 4594 guidelines and industry best practices, including the following parameters:

    - Configure and implement a consistent end-to-end QoS policy
    - Real-time Priority Queue should be less than 33% of link
    - Best-Effort Queue should be guaranteed at 25% of link
    - Scavenger/Bulk queue should be minimally provisioned
    - Enable congestion-avoidance on non-priority queues
    - Traffic shaping on WAN interfaces to not exceed sub-line rate ISP service levels
    - Do not enable dropping policies, i.e. WRED, on priority queue or scavenger queue
    - Do not enable WRED on network control traffic application class queue
    - Preserve traffic marking from ELN and perform congestion management based on ELN marking
    - You will work with BAIFA and TSI to further define, modify and tune congestion management configuration

86-21.03A(1)(ii) Authentication

1. Work with BATANET IT to implement a Read-Only Domain Controller (RODC) in the Beale Street Data Center Backhaul Network NMS environment.
2. Provide and configure a network authentication server for centralized RADIUS authentication to the BATAnet domain via the RODC. Configure all network equipment to utilize the centralized Authentication Server Software via RADIUS for login/password authentication and logging.
3. Configure the network equipment with two (2) layers of login security – limited access and privileged/configuration access. Utilize logins and passwords specified by BAIFA. The Authentication Server Software must be where the logins and passwords are authenticated via central server, not on each local device.
4. Configure all network equipment with a common secret password that resides on the local network equipment so that access to the device can occur even if the centralized Authentication Server Software is not reachable by the specific network device. The password must consist of at least eleven (11) characters, with a mix of numbers, lower- and upper-case letters, and special characters.
5. Configure SSH2 for secure communications and generated SSH keys using 2048 bit encryption or greater.
6. All login attempts must be logged to the Backhaul NMS syslog server.

86-21.03A(1)(iii) Integration

1. Configure all network devices and related software such as DNS in the Backhaul to comply with the indicated naming, IP addressing, VLAN, routing, VRF, and QoS scheme. Coordinate with BAIFA as needed to ensure interoperability between BATAnet, ELN, ECN and the Backhaul.
2. Configure Backhaul network virtual machine servers to supply network services such as DNS, SMTP forwarding and other network services specified under this Contract.

3. Configure Backhaul NMS for integration with existing BATAnet network management solution, active directory, RADIUS, Messaging and other network applications and protocols necessary. Coordinate with BAIFA to ensure interoperability, compatibility, security and functionality of Backhaul NMS while minimizing any downtime to BATAnet network resources.
4. Configure a single management platform to centrally manage the configuration, security policies, perform forensic analysis and generate reports across Backhaul Firewalls.
    - Work with BATAnet IT to integrate existing BATAnet firewalls
5. New systems shall not be connected to the existing BATAnet network infrastructure during regular business hours.
6. You will develop a detailed back-out plan for review and approval by BAIFA before connecting to the existing network infrastructure.

86-21.03A(1)(iv) Network Management

Complete all necessary tasks to support the complete implementation of the NMS, NMS host server(s), operating system(s), application(s) and database(s), including:

1. All Product Licensing and Registration; PKI, Secure Administration; Identification, creation and polling of Data sources; Data Synchronization; Creation of Scheduled Tasks; Creation and customization of Queries to implement discovery and ongoing network management; creation and nesting of directories, groups, and trees for population of applicable data; Creation of dashboards and customization of existing dashboards; integration into Active Directory for user/group role-based administration; and if supported, integration of NMS data into a central repository; Backup and Recovery of NMS system and data; configuration of Backhaul network to implement data collection and ongoing network management.
2. Backhaul network electronic hardware including Core, Distribution and Access network switches, firewall appliances, servers, storage arrays and ancillary hardware such as UPS must comprehensively detect all equipment failures, faults and exceeded thresholds and alert/report them to the NMS in the form of a minor, major, or critical alarm.
3. Coordinate with BAIFA to provide and tune notification via Email and SMS texts. Notifications must also be correctly configured to be reported to You during the network operations and maintenance period(s).
4. Coordinate with cellular service provider to ensure correct functioning of Out-of-Band (OOB) service connections for each Hub location.
5. Configure all network equipment with the correct SNMP community strings as specified by BAIFA.
6. Configure all network equipment with different SNMP Read and Read-Write strings as specified by BAIFA.
7. Securely configure and implement iLO interfaces for remote management.
8. Mount, connect, configure and if supported calibrate remote environmental monitoring appliance, sensors and application software to correctly monitor and transmit environmental conditions at each Hub location to the NMS, including the following:

    - Temperature
    - Humidity
    - UPS Status
    - HVAC Status
    - Microphone
    - Door switch/door ajar

- Remote Camera/CCTV viewing and motion detection

9. To ensure adequate network management capabilities, you will coordinate with BAIFA to ensure all Backhaul network elements are monitored correctly.
10. Configure NMS hardware and iSCSI implementation. Configure NMS virtual environment iSCSI protocol features and private IP addresses on iSCSI interfaces. Protect iSCSI interfaces from other network traffic sources.
11. Configure NMS environment for Microsoft Hyper-V virtualization, storage, high availability, and any other features necessary to comply with the requirements in this agreement and complete NMS hardware implementation.
12. Configure storage array to provide protection features such as RAID and snapshots.
13. Size, partition, configure and allocate local server and Storage Area Network (SAN) based storage, including virtual storage partitions as required by the array and server hardware, management application, virtualization software manufacturers and reference architecture provided by storage, application and virtualization vendors, for example configure array management partitions, virtualization partitions, virtual guest logical volumes, backup partitions, and snapshot partitions in accordance with manufacturer and vendor best practices.
14. Configure other features of the storage array, including data deduplication and compression. Configure the management interfaces of the storage array for centralized management and alerting to and from specific IP addresses to be supplied by BAIFA.
15. Configure virtualization host servers for N+1 cluster failover and load sharing. Provide and configure redundant connections to the Backhaul network core switch at 375 Beale.
16. Configure Backhaul server infrastructure including Active Directory server(s), DNS server(s), SMTP server(s), RADIUS server(s), Security server(s), Application server(s) and any other servers necessary to provide fully functional network management system.
17. Configure sampling of flow-based data such as NetFlow, JFlow or sFlow.
18. Configure NMS QoS monitoring to:

    - Provide pre and post policy traffic and traffic drops statistics
    - Provide per conversation and/or application validation of QoS Policy
    - Provide protocol and end point statistics
    - Collect QoS policy statistics via MIB query
    - Collect Class Based QoS data via MIB query

19. Install and configure network management client access application(s) on BATA IT designated workstations.
20. You will not remotely access or install remote access software to the Backhaul network outside of the BATA-maintained VPN.
21. You shall implement and configure the Backhaul NMS to:
    - Capture, modify, print and save and restore running configurations on all Backhaul network communications devices.
    - Provide functions to update and roll back firmware to all Backhaul network communications devices via TFTP and additionally, any of the following:

      i. Secure File Transfer Protocol (SFTP)
      ii. Secure Shell (SSHv2)
      iii. Hypertext Transfer Protocol Secure (HTTPS)

- Provide centralized configuration management functions for the following:

  i. Naming and detailed description data for managed objects.
  ii. Track maintenance and work history
  iii. Assignment and tracking of scheduled and manual maintenance
  iv. Schedule automatic upgrade and update of software and firmware for Backhaul network, including network servers, network switches, routers, firewalls, management software and ancillary hardware such as UPS.
  v. Manual upgrade and update of software and firmware for Backhaul network, including network servers, network switches, routers, firewalls, management software and ancillary hardware such as UPS.
  vi. Software and firmware repository for Backhaul network, including network servers, network switches, routers, firewalls, management software and ancillary hardware such as UPS.

- Provide polling and validation of software and configuration for Backhaul network, including network servers, network switches, routers, and firewalls.

- Provide centralized auditing capability including the following:
  i. Listing of all specified managed devices with model number, firmware and software loaded on each device with version number and patch number where appropriate.
  ii. Real-time configuration change alerts for all Backhaul Hub network electronics.
  iii. Log of all failures associated with a device or incident to include date and time, alarm severity, alarm name, alarm description, and alarm or issue resolution.
  iv. Log of all user account access, NMS activity and changes to the NMS
  v. Logging to default or user defined location and automatic archiving to remote location. Hardware and software necessary to support archiving store.

- Provide Discovery and Monitoring, including:

  i. Network management and monitoring in-band wherever possible.
  ii. Provide and configure all required licenses to support Backhaul network hardware and software. All licenses must be registered in BAIFA's name with BAIFA as the owner.

- Provide centralized Change Management functions including the following:

  i. Installation, modification and tracking of network configuration parameters (hardware and software) to enable the continuous operation of services.
  ii. Reconfiguration the equipment electronically and remotely. All interface models, interface ports and system controller options and settings shall be configurable, without using hardware option settings.

A replaced module shall have its options automatically downloaded from the database contained in the online memory.

iii. Contingency reconfiguration.

iv. Reporting of change-of-state of all communications equipment, where supported.

v. Network path and logical topology management with provisioning, modification and auditing capabilities

vi. Remote provisioning of communications equipment, facilities and cross-connects. The following service provisioning functions shall be available both locally and remotely:

a. Establishment/removal/rearrangement of connection

b. Placement of equipment into service

c. Removal of equipment from service

d. Software downloads capability of new generic releases to communications equipment, where applicable.

- Provide security monitoring and management. Configure controls to protect the network from unauthorized, incorrect or accidental use, modification or disclosure, including the following:

i. Backup and restore features to protect network switch/router/firewall configurations, network storage device configurations and BAIFA network management virtual environment critical server and Network Management console/workstation configurations. Configure backup and restore subsystem to comply with BAIFA provided Backup and restore policy.

ii. Control of network user access

iii. Logging and storage of all NMS user activity for convenient access

iv. Security violations alerts and reporting

v. Security log data aggregation, storage, analysis and reporting

vi. Real-time monitoring, correlation of events and notifications

vii. Security Dashboard views to support identification of patterns and activities that do not conform to expected network communications

viii. Limit access to the Backhaul network management interfaces and the NMS.

ix. Security vulnerability scanning and reporting.

a. Configure scheduled and manual vulnerability scans of the Backhaul network in accordance with security policies to be provided by BAIFA, including but not limited to: network switches, routers, firewalls, server and storage array hardware, operating systems, applications and databases deployed as part of the Backhaul system.

x. Configure NMS to provide an initial network and security baseline of the Backhaul. The baseline shall include:

a. Inventory of hardware assets

b. Inventory of software assets, including OS/Firmware version and patch levels

c. Inventory of virtual assets (i.e. virtual machines)

d. Inventory of network device configurations
e. Inventory of individual accounts with access to Backhaul network electronics and NMS
    i. Privileges for each account
    ii. Group memberships for each account
f. Performance parameters of each hardware asset during a 30-minute polling interval, including:
    i. CPU utilization
    ii. Memory Utilization
    iii. Storage Utilization
    iv. Average and peak network port utilization
g. Network performance for each network segment during a 30 minute polling interval, including:
    i. Average and peak bandwidth utilization
    ii. Throughput (transfer speed)
    iii. Latency, jitter and error rate
    iv. Buffer utilization
    v. Routing and routed protocol utilization, drops and errors
    vi. Flow analysis for devices that support Netflow or similar
    vii. End-to-end packet timing, route and path cost analysis from each roadside hub and D4 TMC locations to the Benicia and 375 Beale data centers; and between both data centers

xi. Configure NMS to provide periodic analysis of Backhaul to record and compare changes to the existing baseline and provide a new baseline.

xii. Provide recommendations to BAIFA for NMS monitoring thresholds based on baseline results and best practices. BAIFA shall review all threshold recommendations for approval prior to configuration into the NMS by You.

i. Provide centralized performance management functions for the following:

i. Collection of network traffic statistics
ii. Network alarms, performance and health status to NMS
iii. Historical files of alarms, commands messages and operator actions
iv. Message log retrieval for past events analysis
v. Event logging via syslog facilities
vi. Monitoring and polling of Backhaul network managed objects
vii. Real-time traps and alerting
viii. Incident notification via email, SMS and NMS administration GUI
ix. Root cause analysis
x. Generation of graphical data to support performance trend analysis

a. Monitor and report change-of-state of all communications equipment, where supported by communications equipment.

j. Provide Fault Management capabilities for the detection, isolation and correction of abnormal network conditions, and include the monitoring of automatic/manual diagnostics
k. Provide centralized Fault Management functions for the following:

i. Work-flow based escalation of incidents reported to the NMS
ii. Incident classification
iii. Incident and event correlation
iv. Configurable thresholds
v. Alert Notification via email, SMS and NMS administration GUI

l. Provide failure and maintenance recording with trend tracking and predictive failure analysis capability
m. Provide compiled status and alarm data from the various registers into summary reports for recall and demand. Work with BAIFA to configure up to 15 default reports and 5 custom reports based on the criteria described in **86-21.02I Network Management (Reporting).**
n. Provide secure storage of Backhaul network logging data in accordance with Data storage and retention policy to be provided by Agency. Proposed cryptographic encryption must be reviewed and approved by BAIFA prior to implementation.
o. Provide centralized Reporting functions for the following:

i. Track and report BAIFA policy compliance
ii. Schedule reports to be automatically generated, and optionally, emailed to staff
iii. Manual and scheduled archiving.
iv. Summarization and filtering of data
v. Restricted role-based access to operational and reporting data.
vi. Work with BATA IT and BAIFA to define and configure role-based access groups.

22. Provide and configure any other NMS functionality and features listed in section **86-21.02 Network Management.** You will work with BAIFA to ensure functionality and features are configured correctly.

86-21.03A(1)(v) Network Security

1. Configure and implement Backhaul network and system hardware and software in accordance with Agency provided BAIFA Backhaul Network security policies.
2. Configure all Backhaul network equipment in accordance with Agency provided BAIFA Minimum Security Standard for Networking Devices.
3. Configure auditing and access control of network user access to ensure compliance with BAIFA security policies. Use of local accounts is not allowed unless approved by BAIFA.
4. Configure SNMP-capable hardware and software for SNMP version 3 or highest version supported.
5. Configure all network equipment to allow SNMP connections only from the specific IP address(es) which correlate to BAIFA's management system.
6. You will disable telnet and enable SSHv2, when supported.
7. You will disable all unused network ports.
8. Disable all unnecessary network services on the network equipment including, but not limited to rlogin, http, and ftp.
9. Configure routing protocol authentication to ensure security of routing exchanges.
10. Configure a DMZ not connected to the Internet for external agency access to Backhaul network services, such as for access to Backhaul network management reports.

11. Configure an extranet DMZ not connected to the Internet for internal agency and external agency stakeholder access to Backhaul network services in the DMZ, such as for access to Backhaul network management reports.
12. Network IPS/IDS rules and implementation must be configured and tuned to correctly protect the Backhaul management network VLAN and interfaces and must not interfere with ELN traffic. Manual testing, tuning and updates of the IDS/IPS must also be performed during operations and maintenance period for Segment I and Segment II.
13. Backhaul network firmware and software patches and updates must be configured for automatic download to a central repository server, when supported by hardware vendor and the Backhaul NMS. All hardware and software must be configured for manual updates. You must monitor vendor communications and announcements for security and software updates and notify BAIFA in accordance with SLA performance provisions in the agreement. You must perform risk analysis and testing and provide a report including the results of testing and a back out plan to BAIFA for review and approval prior to updates to the Backhaul network hardware and software.

86-21.03A(1)(vi) Network Server Security

1. Install server software on a dedicated host or on a dedicated guest OS if the server is virtualized.
2. Patch and upgrade the server operating system and applications to correct for known vulnerabilities. Document any patches or upgrades that have not been applied and the constrained software/manufacturer. BAIFA shall review any unpatched software prior to approval.
3. Remove or disable unnecessary services, applications and network protocols.
4. Remove or disable all unneeded default user accounts created during the server installation.
5. Remove all manufacturer documentation, example and test files, scripts, executable code, and unneeded compilers from the server.
6. Configure operating system user authentication.
7. Configure resource controls such as limiting drive space for applications and maximum network connections allowed by the server.
8. Separately partition server operating system file space, application file space and log file space; ensure file spaces are sized appropriately
9. Apply an appropriate security template or hardening script to the server. A fully licensed and executable copy of the security template or hardening script shall be supplied on CD to BAIFA for server recovery and rebuild.
10. Configure each network service to listen for client connections on only the necessary TCP and UDP ports, if possible. When supported by the operating system or software application, limit the number of dynamic port allocations.
11. Install McAfee Server Host-based firewall and antivirus service on each server host or guest OS if virtualization is used. You must work with BAIFA to integrate Backhaul McAfee software to existing BATAnet ePolicy Orchestrator (ePO) server.
12. Configure server Host and Guest OS logging to NMS system.
13. Configure high availability features to ensure failover resiliency of the Backhaul NMS.
14. Configure an extranet DMZ for BAIFA stakeholder access to the Backhaul NMS report server.
15. Configure all protocols and services necessary to ensure correct and complete functionality of the Backhaul NMS.

86-21.03A(1)(vii) Integrity and Compatibility

1. Network electronic hardware, including managed switches and firewalls connecting local and remote sources must be monitored and alarmed at BAIFA Operations Management at the 375 Beale Data Center by the Network Management System (NMS).
2. Any proposed use of proprietary network protocols and services is subject to review and approval by BAIFA. All Contractor supplied network hardware must provide interoperability and compatibility between shared features. For example, switching and routing protocols implemented at shared links between Hubs sites must be compatible and interoperable. Physical and logical connections to non-Backhaul networks, such as the ELN must be non-proprietary and based on open standards.
3. All network electronic hardware must have a proven successful history within a 24/7 high transaction volume environment and must be compatible with the Cisco Validated Design architecture or approved equal. You must submit a list of three (3) sites and contact information for verification as part of the response bid package.
4. More than two (2) Repair Events of network hardware, including subcomponents, from the time the network hardware is placed in service until the end of the Warranty Period shall be cause for the complete replacement of the network hardware and all installed subcomponents.
5. It must be possible to replace a Backhaul network switch without impacting more than the devices connected to the same replaced switch.

86-21.03A(1)(viii) Backup and Restoration

6. All Backhaul network electronics, server, database and storage software must be fully backed up on a daily basis using a regular and hierarchical backup scheme such as Grandfather/Father/Son. Backup must utilize full backup modes only. Configure the Storage array to use snapshot based backups on a regular basis. You will provide a detailed backup scheme which accounts for tiered local storage and offsite tape rotation for BAIFA review and approval.
7. Software used for backup and restoration must be configured to alert network administrators of job status, including whether the backup or restoration was successful or unsuccessful. Failed jobs shall include detailed job information including date and time, the job name and description, the generated error message, data that failed to backup or restore, number of retries (if configured) and target device(s).
8. Restoration files or images must be submitted for each network device, such as switches, routers, firewalls, servers and storage arrays such that replacement hardware can be configured as an exact replacement. You will test each set of restoration files or images on Backhaul electronic hardware and the Backhaul NMS system as part of the qualifying and certification testing plan to validate an accurate restoration. Test results must be submitted to BAIFA for review and acceptance.
9. Configure the tape library for automatic Backups and tape rotations.
10. Configure tiered storage for disk-to-disk and disk-to-tape backups.
11. Configure backup scripts to fully backup data from target nodes to tiered storage, including but not limited to:
    - System State of Windows-Based machines,
    - Network electronics configuration files,
    - System files & application data partitions,
    - Database servers, instances, log files and transaction logs,
    - Event logs, syslogs, and other log files.
12. Document restoration, rollback, controlled shutdown and startup procedures for all Backhaul hubs and the NMS system.

13. It must be possible to replace network and system hardware with network and system hardware of equal or greater capacity from the same manufacturer or of the same type without change to any software.
14. You will coordinate with BAIFA to configure backup and restoration software parameters.

86-21.03B Segment II

86-21.03B(1) Installation, Configuration, Integration and Testing

86-21.03B(1)(i) General

Contractor shall be responsible for:

1. All network electronics and software installation Work necessary to complete the indicated network, except as specified or indicated otherwise.
2. All Work must be done in a neat and professional manner, in accordance with all applicable standards and practices.
3. All installation and testing must be performed by qualified network technicians with a minimum of five (5) years of experience in the installation and testing of similar equipment.
4. All equipment must be installed, configured and tested in strict accordance with the original manufacturer's instructions.
5. All equipment must be placed into operation in accordance with specified function.
6. Install equipment in the locations specified or indicated.
7. All equipment chassis must be solidly grounded in accordance with NEC.
8. Install and wire all equipment in accordance with the Drawings. Any variations shall be noted on the site copy of contract Drawings and indicated on the as-builts.
9. All network electronics and software must be free of all known security vulnerabilities, worms and viruses at the time when testing begins.
10. You will submit detailed configuration, implementation and backout plans for approval by BAIFA before Work begins.
11. A Sequence of Work must be developed and provided to BAIFA for approval before Work begins, assuming the following priorities for BAIFA in order of importance:

    - Distribution I-880 Hub and corridor connectivity (see plans for locations of communications Hubs):

        i. AutoMall Hub
        ii. Fiber Optic cross-connection at City of Fremont Traffic Operations Center (39550 Liberty Street, Fremont CA)
        iii. BAIFA Oakland Hub (BOH) to AutoMall Hub fiber optic cable connection and cross-over
        iv. Hegenberger Hub
        v. I-80 East Hub
        vi. I-80 West Hub

    - Distribution I-880 Network configuration and integration into Backhaul NMS
    - Distribution I-880 Network Interface and routing for ELN Network Data Traffic
    - Distribution I-880 Network Interface and routing for ECN and ITS Data Traffic
    - Distribution I-80 Hub connectivity (I-80 East and I-80 West)

- Distribution I-80 Network configuration and integration into Backhaul NMS
- Distribution I-80 Network Interface and routing for ELN Network Data Traffic
- Distribution I-80 Network Interface and routing for ECN and ITS Data Traffic

12. Contractor shall follow the work criteria set forth in **86-21.03A Segment I,** to complete the installation, configuration, integration and testing of the Segment II Backhaul hubs into the Segment I Backhaul network and Backhaul NMS.

86-22 NETWORK MAINTENANCE REQUIREMENTS

86-22.01 Vendor Maintenance Contracts

Contractor shall provide one (1) year of vendor maintenance on network elements as defined below.

For all network electronics, provide a vendor maintenance contract that provides:

1. Unlimited software updates through the vendor's website and compact disc(CD).
2. Unlimited 24-hour telephone and email support.
3. 24 hours a day, 7 days a week 4-hour (24x7x4) Hardware replacement with on-site replacement support.

For all network management server hardware and peripherals, provide a vendor maintenance contract that provides:

1. Unlimited software updates through the vendor's website and CD.
2. Unlimited 24-hour telephone and email support.
3. 24 hours a day, 7 days a week 4-hour (24x7x4) Hardware replacement with on-site replacement support.

For all computer software, provide a vendor maintenance contract that provides:

1. Unlimited software updates through the vendor's website.
2. 8-hour (9 a.m. to 5 p.m.) Monday through Friday telephone and email support.

During the maintenance period, provide BAIFA with 100 hours of 24-hour, 7-day a week onsite labor and support by manufacturer/vendor-certified personnel with 2-hour response, including routine maintenance, such as port adds/deletes/changes.

Provide BAIFA with one (1) year of 24-hour, 7-day a week remote security incident handling, including monitoring, reporting, analysis and response and support by vendor-certified personnel, including quarterly non-intrusive vulnerability scanning and prioritized exploit remediation.

The one year of maintenance coverage for each network element shall begin no sooner than the date of BAIFA's acceptanceof the phase of work comprising such network element.

All network electronics and software licenses and maintenance contracts shall be created in BAIFA's name and transferred to BAIFA during installation. BAIFA shall be given a document

listing all contact information to identify who to contact in the event of a failure or who to contact if they choose to modify their maintenance contract.

86-22.02 Operations and Maintenance Support Service Level Requirements

86-22.02A General

BAIFA's Backhaul network is integral to the effective operation of the Express Lanes Network (ELN) tolling infrastructure. The Backhaul network provides a network communications backbone which allows high-speed transmission of toll system data to/from data centers and roadside field devices. BATA desires to utilize the Contractor to augment its network operations and maintenance of the Backhaul network during the maintenance period of each phase of the Backhaul network to ensure a highly available and responsive Backhaul network. Accordingly, the reliability, responsiveness and recoverability of the network during the warranty period are of critical concern.

86-22.02B Operations and Maintenance Service Level

Service levels during the operations and maintenance (O&M) period for post-acceptance services including installation, configuration, integration and cut-over, roll-backs, incident management, fault management, performance management, change management, configuration management and security management, and maintenance must meet the criteria specified in the **Service Level Response and Repair Compliance Table in 86-22.02C** below. Failure to provide these services in a timely manner will result in an assessment of Penalties.

Incidents and events for the purpose of this service level agreement represent one or more occurrences of significance or interest on a (managed) target in the Backhaul network environment. Examples of incidents or events may include policy compliance violation (i.e. login as "administrator", detect use of unauthorized protocols), availability alerts (i.e. specific service on target is down, target is down, network gateway unreachable), metric alerts (i.e. high CPU utilization, high network latency), or job events (i.e. Backup failed, service failed to start). Requests for new or additional service and requests for information are included in the definition of an incident and included in the scope of the O&M service level. Unless otherwise stated, the Contractor must respond to Incidents and Events outside the normal operating parameters of the Backhaul network, hereto referred to as "trouble" and repair such problems, in accordance with the service level performance requirements specified in this agreement. BAIFA reserves the right to designate resources including locations, assets, services, authorized staff, departments or stakeholder agencies as "critical", "priority", "non-priority" and "low-impact" as defined in section **86-22.02C O&M Service Level Definitions** and shall give ten (10) working days notice to the Contractor of such designations which will be considered binding. Resources not designated by BAIFA shall be considered "low-impact" for the purposes of the **Service Level Response and Repair Compliance Table in 86-22.02C** below.

The Contractor is responsible to respond to Backhaul network trouble and to repair the Backhaul network regardless of whether the Contractor is or is not responsible for casing the fault incident or event. The response and repair times in the **Service Level Response and Repair Compliance Table in 86-22.02C** below shall be performed as specified without regard to time of day or day of week (including holidays). If a single incident or event results in multiple response and repair times, or if multiple incidents or events result in multiple response and repair times, the times shall not be added cumulatively (cumulative time). For the purpose of the Operations and Maintenance Support Service Level requirements, cumulative time is defined as extending the response and repair time of one or more separately generated trouble tickets by combining

multiple separately generated incidents or events. The repair time shall include the time taken to respond to a single incident or event.

86-22.02C Operations and Maintenance Service Level Definitions
"Response time" is defined as follows:

The time between receipt of notification and the time the Contractor begins working on a resolution. The response time begins immediately when an authorized BAIFA representative contacts the Contractor about Backhaul network trouble; when the Contractor is notified of Backhaul network trouble through the Backhaul network management system; or when the Contractor becomes aware of a Backhaul network trouble through other means. The response time concludes when the Contractor has acknowledged the notification by phone or email AND a technician has been dispatched to resolve the trouble. Automatic generation of a trouble ticket or acknowledgment of an incident or event ONLY will not be considered a "response".

"Repair time" is defined as follows:

The time between response time and when the trouble has been cleared and a BAIFA authorized representative confirms restoration. For the purposes of the agreement, the terms "restoration" and "repair" are synonymous.

The Contractor is required to meet or exceed the service levels defined in the **Service Level Response and Repair Compliance** table below.

Service Level Impacts are defined as follows:

Critical: The unauthorized access, modification or disruption to the Backhaul network resulting in a severe impact to the ELN, Backhaul critical functions, BAIFA/BATA/MTC workforce, stakeholders and/or its customers and to which there is no workaround. For example: a complete loss of network services to the primary ELN data center(s) even after a restore of device configuration from backup and a restart of Backhaul network electronics has been performed.

Priority: The unauthorized access, modification or disruption to the Backhaul network resulting in a partial or limited loss of essential services to the ELN, Backhaul critical functions, BAIFA/BATA/MTC workforce, stakeholders and/or its customers but a workaround exists to allowed continuity of essential network services and operations. For example: Backhaul services are disrupted by a conduit/fiber break but a workaround exists allowing for continuity of essential services (i.e. ELN data is still routed to the primary and secondary data centers).

Non-Priority: The unauthorized access, modification or disruption to the Backhaul network resulting limited or partial loss to non-critical/non-essential services to the ELN, BAIFA/BATA/MTC workforce, stakeholders and/or its customers but a workaround exists to allowed continuity of normal network services and operations.

Low-Impact: Incident or event does not result in loss of network functionality, quality or performance of the Backhaul network or is a general usage question. Software updates from the mfr/vendor addressing a critical incident or event. Software Updates from the manufacturer/vendor not directly addressing a critical incident or event.

Opening of Tickets

At a minimum, BAIFA shall be able to open O&M tickets with the Contactor through the following means or channels:

Email from BAIFA/BATA authorized staff
Access to a Contractor secure internet portal with web-based GUI
Telephone call to technical support/helpdesk support center
Notification to Contractor Network Operations Center from Backhaul NMS

Closure of Tickets

Service Tickets shall be considered closed when BAIFA or its authorized representative receives fix, workaround or information that resolves the incident or event and agrees that the incident or event has been resolved. Ticket will also be closed 10 business days after the final e-mail message has been sent to BAIFA or its authorized representative. Records of tickets must include the information listed under "Service Ticket Information" below and be presented to BAIFA within 24 hours upon written request for compliance review.

Service Ticket Information

Service tickets must, at a minimum, contain the following information:

1. Service ticket tracking identification code
2. Requester name and contact information
3. Customer Support Representative (CSR) who logged the request, including contact information
4. Technician assign to the request, including contact information
5. Type of incident or event
6. Initial and Final Impact Levels. If the initial and final impact levels are different, also include the BAIFA authorized representative that approved the service level impact change
7. Incident Summary, including all affected Backhaul resources
8. Incident Details, including any notifications from BAIFA
9. Root cause
10. Time incident initially received
11. Start time of response
12. Time to repair
13. Steps taken to fix problem or apply work around; if a work around is applied, time to permanently fix the problem
14. Total Duration of incident (including duration of workaround and duration of permanent fix)
15. Sub-tasks/sub-tickets opened as part of the work performed under the ticket; include task/ticket details
16. Remote Login authorization details, if access was requested.
17. Status field specifying if the ticket is open, closed or on hold.
18. Any follow-up information requested by BAIFA.

Service Level Response and Repair Compliance Table

Type Of Incident or Event	Response Time	Repair Time

Critical	30 Minutes Maximum Response time	Fix or suitable work around within 3 hours Permanently correct within 10 days.
Priority	2 Hrs Maximum Response time	Fix or suitable work around within 6 hours Permanently correct within 15 days.
Non-Priority	12 Hrs Maximum Response time	Fix or suitable work around within 48 hours Permanently correct within 20 days.
Low-Impact	72 Hrs Maximum Response time	Fix or suitable work around within 10 Working days
Low-Impact - Critical Software/Firmware Updates	10 Working Days Maximum Response time	Risk analysis and back out plan submitted to BAIFA within 10 Days. Once approved, apply update within 24 Hours.
Low-Impact - Non-Critical Software/Firmware Updates	10 Working Days Maximum Response time	Risk analysis and back out plan submitted to BAIFA within 30 Days. Once approved, apply update within 24 Hours.

86-22.03 General Repair Work Requirements
The Backhaul Contractor must agree to the following additional conditions:

The Backhaul Contractor's Customer Service Representative or Technician will remain in constant communications with an authorized BAIFA representative while any service testing is performed on the Backhaul network.

Any required testing must be identified as part of each incident or event response and if approved by BAIFA, completed within 30 minutes of receipt of BAIFA approval. Records of such testing, including start, duration and completion times must be provided upon request by BAIFA.

For affected Backhaul network services not repaired via remote access, Contractor must have a qualified technician, as defined in **86.17, Key Staff Qualification**, equipped for the applicable Backhaul service, onsite within two (2) hours of the response time.

Contractor must provide BAIFA authorized staff a secure remotely accessible internet portal with a web-based graphical user interface including the ability to create, review and update

service tickets, retrieve service ticket status information and a searchable knowledge-base database for the network products and services installed under this contract.

Contractor must continuously monitor the status of the Backhaul network as part of the Contractor's operations and maintenance plan. Contractor must provide a secure means without additional cost or materials to BAIFA, such as an encrypted IPSEC or SSL VPN tunnel to monitor the status of the Backhaul network. The secure connection will allow communications only between the Contractor's business network designed specifically for network operations, such as a network operations center (NOC) and the Backhaul NMS system. Only protocols necessary to provide monitoring and remote login to NMS servers will be allowed. Under no circumstances will connections be allowed from a personal "home" network or open, unsecured locations such as a "café network". Each remote login to the NMS server environment must be authorized as part of the work flow of a trouble ticket and on a case-by-case basis.

86-22.04 Maintenance Manager
Contractor shall provide a maintenance manager who is responsible for the ongoing maintenance of the entire Backhaul communications network to meet functional and performance requirements. The Maintenance Manager manages and ensures Contractor meets service level requirements.

The Maintenance Manager shall have the qualifications set forth in 86.14, Key Staff Qualification.

86-23 COMMUNICATIONS TRANSMISSION SYSTEM

86-23.01 General:
All network devices installed as part of this effort shall, at a minimum, comply with and be configured for the following:

1. Simple Network Management Protocol version 3 (SNMPv3)
2. Network Time Protocol (NTP) or Simple Network Time Protocol (SNTP)
3. Support of remove and local setup and management via console port, secure shell (SSH) and secure Web-based GUI
4. Centralized Authorization Authentication Accounting (AAA) for user authentication, including RADIUS remote access services
5. For Ethernet switches: Port mirroring for troubleshooting purposes when combined with a network analyzer
6. All network switches must be commercially available from a single manufacturer. You will standardize upon a single switch manufacturer
7. Virtual host servers must be identical.

86-23.01A Acceptable Manufacturers/Models:

<u>Network Management Virtual Server:</u>
Hewlett Packard (HP)
Or approved equal (qualifying materials must be approved in writing by the Engineer prior to starting work)
<u>Network Management Virtual Storage Array:</u>
Hewlett Packard (HP)

Or approved equal (qualifying materials must be approved in writing by the Engineer prior to starting work)
Network Core Switch:
Cisco Catalyst 6880-X
Or approved equal (qualifying materials must be approved in writing by the Engineer prior to starting work)
Network Distribution Switch:
Cisco Catalyst 4500-X
Or approved equal (qualifying materials must be approved in writing by the Engineer prior to starting work)
Network Firewall Appliance:
Palo Alto Networks (PA-5000 Series)
Or approved equal (qualifying materials must be approved in writing by the Engineer prior to starting work)

86-23.01B Core Ethernet Switch

86-23.01B(1) General

Provide the function of a Layer 2 (L2) Ethernet switch and Layer 3 (L3) router with advanced QoS and L2/L3 network virtualization capabilities.
Provide processor, switching, and power redundancies.

86-23.01B(2) Chassis

Maximum of 6 EIA rack-units (RU) high
Modular/slot/card design with minimum of 4 total blades/port card slots
Minimum port density of 80 x 1G/10G ports, per switch; or 158 1G/10G ports in a VSS pair.
After all modules are installed for the initial requirements, have a minimum of two (2) available and unassigned slots for future expansion
All power supplies, fan modules, and I/O modules should be field replaceable and hot-swappable
Provide redundant power supplies for all backhaul core switches

86-23.01B(3) Router/Switch Processor/Supervisor:

If chassis supports modular supervisor slot:

- Supervisor switching capacity or 2 Tbps or higher
- Synchronized dual processor/supervisor cards shall provide resilient, self-healing network architecture. If a processor/supervisor fails, high-availability switchover shall transfer switch control to the redundant processor/supervisor within three (3) seconds.

If chassis does NOT support modular supervisor slot:

- Provide high availability (HA) through stacking, Virtual Switching System (VSS) or BAIFA approved equal. A minimum of two switches must be provided for each Core Switch location. A minimum of 2 Virtual Switch Links (VSLs) are required for each VSS.

Processor card shall provide a minimum of one management interface for out-of-band management
Management console port for local PC connections and configuration

Support full Multi-Protocol Label Switching (MPLS), Virtual Private LAN Service (VPLS), Virtual Routing and Switching (VRF), Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Virtual Private Networks (VPN) and dynamic VLAN services.

86-23.01B(4) 10 Gigabit (10G) Ethernet Module

Minimum of sixteen (16) 10G ports per module and a minimum of two (2) modules in the chassis for the initial installation

Ports that support either 10GBase-ZR, 10GBase-LR, or 10GBase-ER SFP+ optics and backwards compatible with 1G SFP GBICs.

86-23.01B(5) Features

Layer 3 EtherChannel/link aggregation of physical 1GigE or 10GigE Ethernet ports
Support a minimum of thirty-two (32) link aggregation bundles with a minimum of four (4) physical ports per bundle
1GigE or 10GigE Ethernet bundling across multiple modules
Spanning-Tree Protocol support, including Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)
Support multiple Spanning Tree groups and a separate instance of Spanning Tree per VLAN
VLAN trunk creation supported from any port using IEEE 802.1Q trunking
VLAN trunk “pruning” support
Wire-rate IP unicast and IP-multicast routing support for Layer 3 dynamic routing services including Open Shortest Path First (OSPF) and Border Gateway Protocol (BGP)/Multiprotocol BGP (MP-BGP)
Support for routing level redundancy (HSRP/VRRP)
Distribution of routing traffic among multiple paths (ECMP)
Support for Layer 3 dynamic multicast routing support including Protocol Independent Multicast (PIM) Sparse mode (PIM-SM), Dense mode (PIM-DM), and Source Specific Multicast (PIM-SSM)
Support for MPLS, including Label Distribution Protocol (LDP), MPLS VPN, and VRF Lite
Software upgrade capability that allows for transparent upgrades

86-23.01B(6) Quality of Service

IEEE 802.1p support on all ports
Differentiated Services (DiffServ) support on all ports
Minimum of eight (8) network traffic queues for classification and queuing of network traffic
Able to differentiate network traffic based on port, source, destination, VLAN, pre-marked traffic
Support for “trusting” of QoS marking on ports
Ability to cross map and mark traffic based on medium or layer (DiffServ, IEEE 802.1p)

86-23.01B(7) Security

Multilevel access security
Media access control (MAC) address-based port level security
Access control lists (ACLs)
Remote Access Dial-In User Service (RADIUS) for user authentication, authorization, and accounting

86-23.01B(8) Management

Simple Network Management Protocol version 3 (SNMPv3), Remote Monitoring (RMON) or Switch Monitoring (SMON), Trivial File Transfer Protocol (TFTP), Secure Shell (SSH) version 2 or higher
Netflow version 8 or higher or BAIFA approved equivalent
Network Time Protocol (NTP) for an accurate and consistent time stamp

86-23.01B(9) Alarms

SNMP trap generation and forwarding to network management system.
Multifunction LEDs per port for port status, half-duplex/ full-duplex indication, switch-level status LEDs for system, redundant power supply (RPS), and bandwidth utilization.

86-23.01B(10) Environmental

Operating temperature: 0° to 40° Celsius
Operating relative humidity: 85% non-condensing
The field strength of radiated emissions shall meet the requirements of ANSI Z136.1 and Z136.2 (Class 1 device).
Complies with NEBS 4 in the following:
Earthquake environment and criteria;
Transportation vibration and criteria.

86-23.01B(11) Power Supply

AC input voltage/frequency: 100 to 240 VAC (autoranging) 47 to 63 Hz.
Redundant load-sharing power supplies
Rated so that one power supply can supply power to the router/switch if fully populated with modules in every slot

86-23.01B(12) Miscellaneous

The Contractor shall:
Make the necessary electrical power connections from the network equipment to the UPS or appropriate electrical outlet provided by others.
Provide horizontal and vertical slotted duct cable management (with removable covers) compatible with the accommodating rack (EIA 19-inch rack furnished by others)
Provide all of the necessary cables, kits, and miscellaneous hardware for complete installation

86-23.01C Distribution Ethernet Switch

86-23.01C(1) General

Provide the function of a Layer 2 (L2) Ethernet switch and Layer 3 (L3) router with advanced QoS and L2/L3 network virtualization capabilities
Provide redundant, hot swappable power supplies and fans.
Provide high availability (HA) through stacking, Virtual Switching System (VSS) or BAIFA approved equal. A minimum of two switches must be provided for each Distribution Switch location. A minimum of 2 Virtual Switch Links (VSLs) are required for each VSS.

86-23.01C(2) Chassis

Maximum of 1 EIA rack-units (RU) high per switch
Small form factor, low power design
All power, fan, and optic modules should be hot-swappable

Minimum Mean Time Between Failure (MTBF of 199,720 hrs)

86-23.01C(3) Performance

Management console port for local PC connections and configuration
Switching capacity 800 Gbps, with up to 1.6 Tbps in a VSS.
Support Virtual Switching System (VSS) or stacking or BAIFA approved equal High Availability (HA) feature
Minimum 16 SFP+ 10 Gigabit Ethernet Port switch with optional expansion slot for up to 8 additional 10 Gigabit Ethernet ports.
Provide backwards compatibility with 1 Gbps SFP GBICs
Auto-detect 10G and 1G Ethernet ports
Front-to-Back Airflow
Wire-rate IP unicast and IP-multicast routing support
Support Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Virtual Private Networks (VPN) and dynamic VLAN services
Support a minimum of 64 virtual routing and forwarding (VRF) tables, and 32 Easy Virtual Networks (EVNs).

86-23.01C(4) Features

Spanning-Tree Protocol support, including Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)
Support multiple Spanning Tree groups and a separate instance of Spanning Tree per VLAN
VLAN trunk creation supported from any port using IEEE 802.1Q trunking
VLAN trunk “pruning” support
Wire-rate IP unicast and IP-multicast routing support for Layer 3 dynamic routing services including Open Shortest Path First (OSPF)
Support for routing level redundancy (HSRP/VRRP)
Distribution of routing traffic among multiple paths (ECMP)
Support for Layer 3 dynamic multicast routing support including Protocol Independent Multicast (PIM) Sparse mode (PIM-SM), Dense mode (PIM-DM), and Source Specific Multicast (PIM-SSM)
Network virtualization through multi-VRF technology for Layer 3 segmentation, or approved equivalent.

86-23.01C(5) Quality of Service

IEEE 802.1p support on all ports
Differentiated Services (DiffServ) support on all ports
Minimum of eight (8) network traffic queues for classification and queuing of network traffic
Able to differentiate network traffic based on port, source, destination, VLAN, pre-marked traffic

86-23.01C(6) Security

Multilevel access security
Media access control (MAC) address-based port level security
Access control lists (ACLs)
Remote Access Dial-In User Service (RADIUS) for user authentication, authorization, and accounting

86-23.01C(7) Management

Simple Network Management Protocol (SNMP), Remote Monitoring (RMON) or Switch Monitoring (SMON), Trivial File Transfer Protocol (TFTP), Secure Shell (SSH) version 2 or higher
Netflow version 8 or higher or BAIFA approved equivalent
Network Time Protocol (NTP) for an accurate and consistent time stamp

86-23.01C(8) Alarms

SNMP trap generation and forwarding to network management system.
Multifunction LEDs per port for port status, half-duplex/ full-duplex indication, switch-level status LEDs for system, redundant power supply (RPS), and bandwidth utilization.

86-23.01C(9) Environmental

Operating temperature: 0° to 40° Celsius
Operating relative humidity: 90% non-condensing

86-23.01C(10) Power Supply

AC input voltage/frequency: 100 to 240 VAC, 50 to 60 Hz.
Redundant load-sharing power supplies
Rated so that one power supply can supply power to the switch if fully populated with 10G optics in every port

86-3.05D Access Ethernet Switch

86-23.01D(1) General

Provide the functions of a Layer 2 Ethernet switch
Provide redundant power supplies

86-23.01D(2) Chassis

Maximum of 1 EIA rack-units (RU) high per switch
All modules should be hot-swappable
Stacking capability through EtherChannel or similar technology

86-23.01D(3) Performance

Management console port for local PC connections and configuration
Minimum twenty-four (24) ports 10/100/1000Base-T Ethernet ports
Minimum two (2) SFP+ uplink ports with 1G/10G compatibility
SFP+ ports support either 10GBase-ZR, 10GBase-LR, or 10GBase-ER 10G optics

86-23.01D(4) Features

Spanning-Tree Protocol support, including Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)
Support multiple Spanning Tree groups and a separate instance of Spanning Tree per VLAN
VLAN trunk creation supported from any port using IEEE 802.1Q trunking

86-23.01D(5) Quality of Service

IEEE 802.1p support on all ports
Differentiated Services (DiffServ) support on all ports

Minimum of four (4) network traffic queues for classification and queuing of network traffic

86-23.01D(6) Security

Multilevel access security
Media access control (MAC) address-based port level security
Access control lists (ACLs)
Remote Access Dial-In User Service (RADIUS) for user authentication, authorization, and accounting

86-23.01D(7) Management

Simple Network Management Protocol (SNMP), Remote Monitoring (RMON) or Switch Monitoring (SMON), Trivial File Transfer Protocol (TFTP) and Telnet interface support.
Network Time Protocol (NTP) for an accurate and consistent time stamp

86-23.01D(8) Alarms

SNMP trap generation and forwarding to network management system.
Multifunction LEDs per port for port status, half-duplex/ full-duplex indication, switch-level status LEDs for system, redundant power supply (RPS), and bandwidth utilization.

86-23.01D(9) Environmental

Operating temperature: 0° to 40° Celsius
Operating relative humidity: 10 to 95% non-condensing

86-23.01D(10) Power Supply

AC input voltage/frequency: 100 to 240 VAC, 50 to 60 Hz.
Redundant power supplies

86-23.01E Network Management Server Virtual Cluster Environment
86-23.01E(1) General:

Provide the hardware, Host and guest operating system platform for the Network Management software that is used for configuration and change control, monitor and manage all network devices of the Backhaul network, serve as the centralized logging server for events and alerts, authentication issues, and provide security services to the Backhaul network. Provide a policy-based tiered storage environment.

86-23.01E(2) Hardware Requirements:
Virtual Host Server:

Redundant rack mount servers. Maximum Height of the Host servers shall be 2 Rack Units.
Ability to provide for complete failover in the event of a catastrophic event.
CPU: Quad Core Capable processors
Memory: Minimum 64 GB RAM per server
Storage:

Hard Drives:
Hot-Swappable 10k, 15k, or flash Serial Attached SCSI (SAS) drives
RAID 5, 6, 10 supported configurations
At least 128GB usable disk space after RAID

Optical Drive: 16X DVD ROM Drive

Network Card:
Provide 8 NIC Ports of which four (4) ports are 10GigE SFP or RJ-45 Network Ports. Four (4) GigE RJ-45 NIC ports.
Four (4) x 10Gbps fiber optic SFP modules compatible with server and core switches if optic network ports are furnished on server
10Gbps iSCSI support with Jumbo Frames
HP Integrated Lights-Out (iLO) or BAIFA approved equal
Power: Dual Redundant Hot-Swappable Power Supply

Backup Server:
Single rack mount servers. Maximum Height of one(1) Rack Unit.
CPU: Quad Core Capable processors
Memory: Minimum 16 GB RAM
Storage:

Hard Drives:
Hot-Swappable 10k, 15k, or flash Serial Attached SCSI (SAS) drives
RAID 5, 6, 10 supported configurations
At least 300 GB usable disk space after RAID
Optical Drive: 16X DVD ROM Drive

Network Card:
Provide 4 NIC Ports of which two (2) ports are 10GigE SFP or RJ-45 Network Ports. Two (2) GigE RJ-45 NIC ports.
Two (2) x 10Gbps fiber optic SFP modules compatible with server and core switches if optic network ports are furnished on server
10Gbps iSCSI support with Jumbo Frames
HP Integrated Lights-Out (iLO) or BAIFA approved equal

Power: Dual Redundant Hot-Swappable Power Supply

Storage Array:
Features:
Data De-Duplication
Thin Provisioning
Cloning
User-defined manual and scheduled snapshots
Dynamic, nondisruptive expansion of any logical volume (LUN)
Dynamic, nondisruptive resize of any RAID pool
Software and hardware upgradeable without system downtime
Automatic policy-based data tiering based on file usage, age
Chassis: One (1) rack mount iSCSI-based storage array. Maximum Height of 3RU.

Storage:
Hard Drives:
Hot-Swappable 10k, 15k, or flash Serial Attached SCSI (SAS) drives
RAID 5, 6, 10, 50 supported configurations
Licensed and configured for snapshot based backups.

At least 7 TB usable disk space after RAID and creation of snapshot partition.
Storage Array Controller:
Dual 10GigE iSCSI-based controllers
Jumbo Frames Supported
Dedicated 10/100 or GigE Management Ports on each Controller
Management via SSH, HTTPS and SNMP v2 or SNMP v3.
Power: Dual Redundant Hot-Swappable Power Supply

86-23.01E(3) Software Requirements:
Operating System
Microsoft Windows Server 2012 for Hyper-V virtualization or BAIFA Approved Equal
Microsoft Windows Server 2012 64-bit for Backup Server or BAIFA Approved Equal
Microsoft Windows Server 2012 64-bit for NMS servers or BAIFA Approved Equal

86-23.01E(4) Miscellaneous:
Provide rack mount kits to install on-site rack furnished by others
Provide all of the necessary cables, kits, and miscellaneous hardware for complete installation

86-23.01F Firewall Appliance

86-23.01F(1) General:
All connections to the BAIFA network that interface with external autonomous systems (i.e. commercial leased communications, internet, external agencies, etc…) and wireless communications must be firewalled. In the event that Virtual Private Networks are configured, such connections must be encrypted with strong encryption and subject to review by BAIFA.

Provide seamless network connectivity via a Virtual Private Network (VPN) to the Backhaul network.
Utilize standard IPSec or SSL methods for establishment and method of VPN using strong (128-bit or better) encryption and data privacy methods.

Stateful packet inspection for inbound and outbound protection from unauthorized and malicious network communication transmissions.

Network Intrusion Detection and Prevention services (NIDS/NIPS) for inbound and outbound protection from unauthorized and malicious network communication transmissions.

86-23.01F(2) Physical:
Maximum of two (2) EIA rack-units (2 RU) high, mountable in EIA 19-inch rack furnished by others; or single slot line card compatible with Core switch chassis
Minimum of twelve (12) 100/1000 Base-T ports (RJ-45) with auto-negotiation
Minimum of eight (8) 1000 Base-X optical ports with hot swappable SFP GBICs
I/O Ports configurable for multiple zones including: External/Public, DMZ, Extranet, Internal/Private, and additional zones as required.
One (1) management console port for local PC connection and configuration
One (1) 10/100 management Ethernet port (RJ-45) with auto-negotiation

86-23.01F(3) Features:
Dynamic Host Control Protocol (DHCP) client and server compatibility
Ability to support a static IP address on “External/Public” interface
Port Address Translation (PAT) and Network Address Translation (NAT)

Configurable Message Transfer Unit (MTU) on interfaces
Minimum 2 Gbps Stateful Inspection / IPS throughput
Minimum 2 Gbps IPSec VPN throughput
Support for site-to-site VPN tunneling
Minimum 2000 concurrent IPSec VPN connections
Point-to-Point Protocol Over Ethernet (PPPoE) support for device authentication to network service provider's network
Centralized role-based access control using Remote Dial-In User Authentication Service (RADIUS) support for authentication, authorization, and accounting
Configurable IP packet size
Configurable jitter buffering mechanism to compensate for packet delay variation (jitter) of up to 20 millisecond in the network

86-23.01F(4) Security
Tunneling protocol support: IP Security (IPSec) with Internet Key Encryption (IKE) key management
Capable of Intrusion Detection and Prevention Services (IDPS)
Encryption Algorithms, Key Management, and Authentication Algorithms:
Internet Protocol Security (IPSEC)
Data Encryption Standard (3DES)
AES (128/192/256-bit)
MD5
SHA-1
SHA-256/384/512

86-23.01F(5) Authentication:
Pre-shared secret, digital certificates, and/or pre-shared tokens
Browser intercepted user authentication

86-23.01F(6) Environmental:
Operating temperature: 0° to 40° Celsius
Operating relative humidity: 0 to 80% non-condensing

86-23.01F(7) Power Supply:
AC power supply supports 100 to 240 VAC at 50/60 Hz
Dual Power Supplies

86-23.01F(8) Management:
SNMP version 2 or higher, SSH, TFTP and Console, Web-Based HTTPS
Logging of events to Centralized logging server using Syslog

86-23.01F(9) Miscellaneous:
All firewalls shall be commercially available from a single manufacturer. Contractor shall standardize upon a single firewall manufacturer
Vendor maintenance service and all required licenses shall be provided for all network firewalls
All firewalls shall have the ability to create point to point encrypted tunnels over any network path
Firewall encryption shall support strong encryption
Provide rack mount kits to install in site EIA 19-inch rack furnished by others

Provide Ethernet Category 6 and fiber optic patch cable(s) to connect the Firewall device to Backhaul core switch and networks provided by others
Provide all of the necessary cables, kits, and miscellaneous hardware for complete installation

86-23.01G Remote Environmental Monitoring Hardware

86-23.01G(1) General:
Provide physical and environmental monitoring and security at each Backhaul location on a single rack mountable chassis
Provide remote camera for CCTV viewing
Provide camera-based motion detection
Provide door switch or door ajar monitoring
Provide microphone to capture and monitor audio
Provide temperature & humidity monitoring
Provide status of UPS and HVAC conditions
Provide analog and digital inputs

86-23.01G(2) Physical
Maximum of 1 EIA rack-units (RU) high per base chassis
Integrated sensors and port connections for all sensors in 86-3.05G(1) and expandable to at least four (4) additional sensor modules
Integrated Ethernet 10/100 Mbps RJ-45 Connector(s)
LEDs on base chassis and sensors modules to provide visual indication of hardware status
Sensor modules powered via connection to base chassis with no further external power required for each sensor module

86-23.01G(3) Features
Configurable thresholds for alerts
Send alerts via SMTP or SNMPv2 or higher traps; send alerts or status via syslog

86-23.01G(4) Security
Secure Management via SSL or HTTPS

86-23.01G(5) Environmental
Temperature: 2º to 50º C (35º F to 120º F)
Relative Humidity: 10% to 90% (non-condensing)
Designed for Outdoor Cabinet use

86-23.01G(6) Management
SNMP version 2 or higher, Web-Based GUI using HTTPS, Console and at least one of the following: SSH, TFTP
Provide logging of events to Centralized logging server using Syslog

86-23.01G(7) Miscellaneous
All remote environmental monitoring hardware shall be commercially available from a single manufacturer. Contractor shall standardize upon a single manufacturer
Provide rack mount kits to install in Backhaul cabinet racks furnished by Contractor and data center site EIA 19-inch racks furnished by others
Provide Ethernet Category 6 patch cable(s) to connect the base chassis device to network access switch(es)
Provide all of the necessary cables, kits, and miscellaneous hardware for complete installation

86-23.01H Tape Backup Storage System:
86-23.01H(1) General:
Provide drive and tape storage. Utilize 10GB iSCSI as the primary communications protocol. Backwards compatible with 1GB iSCSI.

86-23.01H(2) Software Features:
Disk-to-Disk and Disk-to-Tape backup automation based on user-defined storage policy

86-23.01H(3) Chassis:
Tape Library
One (1) rack mount 10gigabit iSCSI or Ethernet-based tape storage library. Maximum Height of 3RU.
Hardware-based encryption of 128-Bit AES or higher level encryption
Rewritable and Write Once Read Many (WORM)
Library slot capacity to hold a minimum of twelve (12) tape cartridges
Minimum data transfer rate to tape of 2.0TB/hr

86-3.05H(4) Tape:
Minimum Twelve (12) Tape Cartridges
LTO Ultrium 6 based storage and compression
Cartridge capacity of 2.5 TB native; 6.25 TB with data compression

86-23.01H(5) Management:
Management via SSH, HTTPS and SNMP v2 or higher.

86-23.01H(6) Power:
Dual Redundant Hot-Swappable Power Supply

86-23.01H(7) Network:
10GigE SFP or RJ-45 Network Port(s)
10Gbps iSCSI support with Jumbo Frames
Fiber optic SFP modules compatible with Tape Library and core switches if optic network ports are furnished on tape library

86-23.01I iSCSI-Based Managed Ethernet Switch
86-23.01I(1) General:
Capable of processing and forwarding iSCSI packets at full wirespeed (10Gbps) on all ports simultaneously
Support iSCSI optimization and management of switch protocols and features including configuration of ports and port channels, spanning-tree, jumbo frames, Unicast storm, flow control

86-23.01I(2) Chassis:
Rack Mounted. Maximum of 2 EIA RUs.
Mimimum of sixteen (12) 10GigE iSCSI-enabled ports.
Management console port for local PC connections and configuration
Ports fully compatible with Storage array and Host server iSCSI NICs

86-23.01I(3) Features:

Spanning-Tree Protocol support, including Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)
Support multiple Spanning Tree groups and a separate instance of Spanning Tree per VLAN
VLAN trunk creation supported from any port using IEEE 802.1Q trunking
Support multiple Spanning Tree groups and a separate instance of Spanning Tree per VLAN
VLAN trunk "pruning" support

86-23.01I(4) Quality of Service:

IEEE 802.1p support on all ports
Differentiated Services (DiffServ) support on all ports
Minimum of four (4) network traffic queues for classification and queuing of network traffic

86-23.01I(5) Security:

Multilevel access security
Media access control (MAC) address-based port level security
Access control lists (ACLs)
Remote Access Dial-In User Service (RADIUS) for user authentication, authorization, and accounting

86-23.01I(6) Management:

Simple Network Management Protocol (SNMP), Remote Monitoring (RMON) or Switch Monitoring (SMON), Trivial File Transfer Protocol (TFTP) and SSH interface support.
Network Time Protocol (NTP) for an accurate and consistent time stamp

86-23.01I(7) Alarms:

SNMP trap generation and forwarding to network management system.
Multifunction LEDs per port for port status, half-duplex/ full-duplex indication, switch-level status LEDs for system, redundant power supply (RPS), and bandwidth utilization.

86-23.01I(8) Environmental:

Operating temperature: 0° to 40° Celsius
Operating relative humidity: 10 to 90% non-condensing

86-23.01I(9) Power Supply:

AC input voltage/frequency: 100 to 240 VAC, 50 to 60 Hz.
Redundant power supplies

86-23.01J Miscellaneous

The Contractor shall:
Make the necessary electrical power connections from the network equipment to the UPS, PDU or appropriate electrical outlet provided by others
Provide horizontal and vertical slotted duct cable management (with removable covers) compatible with the accommodating rack (EIA 19-inch rack furnished by others)
Provide all of the necessary cables, kits, and miscellaneous hardware for complete installation

86-23.01K Spare Parts

Furnish the following spare network electronics:

Two (2) each of contractor supplied 10GBase-xR GBICS. For example, if 10GBase-LR GBIC is supplied by contractor, then include two (2) 10GBase-LR GBICs as spares.
One (1) 10gigabit optical Ethernet module that is compatible with the Core Ethernet Switch.
One (1) Distribution Hub Ethernet switch.
One (1) Access Ethernet switch
One (1) iSCSI-Based Managed Ethernet Switch
One (1) UPS for Roadside Backhaul Hub Cabinet Locations
One (1) UPS for Data Center Hub Locations if different model/capacity from roadside UPS.
One (1) Power Distribution Unit (PDU)
Two (2) Hard drives compatible with Network Management Virtual Environment Storage Array
Two (2) Hard drives compatible with Backup Server
Two (2) Hard drives compatible with Virtual Host Server, if different model/capacity from Backup server
Six (6) singlemode fiber optic patch cords with sufficient length and termination to be used at any Backhaul Hub or Data Center location.

Other spare parts as recommended by manufacturers and/or Contractor for maintenance.
For other electronics not listed above, furnish a recommended set of spare parts for the maintenance of the network. Installation and configuration of any and all spare parts shall be included in the price for the monthly maintenance.

86-24 Key Staff Qualifications
The following list identifies individuals from your organization as key project personnel and describes the qualifications they must have. If more than one (1) individual is proposed for a key role, each must have the qualifications defined for the key role. The project principal and project manager key roles must be assigned to different individuals. Changes to key personnel will be subject to review and approval by BAIFA.

Project Principal
Qualifications: Eight (8) years previous experience on at least three (3) projects of similar size and technical scope, demonstrated individual success on referenced past projects.

Project Manager
Qualifications: Eight (8) years previous experience on at least two (2) projects of similar size and technical scope with demonstrated individual success on referenced past projects. Qualifying industry recognized certification such as the PMBOK PMP certification.
The Maintenance Manager
Qualifications: Seven (7) years previous experience on at least two (2) projects of similar size and technical scope, demonstrated understanding of change control methodologies in a complex, multi-use, multi-service level environment, demonstrated individual success on referenced past projects. Previous experience in providing ongoing maintenance and support within a NOC environment is required.

Network Communications Implementation Manager, who will be responsible for implementation, integration, configuration, management and functionality of the entire Backhaul communications network, including all roadside and data center elements.

Qualifications: Industry- recognized, six (6) years previous experience on at least two (2) projects of similar size and technical scope, demonstrated individual success on referenced past projects.

Network Management System Implementation Engineer, who will be responsible for the configuration, integration and implementation of the Backhaul communications network management system (NMS) hardware, software and virtualization as well as overall Backhaul network and systems management, security and compliance.

Qualifications: Four (4) years previous experience on at least two (2) projects of similar size and technical scope, at least three (3) years' experience deploying, installing, configuring and integrating Bidder proposed network management and network security software suite, demonstrated individual success on referenced past projects.

Technicians qualified to install, configure, and test the prescribed design as specified in this Contract. You will have staff to support all of the equipment after the installation including, but not limited to, break/fix service dispatch and equipment in external environments.

APPENDIX A

Contract Drawings and Plans

Replacement Sheets:

Project Plan Sheets 1, 3, 68, 69, 75, 107, 108, 109, 110, 111, 112, 113, 114, 115, 118, 122, 124, 128, 129, 130, 131, 132, 133, 139, 146, 147, 155, and 175

Added Sheets:

Project Plan Sheets 66A, 66B, 66C, 66D, 66E, 66F, 66G, 66H, 66I, 66J, 66K, 66L, 66M, 66N, 66O, 66P, 66Q, and 154A

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9 0.0/24.6	1	175

INDEX OF PLANS

SHEET NO.	DESCRIPTION
1	TITLE SHEET AND LOCATION MAP
2	KEY MAP AND LINE INDEX
3	TEMPORARY WATER POLLUTION CONTROL QUANTITIES
4-65	UTILITY PLANS
66	CONSTRUCTION AREA SIGNS
66A-66N	TRAFFIC HANDLING PLANS AND QUANTITIES
66O-66Q	DETOUR PLANS AND QUANTITIES
67	EROSION CONTROL LEGEND AND QUANTITIES
68-175	ELECTRICAL PLANS

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN SPECIAL PROVISIONS.

2

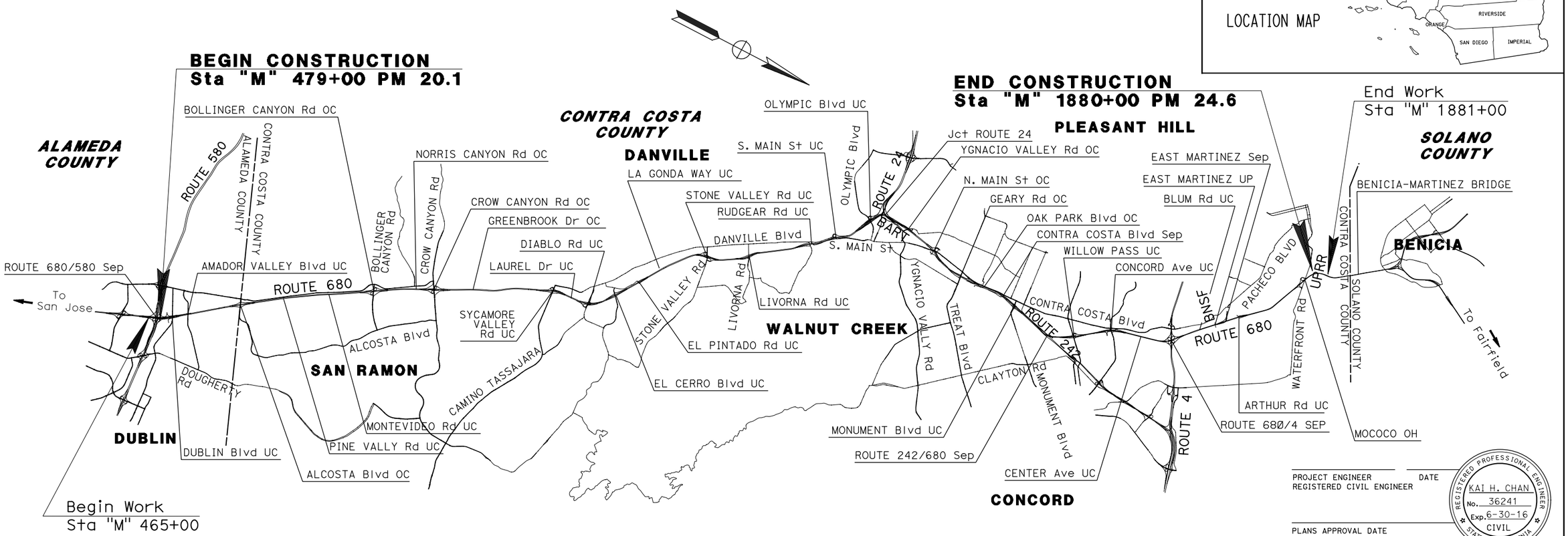
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN ALAMEDA AND CONTRA COSTA COUNTIES ON ROUTE 680 FROM ROUTE 580 TO BENICIA BRIDGE TOLL PLAZA AND VARIOUS LOCATIONS

TO BE SUPPLEMENTED BY STANDARD PLANS DATED 2010

2

LOCATION MAP



2 REVISED PER ADDENDUM No. 2

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

NO SCALE

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
KAI H. CHAN
No. 36241
Exp. 6-30-16
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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ATKINS
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607

CONTRACT No.	04-2J3304
PROJECT ID	0414000490

LAST REVISION 00-00-00
DATE PLOTTED => 6/24/2015
TIME PLOTTED => 11:21:49 AM

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER | CALTRANS DESIGN OVERSIGHT APPROVAL | REGISTRATION No. | LICENSE Exp DATE | DATE SIGNED

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	3	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER KAI H. CHAN No. 36241 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607

TEMPORARY WATER POLLUTION CONTROL SUMMARY [*]

SHEET No.	Temp DRAINAGE INLET PROTECTION	Temp FIBER ROLLS
	EA	LF
E-3 THRU E-69	70	2,400
TOTAL	70	2,400

[*] NOT A SEPARATE ITEM. QUANTITY PROVIDED FOR INFORMATION ONLY

2 REVISED PER ADDENDUM No. 2

TEMPORARY WATER POLLUTION CONTROL QUANTITIES

WPCQ-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: KAI CHAN

CALCULATED-DESIGNED BY: ARON ZEREZGHI

CHECKED BY: NATHAN COPE

REVISED BY

DATE REVISED

c:\pw_work\atknaca01\chan2418\dms01797\04140004490gd001.dgn

LAST REVISION 00-00-00

DATE PLOTTED => 6/24/2015
TIME PLOTTED => 11:21:55 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66A	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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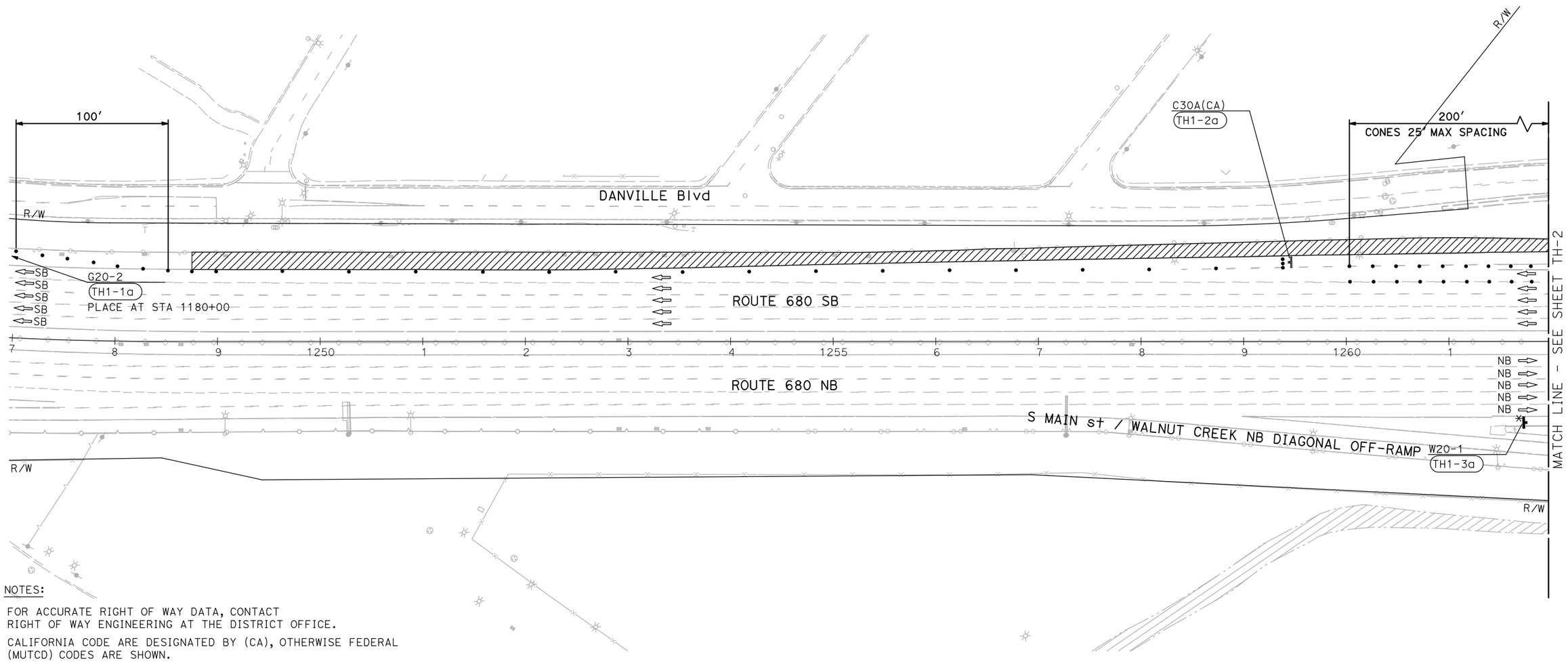
METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607

LEGEND:

- TRAFFIC DIRECTION
- WORK AREA
- TRAFFIC DRUM (50 ft MAX SPACING UNLESS OTHERWISE NOTED ON PLAN)
- THX-XX SIGN NUMBER
- FLASHING ARROW SIGN (FAS) ON SUPPORT OR TRAILER
- TEMPORARY TRAFFIC CONTROL SIGN
- PORTABLE FLASHING BEACON



NOTES:

1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
2. CALIFORNIA CODE ARE DESIGNATED BY (CA), OTHERWISE FEDERAL (MUTCD) CODES ARE SHOWN.
3. STANDARD ADVANCE WARNING SIGNAGE MUST BE USED.
4. UNLESS OTHERWISE SPECIFIED IN THE SPECIAL PROVISIONS, ALL TEMPORARY WARNING SIGNS SHALL HAVE BLACK LEGEND ON ORANGE BACKGROUND.
5. FOR DETAILS NOT SPECIFIED, USE 2010 REVISED STANDARD PLANS FOR TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON FREEWAYS AND EXPRESSWAYS.
6. ALL EXISTING SIGNS IN CONFLICT WITH TRAFFIC HANDLING PLAN MUST BE COVERED OR REMOVED UNDER THE DIRECTION OF THE ENGINEER
7. UNLESS OTHERWISE NOTED, ALL TRAFFIC LANES MUST BE 11' MIN WIDTH
8. LANE DROPS ARE 780 FEET MINIMUM

2 REVISED PER ADDENDUM No. 2

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(MAIN STREET SB ON-RAMP)

SCALE: 1" = 50'

TH-1

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
KAI CHAN
CONSULTANT FUNCTIONAL SUPERVISOR
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

c:\pw_work\atknaca01\chan2418\dms01797\04140004 90md001.dgn

LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:03 AM

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66B	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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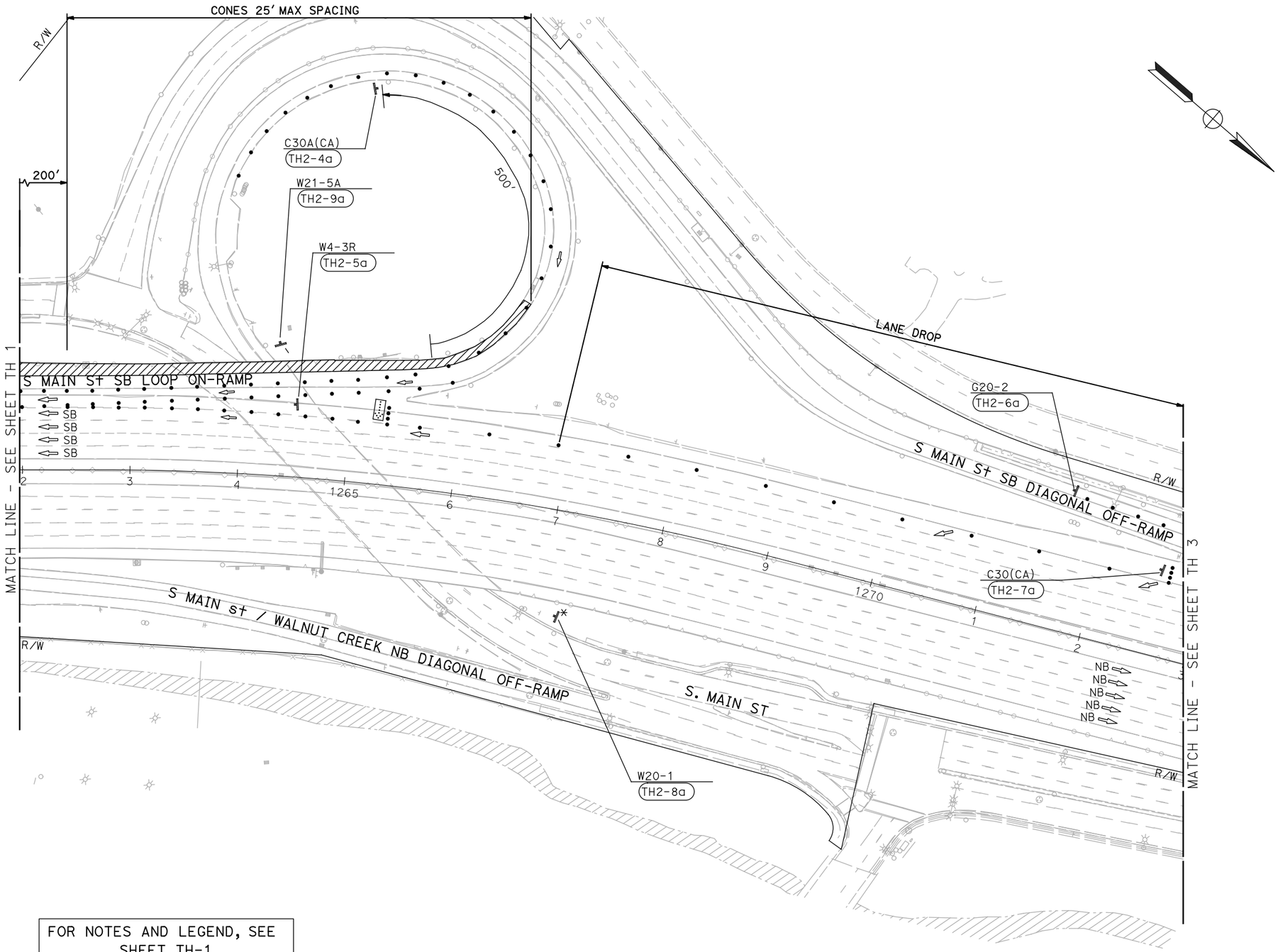
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(MAIN STREET SB ON-RAMP)

SCALE: 1" = 50'

TH-2

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
SUPERVISOR | KAI CHAN
CONSULTANT FUNCTIONAL

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

c:\pw_work\atknaca01\chan2418\dms01797\04140004 90md002.dgn

LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:09 AM

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66C	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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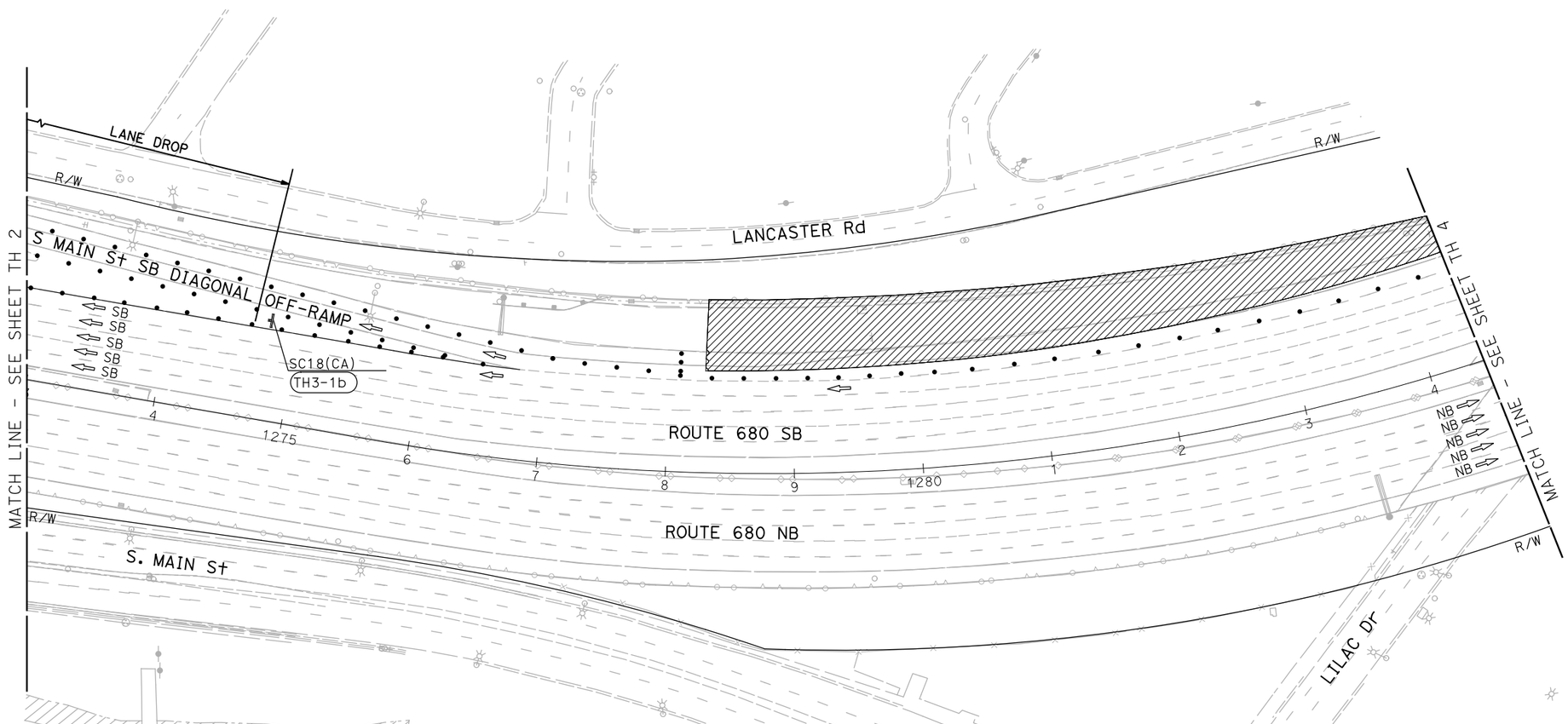
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 REVISED PER ADDENDUM No. 2

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(OLYMPIC BOULEVARD SB ON-RAMP)

SCALE: 1" = 50'

TH-3

REVISED BY	TARIN VELOTTA
DATE REVISED	THERESA GAISSER
CALCULATED-DESIGNED BY	
CHECKED BY	
CONSULTANT FUNCTIONAL SUPERVISOR	KAI CHAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:16 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66D	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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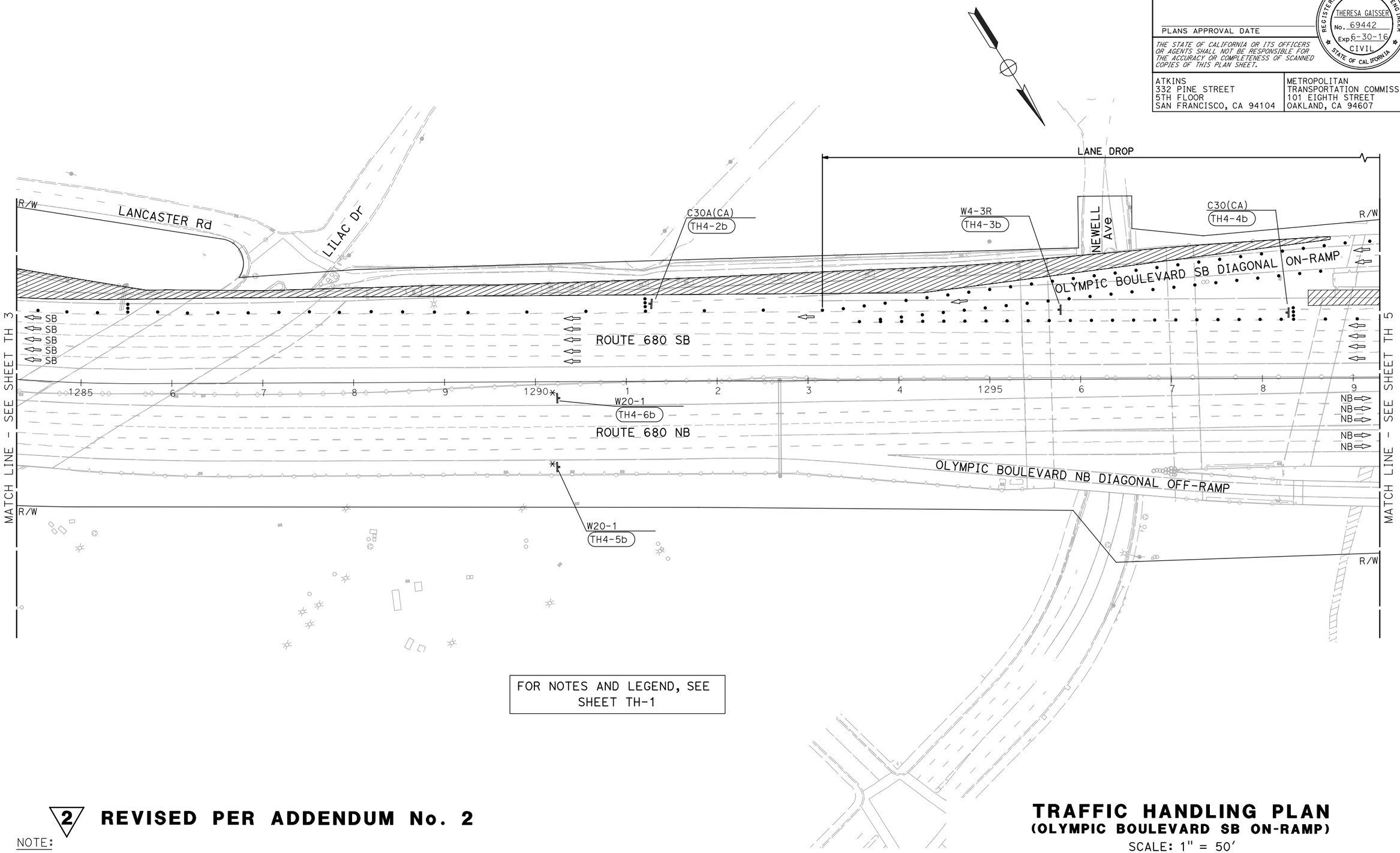
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 REVISED PER ADDENDUM No. 2

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(OLYMPIC BOULEVARD SB ON-RAMP)

SCALE: 1" = 50'

TH-4

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
KAI CHAN
CONSULTANT FUNCTIONAL SUPERVISOR

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Caltrans

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:25 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md004_new.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66E	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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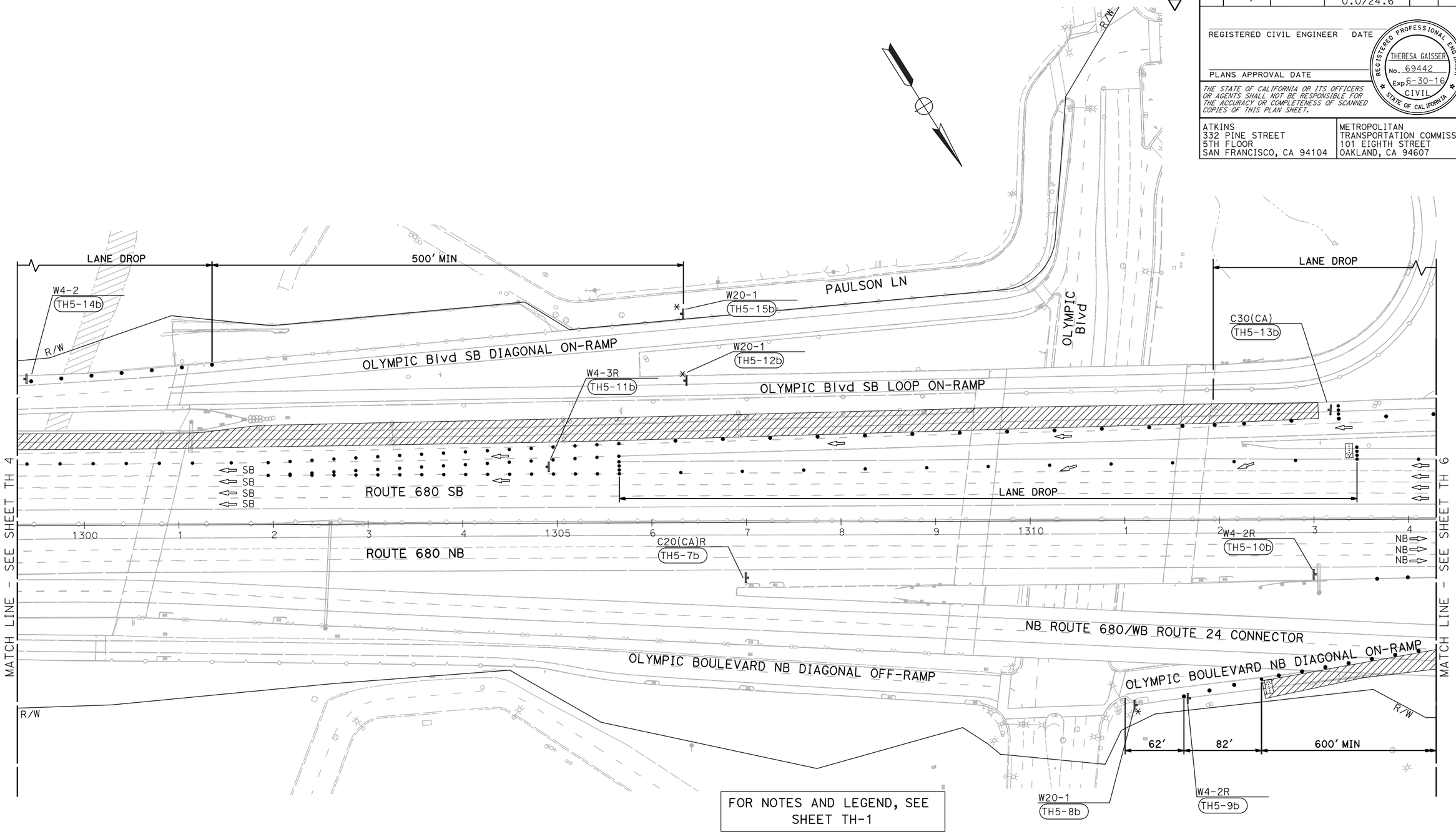
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 REVISED PER ADDENDUM No. 2

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(OLYMPIC BOULEVARD SB ON-RAMP)

SCALE: 1" = 50'

TH-5

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY	CHECKED BY
TARIN VELOTTA	THERESA GAISSER

CONSULTANT FUNCTIONAL SUPERVISOR: KAI CHAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:33 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md005.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66F	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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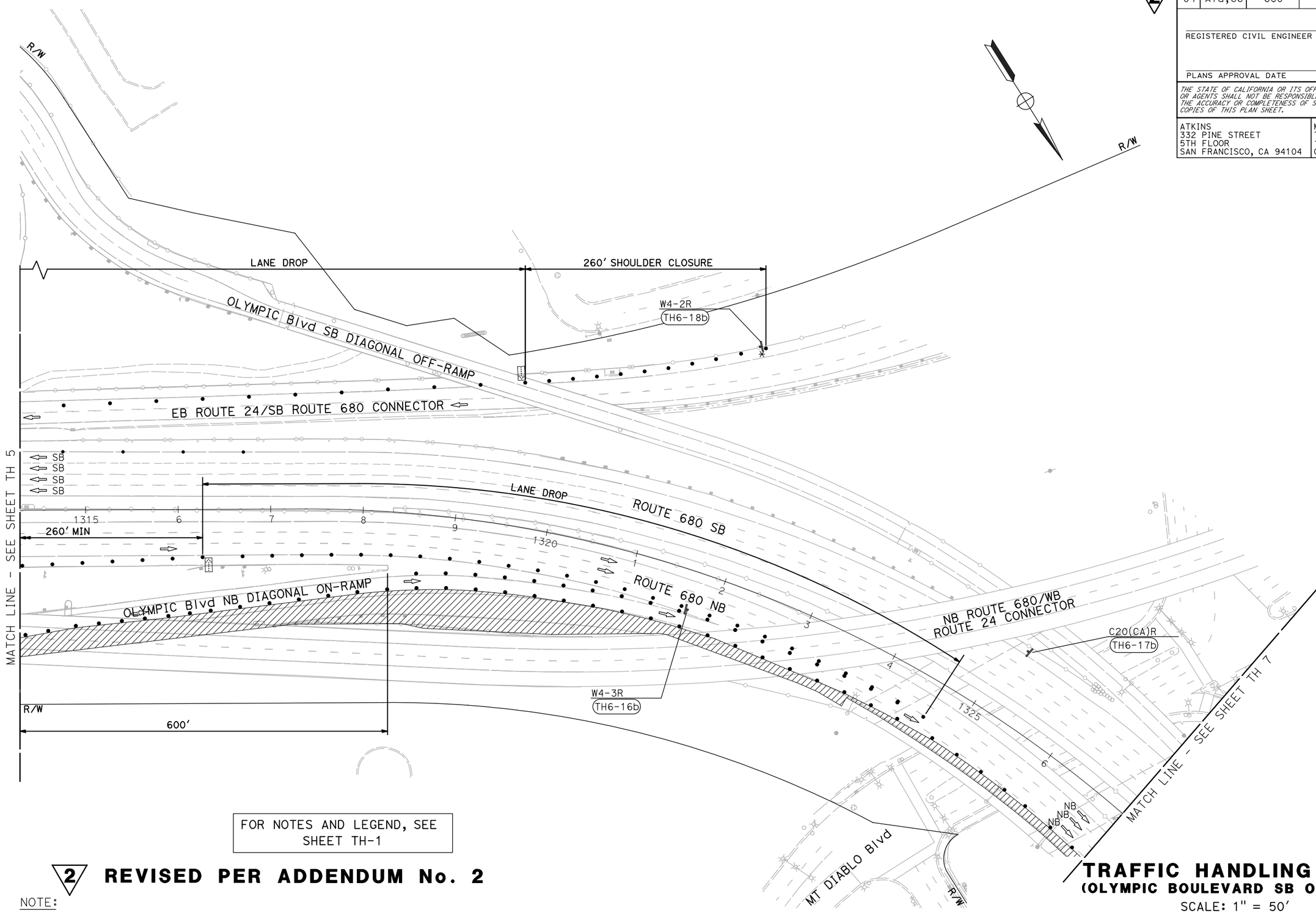
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(OLYMPIC BOULEVARD SB ON-RAMP)

SCALE: 1" = 50′

TH-6

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR | KAI CHAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:40 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md006.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66G	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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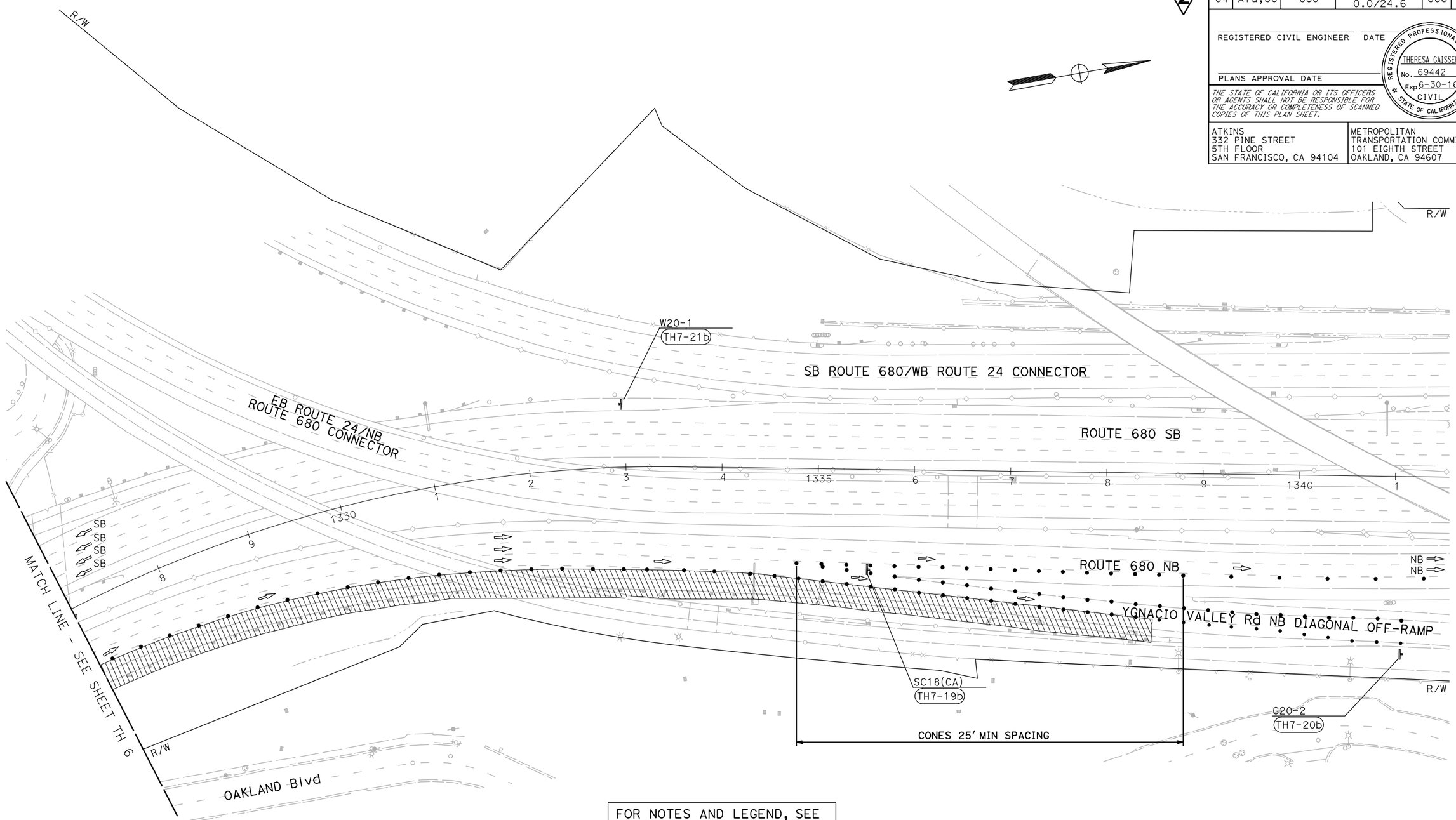
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 REVISED PER ADDENDUM No. 2

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(YGNACIO VALLEY RD NB OFF-RAMP)

SCALE: 1" = 50'

TH-7

REVISED BY	DATE REVISED
TARIN VELOTTA	THERESA GAISSER
CALCULATED-DESIGNED BY	CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR	KAI CHAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:47 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md007.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66H	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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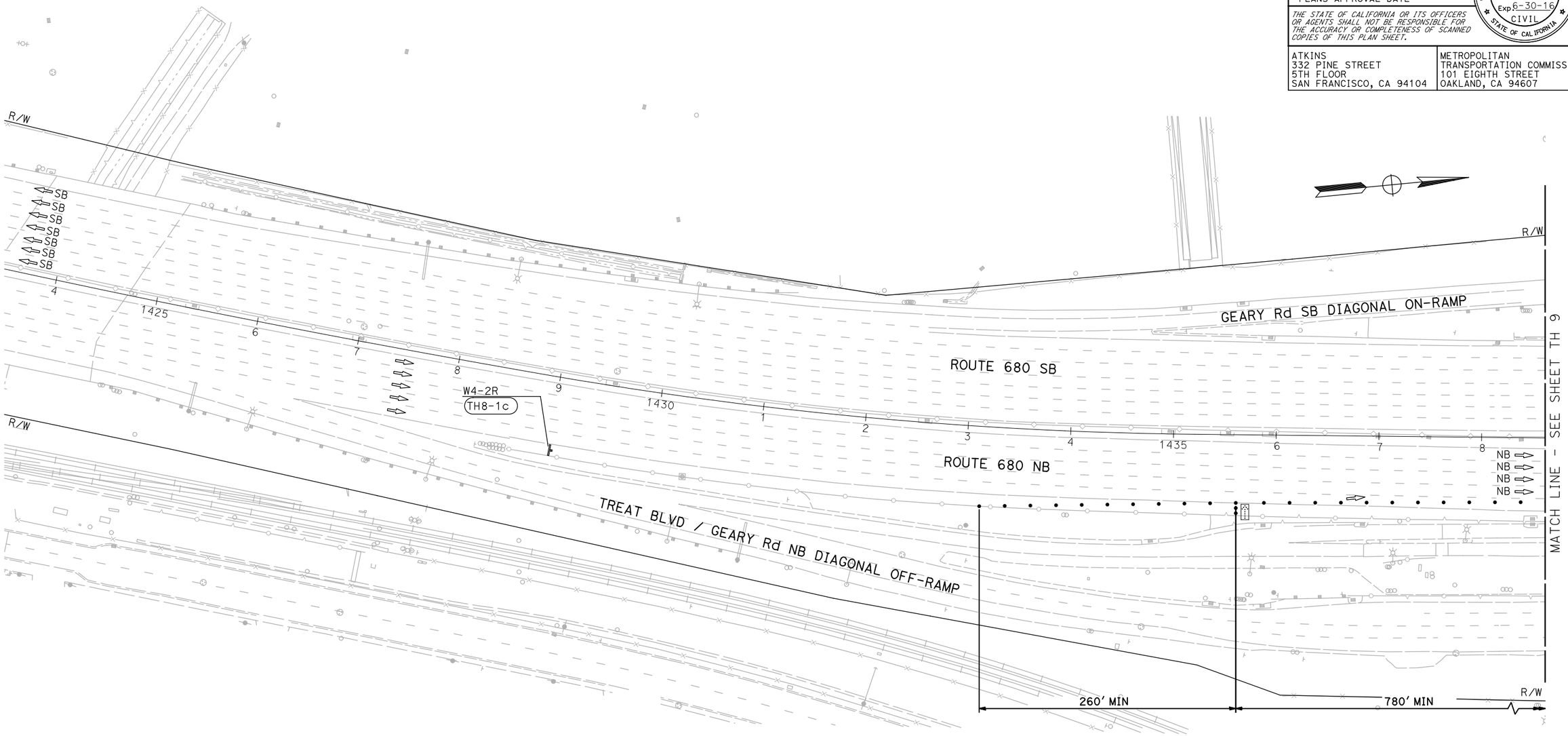
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607

NOTE:

1. PLACE W20-1 AND C20 SIGNS UPSTREAM OF TRAFFIC PER RSP T10



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(GEARY RD NB ON-RAMP)

SCALE: 1" = 50'

TH-8

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
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CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:22:54 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md008.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66I	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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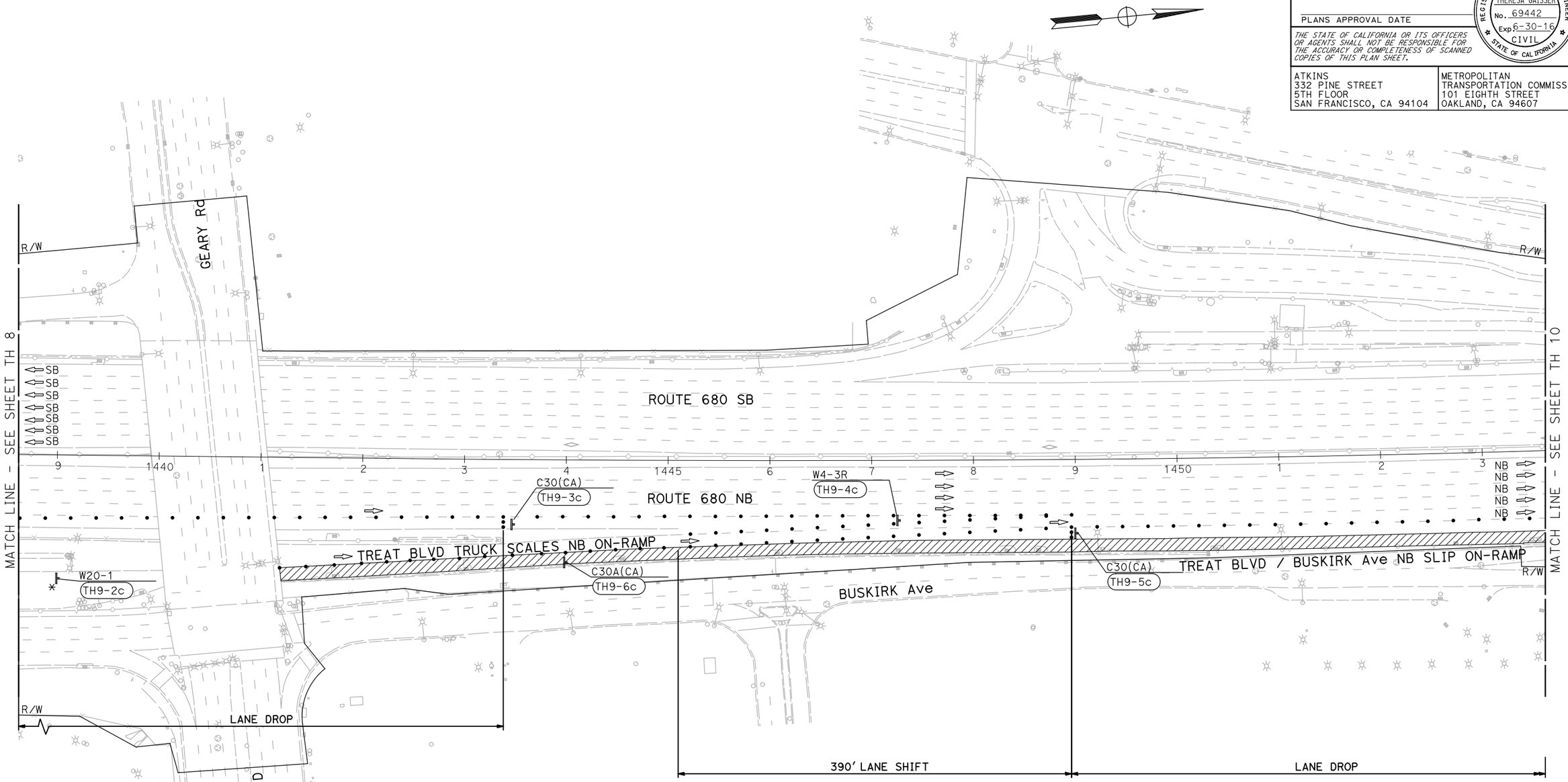
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



2 **REVISED PER ADDENDUM No. 2**

FOR NOTES AND LEGEND, SEE SHEET TH-1

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(GEARY RD NB ON-RAMP)

SCALE: 1" = 50'

TH-9

REVISED BY | DATE REVISED

TARIN VELOTTA | THERESA GAISSER

CALCULATED-DESIGNED BY | CHECKED BY

KAI CHAN

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:23:01 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md009.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66J	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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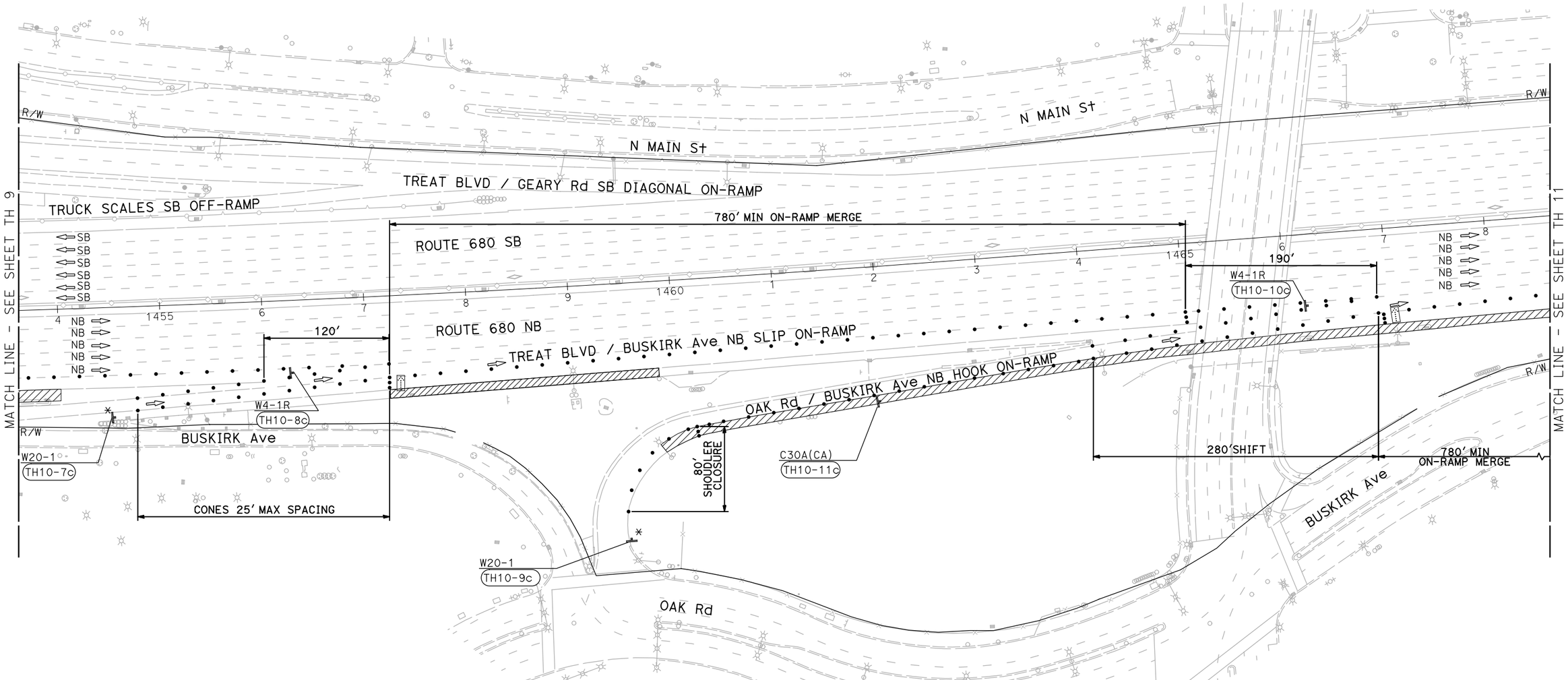
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(BUSKIRK Ave NB ON-RAMP)

SCALE: 1" = 50'

TH-10

REVISED BY	DATE REVISED
TARIN VELOTTA	THERESA GAISSER
CALCULATED-DESIGNED BY	CHECKED BY
KAI CHAN	

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:23:07 AM

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66K	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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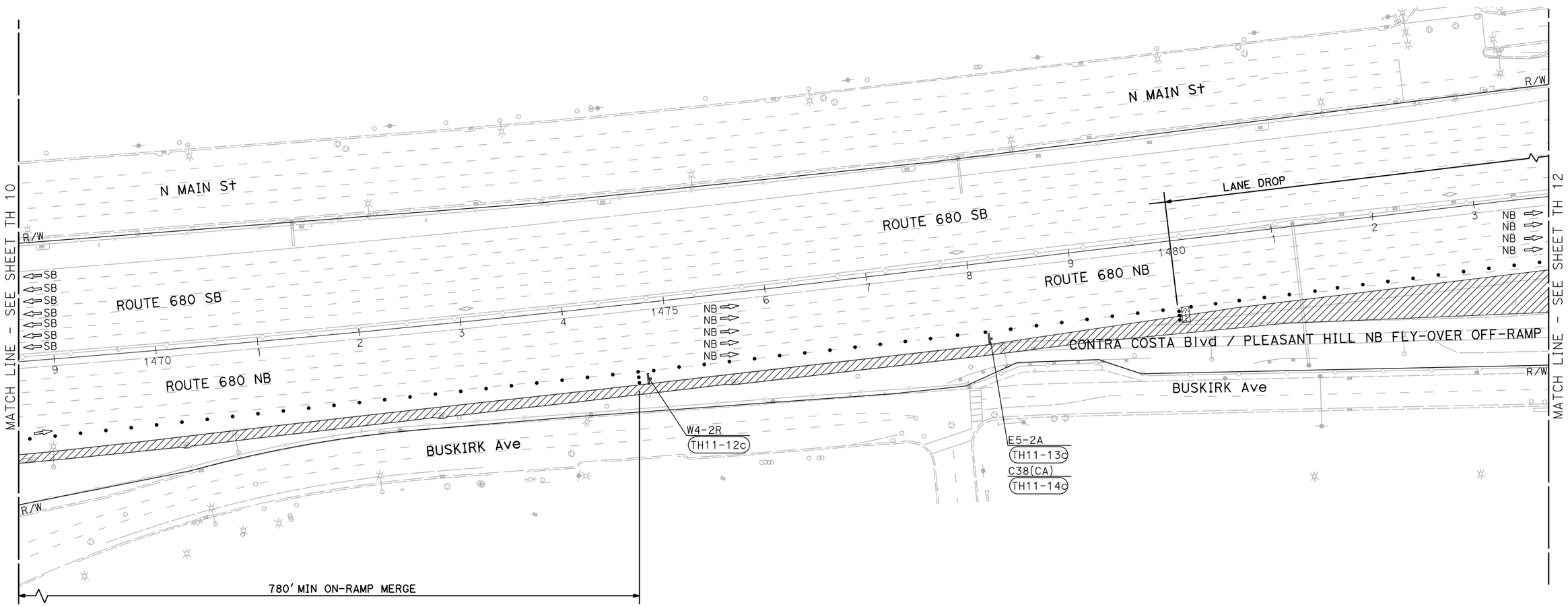
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(BUSKIRK AVE NB ON-RAMP)

SCALE: 1" = 50'

TH-11

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: KAI CHAN

CALCULATED-DESIGNED BY: TARIN VELOTTA

CHECKED BY: THERESA GAISSER

REVISED BY

DATE REVISED

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:23:14 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md011.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66L	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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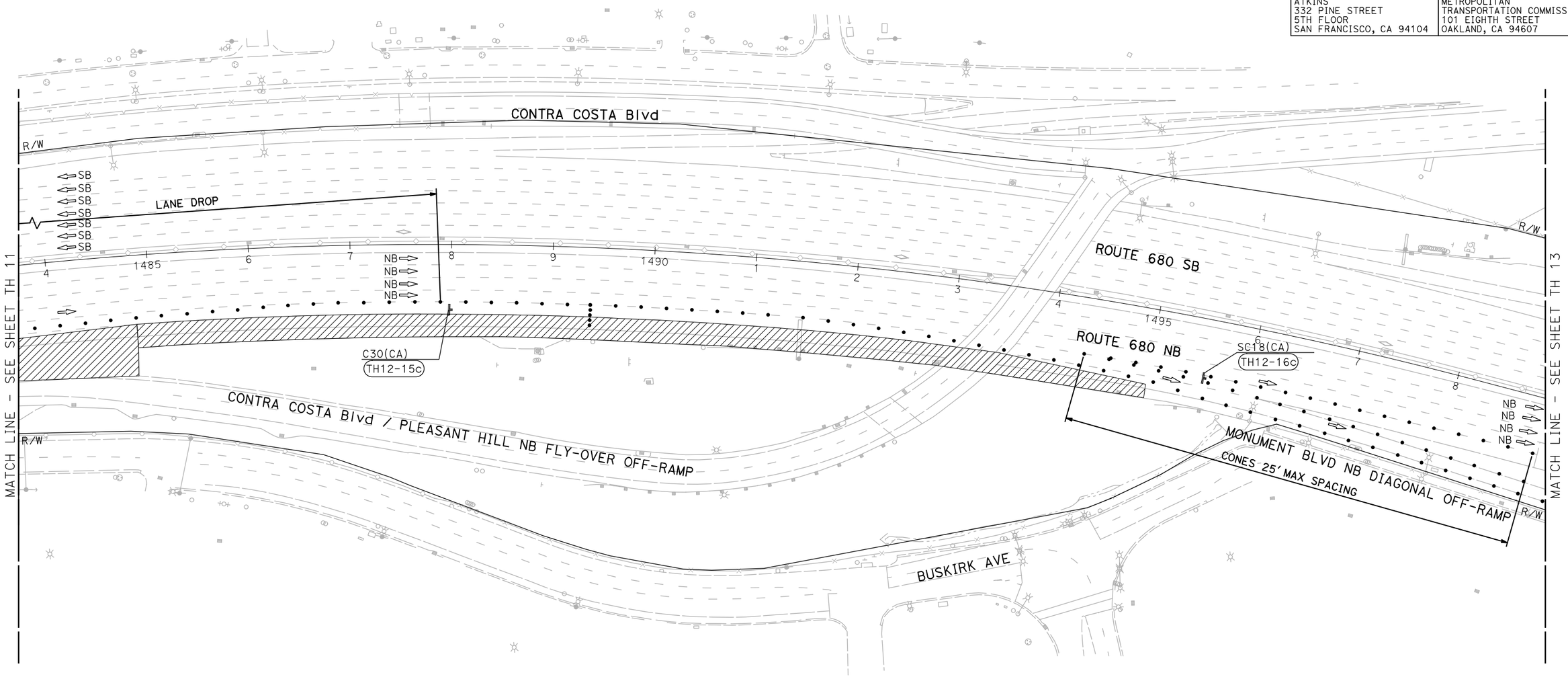
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(BUSKIRK AVE NB ON-RAMP)

SCALE: 1" = 50'

TH-12

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
KAI CHAN
CONSULTANT FUNCTIONAL SUPERVISOR

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:23:21 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md012.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66M	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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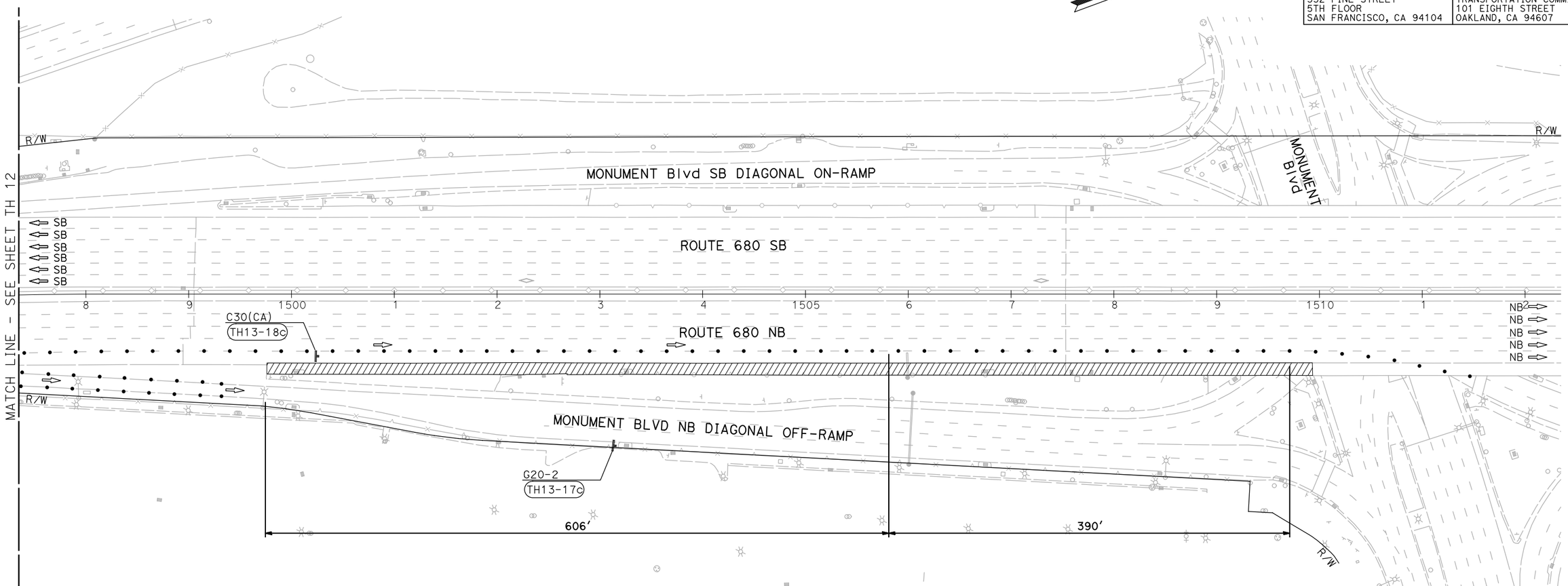
ATKINS
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607



FOR NOTES AND LEGEND, SEE SHEET TH-1

2 **REVISED PER ADDENDUM No. 2**

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

APPROVED FOR TRAFFIC HANDLING WORK ONLY

TRAFFIC HANDLING PLAN
(BUSKIRK AVE NB ON-RAMP)

SCALE: 1" = 50'

TH-13

REVISED BY | DATE REVISED

TARIN VELOTTA | THERESA GAISSER

CALCULATED-DESIGNED BY | CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: KAI CHAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:23:29 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490md013.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66N	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

ATKINS
332 PINE STREET
5TH FLOOR
SAN FRANCISCO, CA 94104

METROPOLITAN
TRANSPORTATION COMMISSION
101 EIGHTH STREET
OAKLAND, CA 94607

STATIONARY MOUNTED CONSTRUCTION AREA SIGNS [*]

SHEET No.	SIGN No.	SIGN CODE	PANEL SIZE IN X IN	REMARKS
TH-1	TH1-1a	G20-2	48 X 24	END ROAD WORK
TH-1	TH1-2a	C30A(CA)	48 X 48	SHOULDER CLOSED
TH-1	TH1-3a	W20-1	48 X 48	ROAD WORK AHEAD
TH-2	TH2-4a	C30A(CA)	48 X 48	SHOULDER CLOSED
TH-2	TH2-5a	W4-3R	48 X 48	ADDED LANE
TH-2	TH2-6a	G20-2	48 X 24	END ROAD WORK
TH-2	TH2-7a	C30(CA)	48 X 48	LANE CLOSED
TH-2	TH2-8a	W20-1	48 X 48	ROAD WORK AHEAD
TH-2	TH2-9a	W21-5A	48 X 48	SHOULD WORK
TH-3	TH3-1b	SC18(CA)	48 X 48	EXIT WITH ARROW
TH-4	TH4-2b	C30A(CA)	48 X 48	SHOULDER CLOSED
TH-4	TH4-3b	W4-3R	48 X 48	ADDED LANE
TH-4	TH4-4b	C30(CA)	48 X 48	LANE CLOSED
TH-4	TH4-5b	W20-1	48 X 48	ROAD WORK AHEAD
TH-4	TH5-6b	W20-1	48 X 48	ROAD WORK AHEAD
TH-5	TH5-7b	C20(CA)R	48 X 48	RIGHT LANE CLOSED AHEAD
TH-5	TH5-8b	W20-1	48 X 48	ROAD WORK AHEAD
TH-5	TH5-9b	W4-2R	48 X 48	(RIGHT) LANE ENDS
TH-5	TH5-10b	W4-2R	48 X 48	(RIGHT) LANE ENDS
TH-5	TH5-11b	W4-3R	48 X 48	ADDED LANE
TH-5	TH5-12b	W20-1	48 X 48	ROAD WORK AHEAD
TH-5	TH5-13b	C30(CA)	48 X 48	LANE CLOSED
TH-5	TH5-14b	W4-2R	48 X 48	(RIGHT) LANE ENDS
TH-5	TH5-15b	W20-1	48 X 48	ROAD WORK AHEAD
TH-6	TH6-16b	W4-3R	48 X 48	ADDED LANE
TH-6	TH6-17b	C20(CA)R	48 X 48	RIGHT LANE CLOSED AHEAD
TH-6	TH6-18b	W4-2R	48 X 48	(RIGHT) LANE ENDS
TH-7	TH7-19b	SC18(CA)	48 X 48	EXIT WITH ARROW
TH-7	TH7-20b	G20-2	48 X 24	END ROAD WORK
TH-7	TH7-21b	W20-1	48 X 48	ROAD WORK AHEAD
TH-8	TH8-1c	W4-2R	48 X 48	(RIGHT) LANE ENDS
TH-9	TH9-2c	W20-1	48 X 48	ROAD WORK AHEAD
TH-9	TH9-3c	C30(CA)	48 X 48	LANE CLOSED
TH-9	TH9-4c	W4-3R	48 X 48	ADDED LANE
TH-9	TH9-5c	C30(CA)	48 X 48	LANE CLOSED
TH-9	TH9-6c	C30A(CA)	48 X 48	SHOULDER CLOSED
TH-10	TH10-7c	W20-1	48 X 48	ROAD WORK AHEAD
TH-10	TH10-8c	W4-1R	48 X 48	MERGE
TH-10	TH10-9c	W20-1	48 X 48	ROAD WORK AHEAD
TH-10	TH10-10c	W4-1R	48 X 48	MERGE
TH-10	TH10-11c	C30A(CA)	48 X 48	SHOULDER CLOSED
TH-11	TH11-12c	W4-2R	48 X 48	(RIGHT) LANE ENDS
TH-11	TH11-13c	E5-2A	48 X 36	EXIT CLOSED
TH-11	TH11-14c	C38(CA)	48 X 36	USE NEXT EXIT
TH-12	TH12-15c	C30(CA)	48 X 48	LANE CLOSED
TH-12	TH12-16c	SC18(CA)	48 X 48	EXIT WITH ARROW
TH-13	TH13-17c	G20-2	48 X 24	END ROAD WORK
TH-13	TH13-18c	C30(CA)	48 X 48	LANE CLOSED

[*] NOT A SEPARATE ITEM. QUANTITY PROVIDED FOR INFORMATION ONLY

2 **REVISED PER ADDENDUM No. 2**

TRAFFIC HANDLING QUANTITIES

APPROVED FOR TRAFFIC HANDLING WORK ONLY

THQ-1

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR: KAI CHAN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	660	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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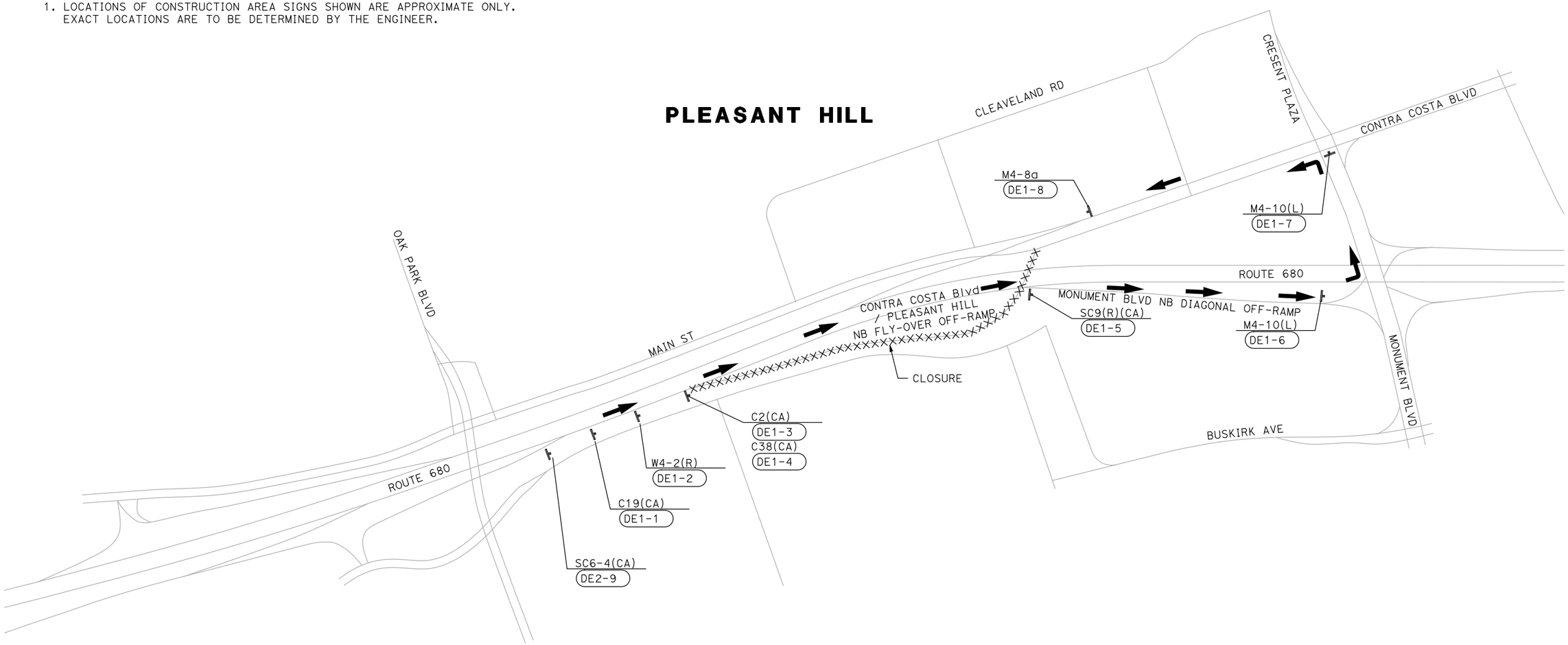
101 EIGHTH STREET
OAKLAND, CA 94607

LEGEND:

DEX-XX	SIGN NUMBER
	DETOUR SIGN
XXXXX	PORTABLE FLASHING BEACON

NOTE:

1. LOCATIONS OF CONSTRUCTION AREA SIGNS SHOWN ARE APPROXIMATE ONLY. EXACT LOCATIONS ARE TO BE DETERMINED BY THE ENGINEER.



NB ROUTE 680 / CONTRA COSTA Blvd OFF-RAMP CLOSURE

2 **REVISED PER ADDENDUM No. 2**

DETOUR PLAN
(CONTRA COSTA Blvd NB OFF-RAMP)

NO SCALE

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DE-1

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BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490mg001.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66P	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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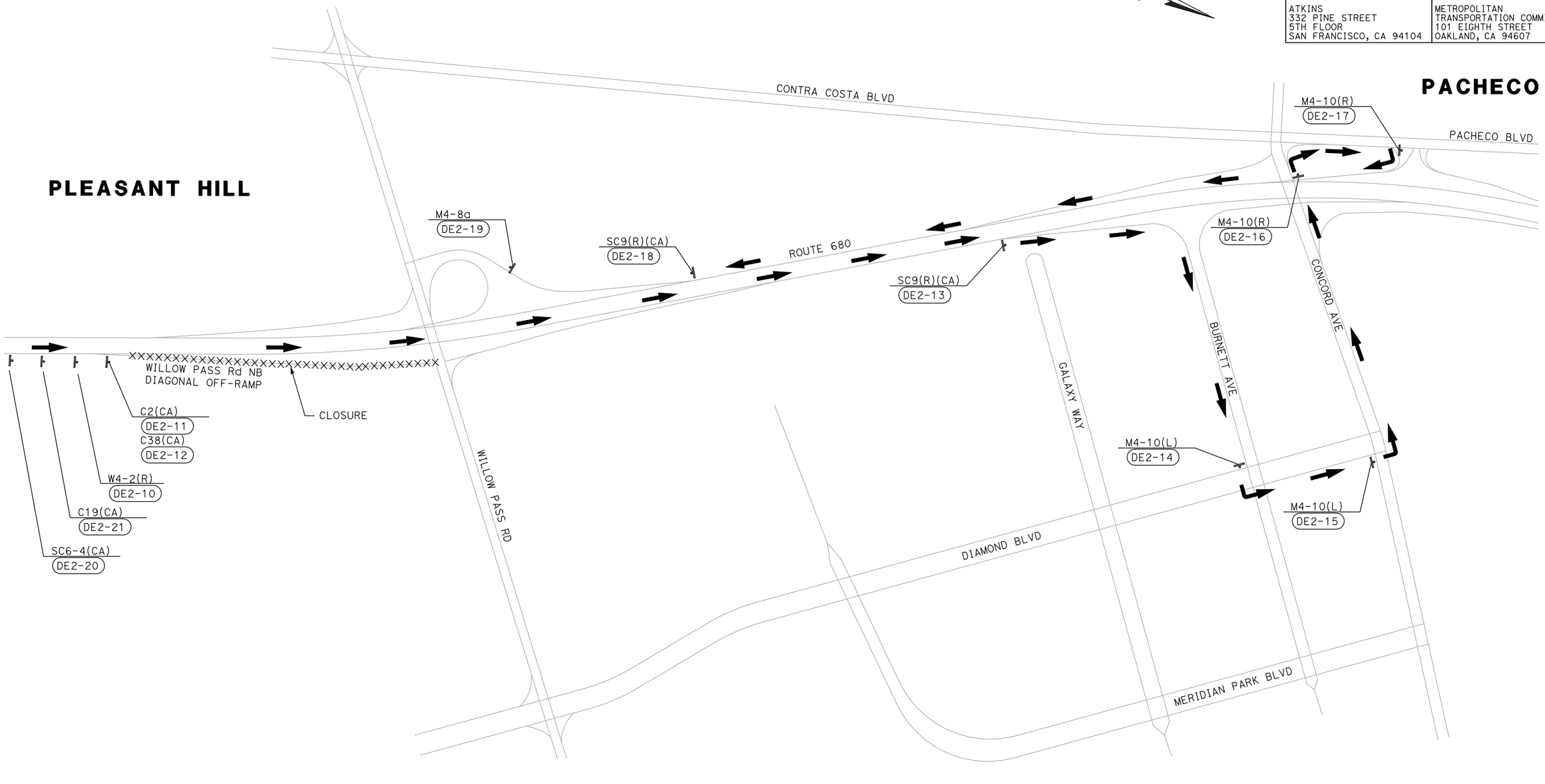

NB ROUTE 680 / WILLOW PASS Rd OFF-RAMP CLOSURE

2 **REVISED PER ADDENDUM No. 2**

DETOUR PLAN
(WILLOW PASS RD NB OFF-RAMP)

NO SCALE

APPROVED FOR DETOUR PLAN WORK ONLY

DE-2

REVISED BY	DATE REVISED

CALCULATED-DESIGNED BY	TARIN VELOTTA
CHECKED BY	THERESA GAISSER
SUPERVISOR	KAI CHAN
CONSULTANT FUNCTIONAL SUPERVISOR	

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	66Q	175

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER THERESA GAISSER No. 69442 Exp. 6-30-16 CIVIL STATE OF CALIFORNIA

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OAKLAND, CA 94607

STATIONARY MOUNTED CONSTRUCTION AREA SIGNS [*]

SHEET No.	SIGN No.	SIGN CODE	PANEL SIZE IN X IN	REMARKS	No. OF SIGNS
DE-1	DE1-1	C19(CA)	48 X 48	RAMP CLOSED AHEAD	1
DE-1	DE1-2	W4-2(R)	48 X 48	LANE ENDS (RIGHT)	1
DE-1	DE1-3	C2(CA)	48 X 30	RAMP CLOSED	1
DE-1	DE1-4	C38(CA)	48 X 36	USE NEXT EXIT	1
DE-1	DE1-5	SC9(R)(CA)	48 X 48	(FWY) DETOUR WITH ARROW	1
DE-1	DE1-6	M4-10(L)	48 X 18	DETOUR (LEFT)	1
DE-1	DE1-7	M4-10(L)	48 X 18	DETOUR (LEFT)	1
DE-1	DE1-8	M4-8a	24 X 18	END DETOUR	1
DE-1	DE1-9	SC6-4(CA)	60 X 48	RAMP CLOSED	1
DE-2	DE2-10	W4-2(R)	48 X 48	LANE ENDS (RIGHT)	1
DE-2	DE2-11	C2(CA)	48 X 30	RAMP CLOSED	1
DE-2	DE2-12	C38(CA)	48 X 36	USE NEXT EXIT	1
DE-2	DE2-13	SC9(R)(CA)	48 X 48	(FWY) DETOUR WITH ARROW	1
DE-2	DE2-14	M4-10(L)	48 X 18	DETOUR (LEFT)	1
DE-2	DE2-15	M4-10(L)	48 X 18	DETOUR (LEFT)	1
DE-2	DE2-16	M4-10(R)	48 X 18	DETOUR (RIGHT)	1
DE-2	DE2-17	M4-10(R)	48 X 18	DETOUR (RIGHT)	1
DE-2	DE2-18	SC9(R)(CA)	48 X 48	(FWY) DETOUR WITH ARROW	1
DE-2	DE2-19	M4-8a	24 X 18	END DETOUR	1
DE-2	DE2-20	SC6-4(CA)	60 X 48	RAMP CLOSED	1
DE-2	DE2-21	C19(CA)	48 X 48	RAMP CLOSED AHEAD	1

[*] NOT A SEPARATE ITEM, QUANTITY PROVIDED FOR INFORMATION ONLY.

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APPROVED FOR DETOUR PLAN WORK ONLY

DETOUR PLAN QUANTITIES

SCALE: 1" = 50'

DEQ-1

REVISED BY | DATE REVISED
TARIN VELOTTA | THERESA GAISSER
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR | KAI CHAN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	68	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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NOTES:

1. THIS PROJECT HAS BEEN DESIGNED USING CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS) STANDARD PLANS AND STANDARD SPECIFICATIONS, 2010 EDITION.
2. ALL NEW INFRASTRUCTURE SHALL BE INSTALLED WITHIN RIGHT-OF-WAY OR EASEMENTS. CONTRACTOR MUST IDENTIFY AND IS RESPONSIBLE FOR ALL UTILITY IDENTIFICATION PRIOR TO INSTALLATION.
3. CALL UNDERGROUND SERVICE ALERT (U.S.A.) AT (800) 227-2600 AT LEAST 48 HOURS PRIOR TO EXCAVATION TO LOCATE ALL EXISTING UNDERGROUND UTILITIES. UTILITY LOCATION SERVICES SHALL MEET LOCAL JURISDICTION REQUIREMENTS.
4. THE FOLLOWING UNDERGROUND FACILITIES MAY BE LOCATED IN THE PROJECT AREA: PULL BOXES, CONDUIT, AND CABLE FOR STREETLIGHTS, TRAFFIC SIGNALS, AND TRAFFIC OPERATIONS SYSTEMS. UNLESS OTHERWISE NOTED, ALL EXISTING FACILITIES SHALL BE PROTECTED-IN-PLACE. THE CONTRACTOR MUST CONTACT THE APPROPRIATE LOCAL JURISDICTION FOR LOCATIONS AT LEAST 2 WORKING DAYS PRIOR TO WORKING IN THE AREA.
5. THE INFORMATION SHOWN ON THESE PLANS CONCERNING THE TYPE AND LOCATION OF EXISTING UNDERGROUND AND OVERHEAD UTILITIES IS APPROXIMATE AND HAS NOT BEEN INDEPENDENTLY VERIFIED BY THE DESIGN ENGINEER. THE LOCATIONS OF UNDERGROUND FACILITIES SHOWN ON PLANS WERE OBTAINED FROM THE BAY AREA EXPRESS LANES COMMUNICATION NETWORK CONDUIT TESTING REPORT AND CALTRANS RECORDS AND PLANS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL UTILITIES ARE SHOWN HEREON. THE DESIGN ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION. THE CONTRACTOR WILL NOT BE COMPENSATED FOR THE REPAIR OF UTILITIES OR SURROUNDING INFRASTRUCTURE THAT IS DAMAGED DURING CONSTRUCTION.
6. CONTRACTOR SHALL PROTECT ALL EXISTING INFRASTRUCTURE AREAS NOT SPECIFIED FOR REMOVAL, AND SHALL BE RESPONSIBLE TO REPLACE OR REPAIR ANY DAMAGED INFRASTRUCTURE AREAS IN A TIMELY MANNER AT NO ADDITIONAL COST. THE CONTRACTOR SHALL PRESERVE AND PROTECT EXISTING PLANTINGS, MATERIALS, AESTHETIC FEATURES, LANDSCAPING, AND IRRIGATION SYSTEMS, AND REPLACE OR RECONSTRUCT ANY PLANTS, MATERIALS, AESTHETIC FEATURES, LANDSCAPING, AND IRRIGATION SYSTEMS DAMAGED DURING THE COURSE OF CONSTRUCTION PER THE LANDSCAPE AND AESTHETICS PERFORMANCE SPECIFICATION.
7. CONDUIT ROUTING, PULL BOX, POLE, AND CABINET LOCATIONS ARE SCHEMATIC FOR THE PURPOSE OF CLARITY AND MAY DIFFER FROM ACTUAL INSTALLATION. FINAL LOCATIONS SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER.
8. ALL NEW CONDUIT SHALL BE INSTALLED PER THE CALTRANS STANDARD SPECIFICATIONS AND PER SPECIFIED DETAILS ON THESE SHEETS UNLESS OTHERWISE NOTED ON THE PLANS.
9. THE CONTRACTOR SHALL PLACE ALL CONDUIT IN A MANNER THAT MINIMIZES HORIZONTAL AND VERTICAL BENDING, NOT TO EXCEED 1 FOOT PER 10 FEET.
10. ANY REMOVAL OF PAVEMENT NECESSARY TO FACILITATE INSTALLATION OF CONDUIT UNDER ROADWAY SHALL BE REPLACED TO ITS ORIGINAL CONDITION.
11. PULL BOXES SHALL BE INSTALLED PER STANDARD PLANS AND PER DETAILS IN THESE PLANS. PULL BOXES SHALL NOT BE INSTALLED IN SIDEWALK RAMPS NOR IN OR WITHIN TEN (10) FEET OF ANY DRIVEWAY OR LOCATED IN SWALES OR DITCHES. PULL BOXES TO BE INSTALLED IN THE PAVED ROADWAY SHOULDER SHALL BE TRAFFIC-RATED.
12. ALL HUB CABINETS SHALL BE INSTALLED OUTSIDE OF THE CLEAR RECOVERY ZONE OR BEHIND BARRIER RAIL OR GUARDRAIL. CABINET DOORS SHALL OPEN AS CALLED OUT IN THESE PLANS.
13. THE COMPLETE ELECTRICAL SYSTEM, INCLUDING PULL BOXES AND VAULTS, SHALL BE GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC). ALL WORK SHALL BE IN COMPLIANCE WITH THE NEC AND LOCAL CODES.
14. ELECTRICAL PULL BOXES FOR CONDUIT SYSTEMS THAT DO NOT CONTAIN FIBER OPTIC CABLE SHALL HAVE A MAXIMUM SPACING OF 500'.
15. LOCATION OF EXISTING PULL BOXES, VAULTS, TSCs, ARE APPROXIMATE. CONTRACTOR SHALL LOCATE ALL EXISTING PULL BOXES TO BE UTILIZED AS PART O THE BACKHAUL COMMUNICATIONS SYSTEM PRIOR TO STARTING WORK.
16. CONTRACTOR SHALL BE ALLOWED UP TO FIVE (5) TRUNK PLICES BETWEEN BACKHAUL COMMUNICATION HUB CABINETS TO ACCOMMODATE FIBER OPTIC CABLE REEL LENGTHS. CONTRACTOR SHALL SUBMIT PROPOSED TRUNK SPLICE LOCATIONS TO ENGINEER FOR APPROVAL.

INDEX OF ELECTRICAL PLANS:

SHEET NUMBER	TITLE
E-1	NOTES, LEGEND, ABREVIATIONS, AND INDEX OF ELECTRICAL PLANS
E-2	LEGEND
E-3 TO E-68	BACKHAUL COMMUNICATIONS SYSTEM
E-69	ELECTRICAL DETAILS (WALNUT CREEK BART SPLICE VAULT)
E-70	ELECTRICAL DETAILS (FIBER OPTIC PULL BOX)
E-71	ELECTRICAL DETAILS (FIBER OPTIC SPLICE VAULT)
E-72	ELECTRICAL DETAILS (TRUNKLINE MODIFICATION)
E-73	ELECTRICAL DETAILS (FIBER OPTIC CONDUIT AND TRENCH DETAIL)
E-74	ELECTRICAL DETAILS (FIBER OPTIC MARKER)
E-75	ELECTRICAL DETAILS (HUB CABINET CONTENTS DETAIL)
E-76	ELECTRICAL DETAILS (HUB CABINET FOUNDATION)
E-77	ELECTRICAL DETAILS (HUB CABINET DETAIL)
E-78	ELECTRICAL DETAILS (I-680 NETWORK OVERVIEW)
E-79 TO E-80	ELECTRICAL QUANTITIES (BACKHAUL)
E-81	ELECTRICAL DETAILS (BAIFA-OAKLAND HUB FIBER OPTIC SPLICE DIAGRAM)
E-82 TO E-83	ELECTRICAL DETAILS (WEST DUBLIN HUB FIBER OPTIC SPLICE DIAGRAM)
E-84 TO E-85	ELECTRICAL DETAILS (WALNUT CREEK HUB FIBER OPTIC SPLICE DIAGRAM)
E-86	ELECTRICAL DETAILS (WALNUT CREEK MAINTENANCE YARD BRANCH CABLE SPLICE DIAGRAM)
E-87	ELECTRICAL DETAILS (WALNUT CREEK MAINTENANCE YARD FIBER OPTIC SPLICE DIAGRAM)
E-87A	ELECTRICAL DETAILS (BAIFA SIGN BANK 2 FIBER OPTIC SPLICE DIAGRAM)
E-88 TO E-90	ELECTRICAL DETAILS (BENICIA TOLL PLAZA FIBER OPTIC SPLICE DIAGRAM)
E-91	ELECTRICAL DETAILS (CALTRANS TMC FIBER OPTIC SPLICE DIAGRAM)
E-92 TO E-106	ELECTRICAL DETAILS (TRUNKLINE SPLICE CABINET SPLICE DIAGRAM)
E-107	ELECTRICAL DETAILS (SERVICE EQUIPMENT ENCLOSURE TYPICAL WIRING DIAGRAM)
E-108	ELECTRICAL DETAILS (BORE PIT BACKFILL)

ABBREVIATIONS:

(SEE RSP ES-1A, RSP ES 1-B, RSP ES-1C)

BAIFA	BAY AREA INFRASTRUCTURE FINANCING AUTHORITY
BART	BAY AREA RAPID TRANSIT
BATA	BAY AREA TOLL AUTHORITY
BOH	BAIFA OAKLAND HUB
CALTRANS	CALIFORNIA DEPARTMENT OF TRANSPORTATION
E	ELECTRIC
FOB	FACE OF BARRIER
FOT	FIBER OPTIC TRUNKLINE
ITS	INTELLIGENT TRANSPORTATION SYSTEM
MPOE	MAIN POINT OF ENTRY
MTC	METROPOLITAN TRANSPORTATION COMMISSION
PDU	POWER DISTRIBUTION UNIT
PG&E	PACIFIC GAS & ELECTRIC
SMFO	SINGLE MODE FIBER OPTIC
STR	STRAND
tc	TELEPHONE CABLE
tvl	TELEVISION VIDEO CABLE
tvc	TELEVISION CONTROL CABLE
tvp	TELEVISION POWER CABLE
tvcp	TELEVISION CONTROL POWER CABLE
TMC	TRAFFIC MANAGEMENT CENTER
TSC	TRUNKLINE SPLICE CABINET
UPS	UN-INTERRUPTED POWER SUPPLY

LEGEND:

(SEE RSP ES-1A, RSP ES 1-B, RSP ES-1C)

NEW	EXISTING	
		BAIFA HUB CABINET ASSEMBLY, DOOR INDICATES FRONT OF CABINET
SV	SV	FIBER OPTIC SPLICE VAULT (SEE SHEET E-71 FOR INSTALLATION DETAIL)
		BART ACCESS POINT
FB	fb	FIBER OPTIC PULL BOX (SEE SHEET E-70 FOR INSTALLATION DETAIL)
		TRUNKLINE SPLICE CABINET (TSC), TYPE P

2 REVISED PER ADDENDUM No. 2

NOTES, LEGEND, ABREVIATIONS, AND INDEX OF ELECTRICAL PLANS

E-1

REVISED BY	DATE REVISED
PATRICK RAMIREZ	KEVIN AGUIGUI

CALCULATED-DESIGNED BY | CHECKED BY

FUNCTIONAL SUPERVISOR: KAI CHAN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	69	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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METROPOLITAN
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101 EIGHTH STREET
OAKLAND, CA 94607

LEGEND:

1. INSTALL BAIFA HUB CABINET ASSEMBLY MINIMUM 30′ FROM EDGE OF TRAVELED WAY OR 4′ MINIMUM BEHIND FACE OF BARRIER. SEE SHEETS E-75 THROUGH E-77 FOR FOUNDATION AND EQUIPMENT INSTALLATION DETAILS.
2. INSTALL 30′ OF 144 STR SMFO CABLE SLACK IN EXISTING PULL BOX.
3. INSTALL 30′ OF 144 STR SMFO CABLE SLACK IN NEW PULL BOX.
4. SPLICE 144 STR SMFO IN NEW FIBER SPLICE CLOSURE. SEE DETAILS ON SHEETS E-81 THROUGH E-106.
5. Exist 3"C, 2-72 STR SMFO CABLE. RC 2-72 STR SMFO CABLES. INSTALL 12 STR SMFO CABLE.
6. Exist 3"C, 72 STR SMFO CABLE. RC 72 STR SMFO. INSTALL 144 STR SFMO CABLE.
7. INSTALL 3"C, ADD 144 STR SMFO CABLE AND 24 STR SMFO CABLE.
8. Exist 3"C, 1-12 STR SMFO CABLE. RC 12 STR SMFO. INSTALL 12 STR SFMO CABLE.
9. Exist 3"C, PT. INSTALL 72 STR SMFO, 6 STR SMFO CABLES.
10. INSTALL 3"C, 24 STR SMFO CABLE.
11. Exist 3"C, PT. INSTALL 1-144 STR SMFO CABLE.
12. INSTALL 150′ OF 144 STR SMFO CABLE SLACK IN EXISTING PULL BOX.
13. INSTALL 1-72 STR SMFO CABLE. ROUTE CABLE THROUGH Exist ELECTRICAL FACILITIES AS DIRECTED BY ENGINEER.
14. INSTALL FIBER OPTIC SPLICE VAULT. SEE SHEET E-71 FOR INSTALLATION DETAILS.
15. INSTALL 2"C, 2#6 (120 / 240 V HUB CABINET), 1#6 (GROUND).
16. PROTECT LOOP DETECTOR LEAD-IN CABLE AND LOOP CONDUCTORS IN PLACE AS DIRECTED BY THE ENGINEER.
17. RC EXISTING PULL BOX AND CONNECT EXISTING TRUNKLINE CONDUIT FOR FIBER OPTIC CABLE. SEE DETAIL B ON SHEET E-72.
18. RC Exist No. 6 PULL BOX AND INSTALL FIBER OPTIC PULL BOX WITH EXTENSIONS AND MODIFY EXISTING CONDUIT RUNS AS REQUIRED FOR FIBER OPTIC INSTALLATION. SEE DETAIL A ON SHEET E-72.
19. Exist. 3"C. INSTALL 2-72 STR SMFO CABLE.
20. Exist 2-2"C, PT. INSTALL 2#6 (120 / 240 V HUB CABINET), 1#6 (GROUND) IN CONDUIT AS DIRECTED BY ENGINEER.
21. INSTALL 3"C, ADD 24 STR SMFO CABLE AND 72 STR SMFO CABLE.
22. Exist 3"C, 72 STR SMFO CABLE. RC 72 STR SMFO CABLE AND INSTALL 72 STR SMFO CABLE.
23. Exist 2"C, 1-tc. RC Exist tc. INSTALL PT.
24. Exist 2"C, 1-tc. RC Exist tc. INSTALL 144 STR SMFO CABLE.
25. INSTALL TYPE III-AF SERVICE EQUIPMENT ENCLOSURE. REFER TO SERVICE WIRING DIAGRAM ON E-107 AND PROVIDE ALL EQUIPMENT ITEMS INDICATED ON PLANS. INSTALL WITH 30′ MINIMUM CLEARANCE BETWEEN EDGE OF TRAVELED WAY AND NEAREST EDGE OF CABINET.
26. TERMINATE BACKHAUL FIBER IN EXISTING BART COMMERCIAL FIBER OPTIC MANHOLE. SEE SHEET E-69 FOR ADDITIONAL DETAIL.
27. Exist 2-3"C, CALTRANS FO CABLE. INSTALL 144 STR SMFO CABLE IN EMPTY CONDUIT AS DIRECTED BY THE ENGINEER.
28. Exist 4-3"C, CALTRANS FO CABLE. INSTALL 144 STR SMFO CABLE IN EMPTY CONDUIT AS DIRECTED BY THE ENGINEER.
29. SPLICE NEW FIBER OPTIC CABLE TO EXISTING FIBER OPTIC CABLE IN EXISTING CALTRANS VAULT. SEE SPLICE DIAGRAMS ON SHEET E-81 THROUGH E-106.
30. Exist 3"C, 72 STR SMFO CABLE. RC 72 STR SMFO. INSTALL 144 STR SMFO CABLE AND 12 STR SMFO CABLE.
31. Exist 3"C, 72 STR SMFO. INSTALL 72 STR SMFO CABLE.
32. INSTALL 30′ OF 24 STR SMFO CABLE SLACK IN NEW PULL BOX.
33. Exist 2-3"C, PT. INSTALL 144 STR SMFO CABLE IN EMPTY CONDUIT AS DIRECTED BY THE ENGINEER.
34. Exist 2"C, BATA SMFO CABLE. INSTALL 144 STR SMFO CABLE IN FABRIC INNERDUCT.
35. INSTALL 2-3"C, ADD 1-144 STR SMFO CABLE.
36. INSTALL 4" DIAMETER PUNCH-OUT HOLE IN WALL OF RAISED FLOOR. PULL SMFO CABLE THROUGH TO Exist RACK.
37. INSTALL 3"C PT, FOR PG&E SERVICE CONDUCTORS. COORDINATE WITH BAIFA ENGINEER PRIOR TO CONDUCTING THIS WORK. TRENCH AND CONDUIT TO BE INSPECTED BY PG&E.
38. INSTALL 2"C, ADD 2#2 (120 / 240 V HUB CABINET), 1#2 (GND).
39. INSTALL 3"C, ADD 48 STR SMFO CABLE.
40. Exist 3"C, 72 STR SMFO. RC 72 STR SMFO CABLE. INSTALL 144 STR SMFO.
41. RC EXISTING PULL BOX. INSTALL NO. 6 (T) WITH EXTENSION AND MODIFY EXISTING CONDUIT RUNS AS REQUIRED FOR FIBER OPTIC CABLE INSTALLATION, SEE DETAIL A AND B ON E-72.
42. Exist CALTRANS FIBER OPTIC SPLICE VAULT. SPLICE 144 STR SMFO CABLE INTO EXISTING BART SMFO CABLE IN NEW SPLICE CLOSURE.
43. Exist 3"C, PT. INSTALL 144 STR SMFO CABLE PER ENGINEER'S DIRECTION.
44. Exist 3"C, 72 STR SMFO CABLE. INSTALL 24 STR SMFO CABLE.
45. COIL 24 STR SMFO CABLE IN EXISTING CABINET. SPLICING TO BE DONE BY OTHERS (BART).
46. NOT USED.
47. NOT USED.
48. Exist. 3"C, 1-12 STR SMFO CABLE. INSTALL 1-12 STR SMFO CABLE BETWEEN NEW FIBER OPTIC DISTRIBUTION UNIT IN CABINET AND EXISTING FIBER OPTIC DISTRIBUTION UNIT AT WALNUT CREEK MAINTENANCE YARD. COORDINATE WITH ENGINEER PRIOR TO STARTING WORK AT THIS LOCATION.
49. Exist 3"C, 72 STR SMFO CABLE, 12 STR SMFO CABLE. RC 72 STR SMFO CABLE. INSTALL 1-144 STR SMFO CABLE. 12 STR SMFO CABLE TO REMAIN.
50. NOT USED.
51. TERMINATE SERVICE CONDUCTOR INTO Exist 60 A CB "HUB CABINET".
52. TERMINATE 12 STR SMFO ON EXISTING FIBER OPTIC DISTRIBUTION UNIT. SEE DETAILS ON SHEETS E-81 THROUGH E-106.
53. Exist 2-3"C, 2-72 STR SMFO CABLE, 12 STR SMFO CABLE. RC 2-72 STR SMFO CABLE. INSTALL 1-12 STR SMFO CABLE.
54. Exist 2-3"C, 72 STR SMFO CABLE, 12 STR SMFO CABLE. RC 72 STR SMFO CABLE, 12 STR SMFO CABLE. INSTALL 144 STR SMFO CABLE, 12 STR SMFO CABLE.
55. Exist 2-3"C, 12 STR SMFO CABLE. RC 12 STR SMFO CABLE. INSTALL 1-12 STR SMFO CABLE.
56. RC Exist SPLICE CLOSURE.
57. NOT USED.
58. Exist 3"C, 1-hcc cable. INSTALL 12 STR SMFO CABLE IN FABRIC INNERDUCT AS DIRECTED BY ENGINEER.
59. INSTALL CONDUIT VIA HORIZONTAL DIRECTIONAL DRILL METHOD.
60. INSTALL FIBER OPTIC DISTRIBUTION UNIT IN EXISTING CABINET.
61. TERMINATE 12 STR SMFO ON NEW 12 STR FIBER OPTIC DISTRIBUTION UNIT. SEE DETAILS ON SHEETS E-81 THROUGH E-106.
62. Exist 2"C, 1-tc. RC tc. INSTALL 1-12 STR SMFO CABLE.
63. Exist 3"C, 1-tc. INSTALL 1-12 STR SMFO CABLE.
64. Exist 3"C, 1-tvl, 1-tvcp, 1-tvp, 1-tc. RC 1-tc. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
65. Exist 3"C, 1-tvl, 1-tvp, 1-tvcp, 2-tc. RC 1-tc. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
66. Exist 3"C, 2-tc. RC 1-tc. Install 1-12 STR SMFO CABLE.
67. Exist 3"C, PT. Install 1-12 STR SMFO CABLE.
68. Exist 3-3"C, PT. Install 1-12 STR SMFO CABLE IN CONDUIT AS DIRECTED BY ENGINEER.
69. Exist 2-3"C, 12#14(120 V PEU, SIGN TEST SWITCH), 1#8 (120 V tos power), 21 DLC. Install 1-12 STR SMFO CABLE IN FABRIC INNERDUCT IN CONDUIT AS DIRECTED BY ENGINEER.
70. INSTALL 30′ OF 144 STR SMFO CABLE SLACK IN EXISTING FIBER OPTIC SPLICE VAULT.
71. INSTALL 30′ OF 144 STR SMFO CABLE SLACK IN NEW FIBER OPTIC SPLICE VAULT.
72. Exist 3"C, 1-72 STR SMFO, 1-12 STR SMFO CABLE. RC Exist 72 STR SMFO CABLE. INSTALL 1-144 STR SMFO CABLE.
73. Exist 2-3"C, 10 DLC, 1-tc. RC tc. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
74. Exist 3"C, 26 DLC. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
75. Exist 2"C, 2#2 (120 V tos power), 4 DLC. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
76. Exist 2½"C, 2#2 (120 V tos power) 10 DLC INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
77. Exist 3"C, 2#2 (120 V tos power), 15 DLC. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
78. Exist 3"C, 12 DLC. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
79. INSTALL FIBER OPTIC DISTRIBUTION UNIT IN Exist CABINET. TERMINATE 72 STR SMFO CABLE IN NEW FIBER OPTIC DISTRIBUTION UNIT.
80. INSTALL NEW WALL-MOUNTED SPLICE CLOSURE. SPLICE 72 STR SMFO CABLE TO Exist 12 STR SMFO CABLE IN NEW SPLICE CLOSURE. PROTECT AND COIL UNTERMINATED 72 STR SMFO CABLE FROM TRAFFIC OPERATIONS SYSTEM HUB ROOM IN PLACE. SEE SHEETS E-81 THROUGH E-106 FOR FIBER SPLICE DIAGRAMS.
81. COIL 50′ OF 12 STR SMFO CABLE IN Exist CABINET FOR FUTURE CONNECTION TO CALTRANS EQUIPMENT.
82. Exist 3"C, 9#14 (120 V tos power), 1#8 (120 V tos power), 26 DLC. INSTALL 1-12 STR SMFO CABLE IN FABRIC INNERDUCT.
83. Exist 3"C, 2-72 STR SMFO CABLE. RC 2-72 STR SMFO CABLES. INSTALL 2-12 STR SMFO CABLE.

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LEGEND

E-2

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04	Ala,CC	680	20.2/21.9, 0.0/24.6	75	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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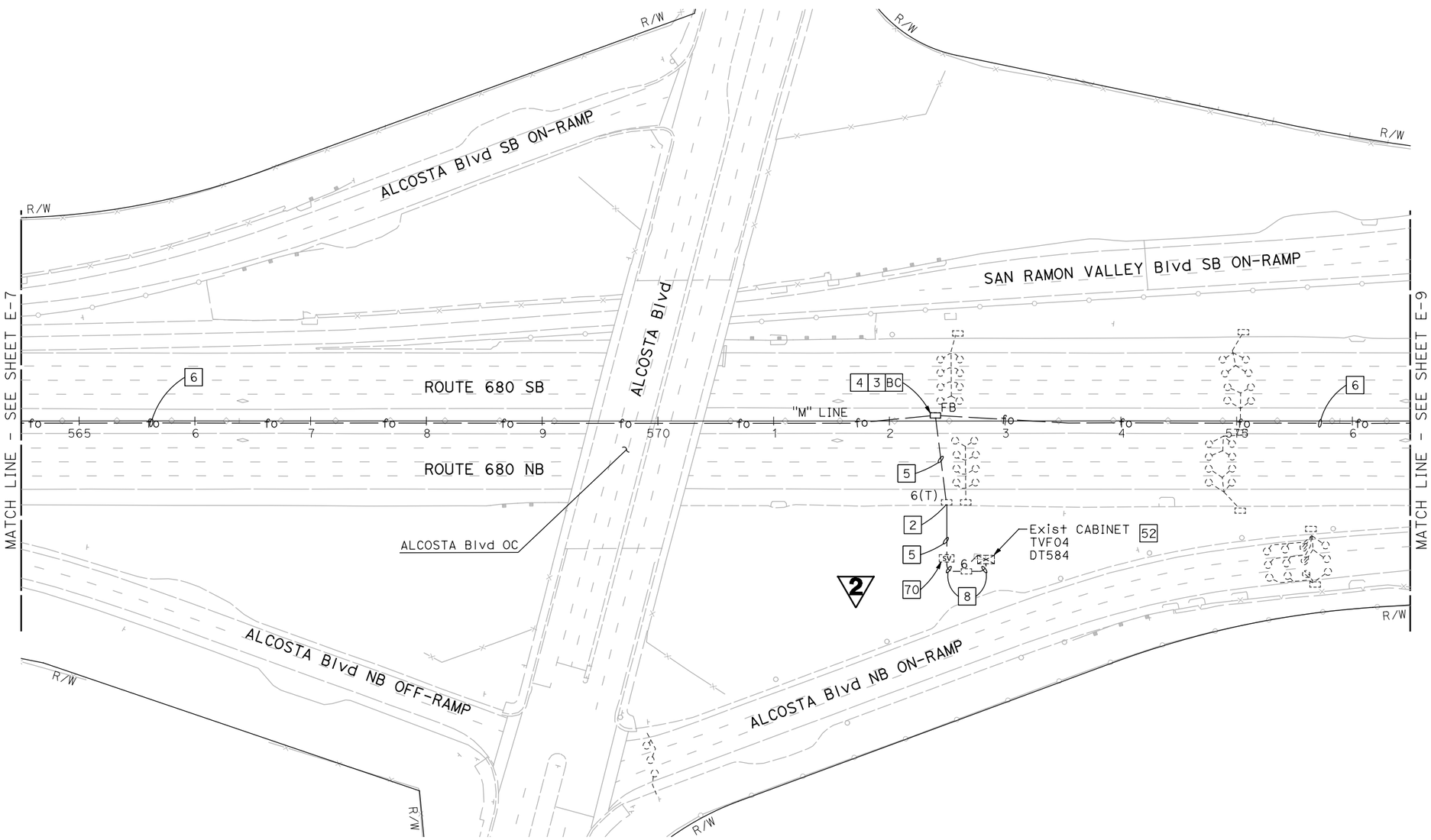

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NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

APPROVED FOR ELECTRICAL WORK ONLY

BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-8

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	107	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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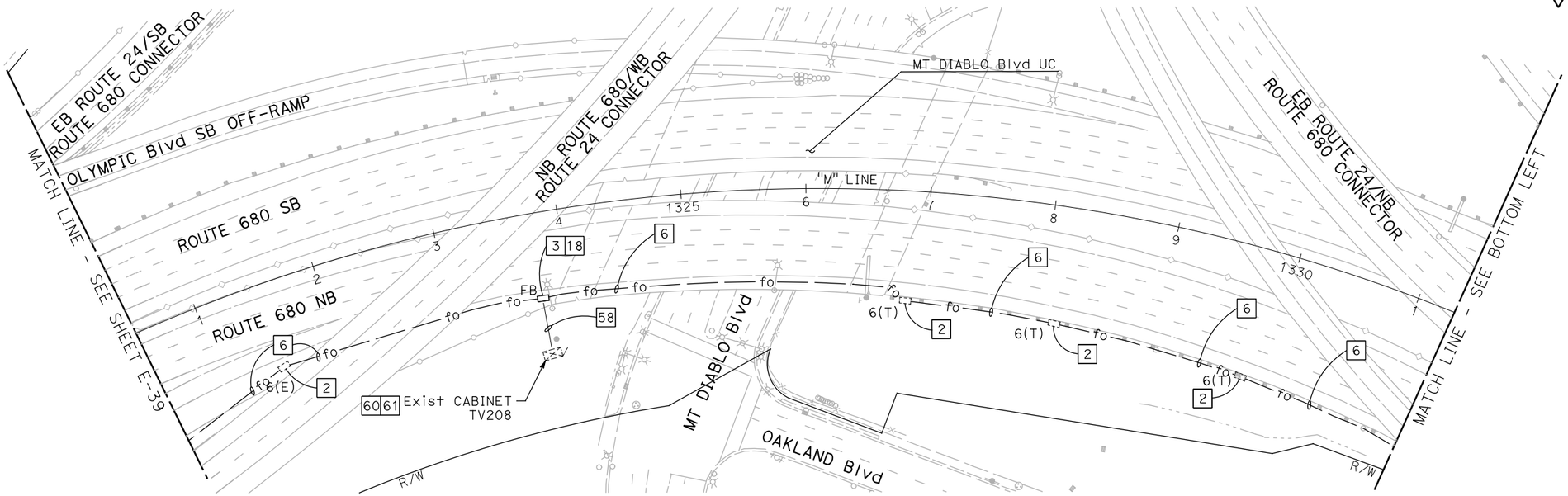

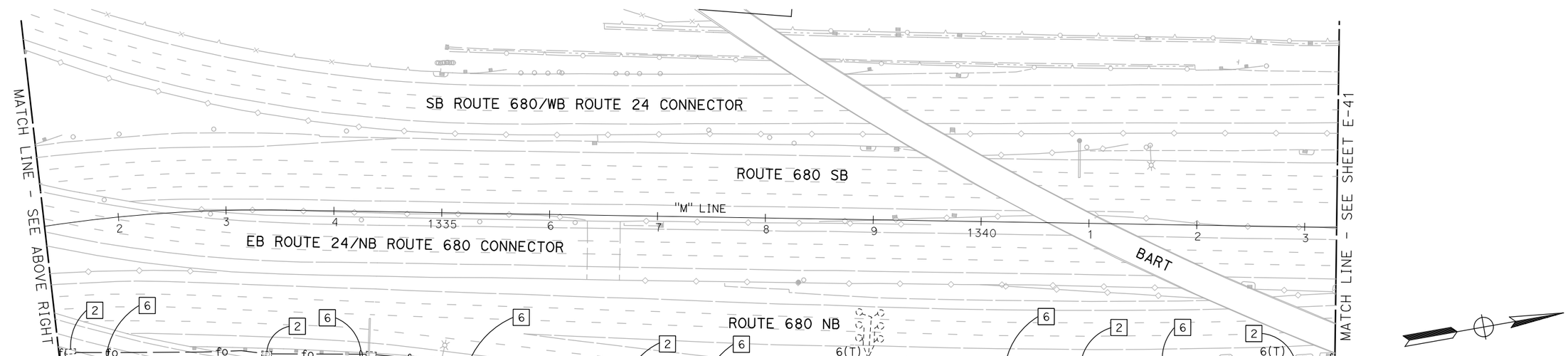

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NOTE:

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-40

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	108	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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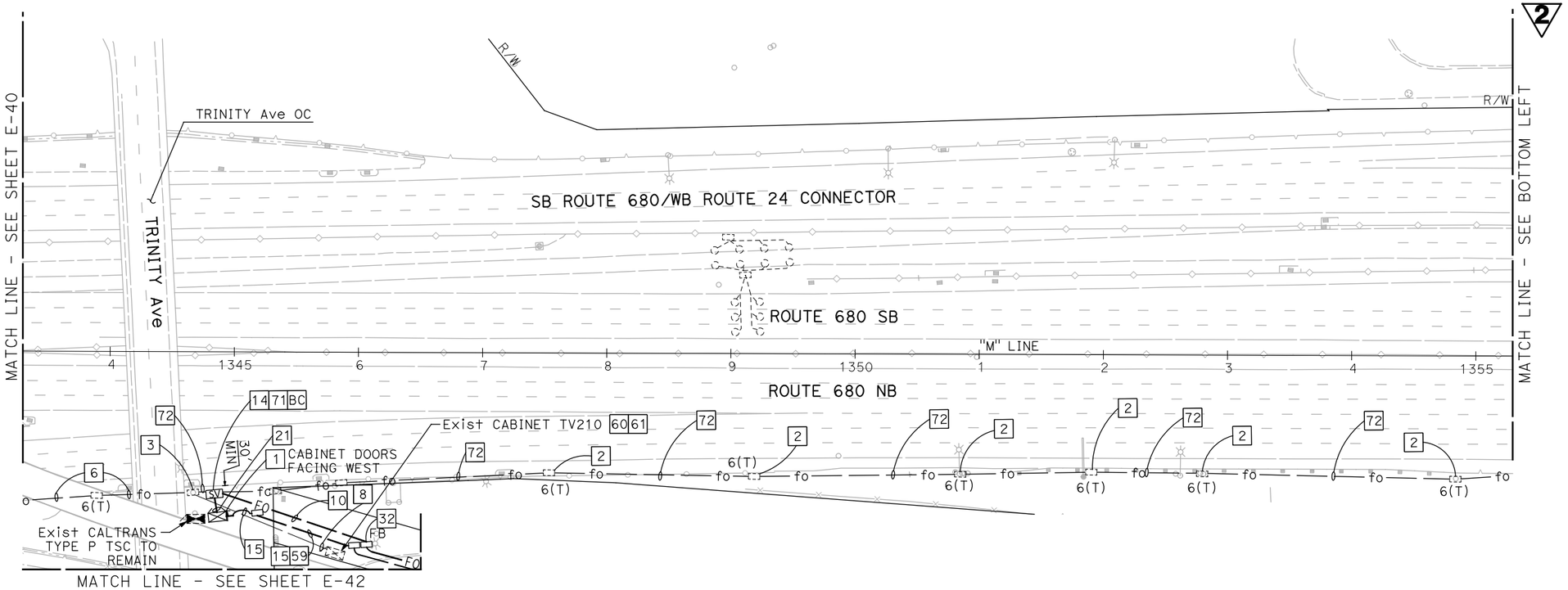

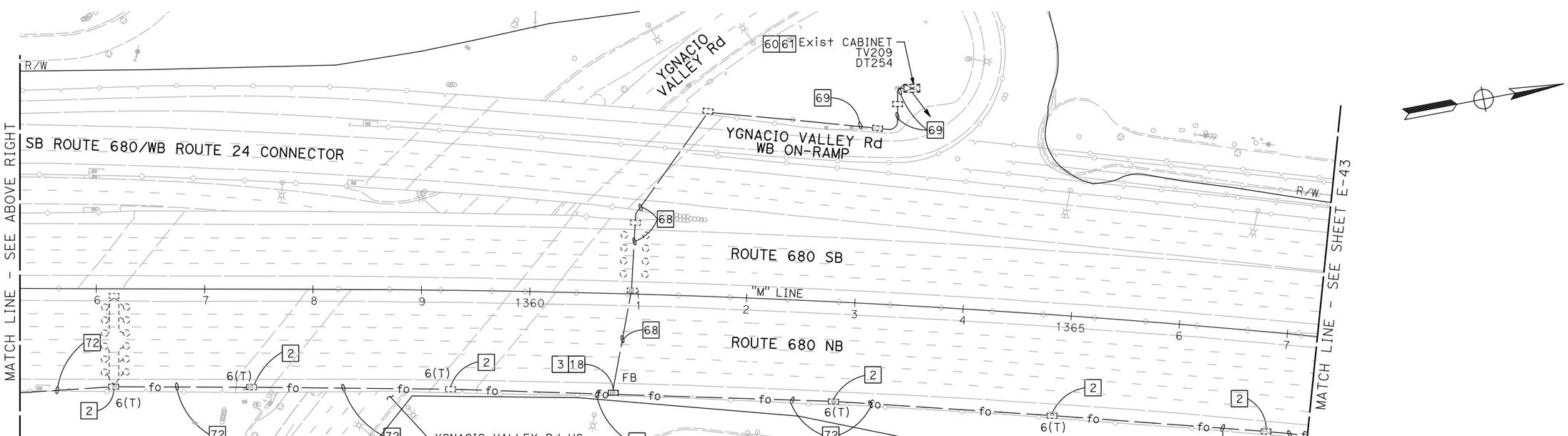

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-41

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	109	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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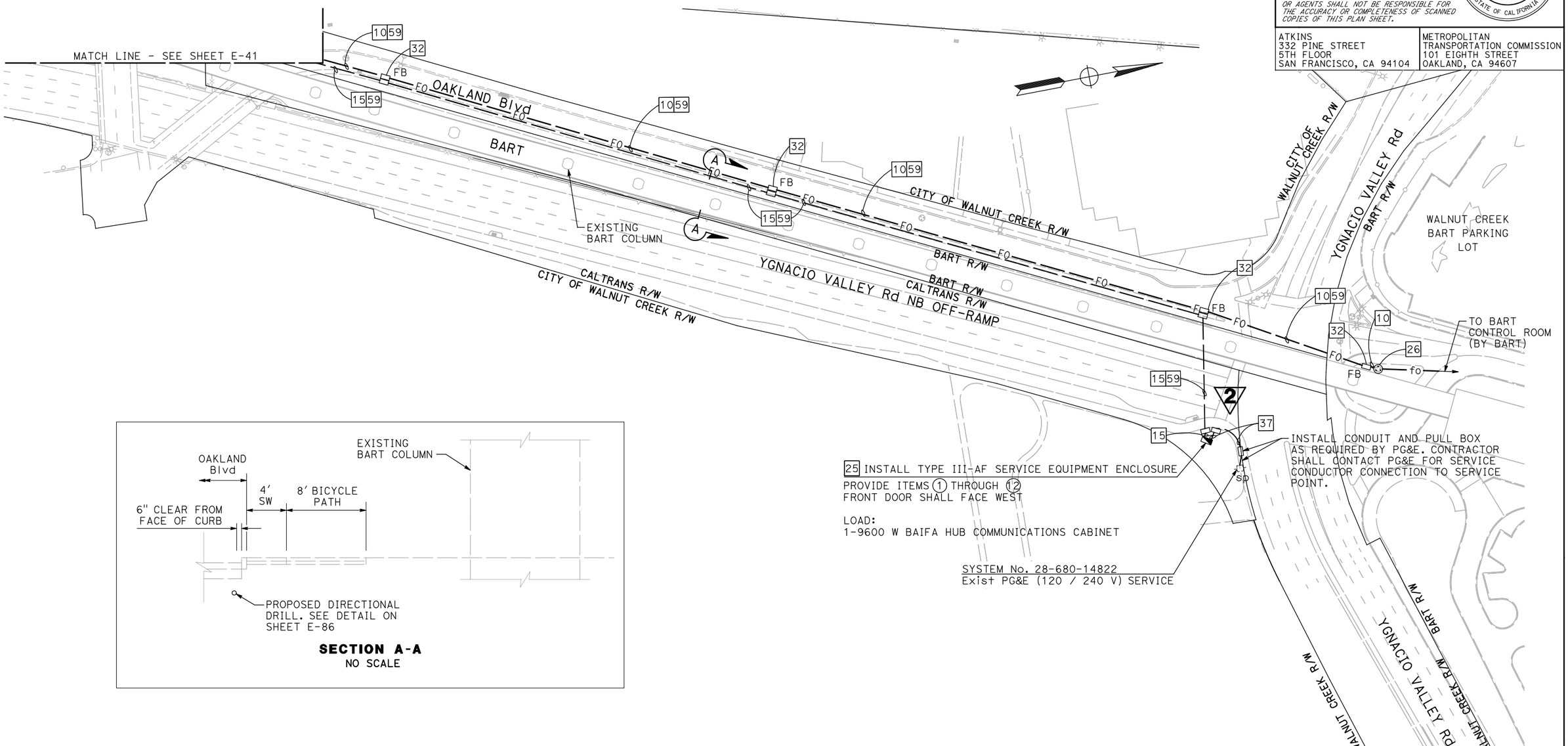

SECTION A-A
NO SCALE

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NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(WALNUT CREEK HUB)

SCALE: 1" = 50'

E-42

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04	Ala,CC	680	20.2/21.9, 0.0/24.6	110	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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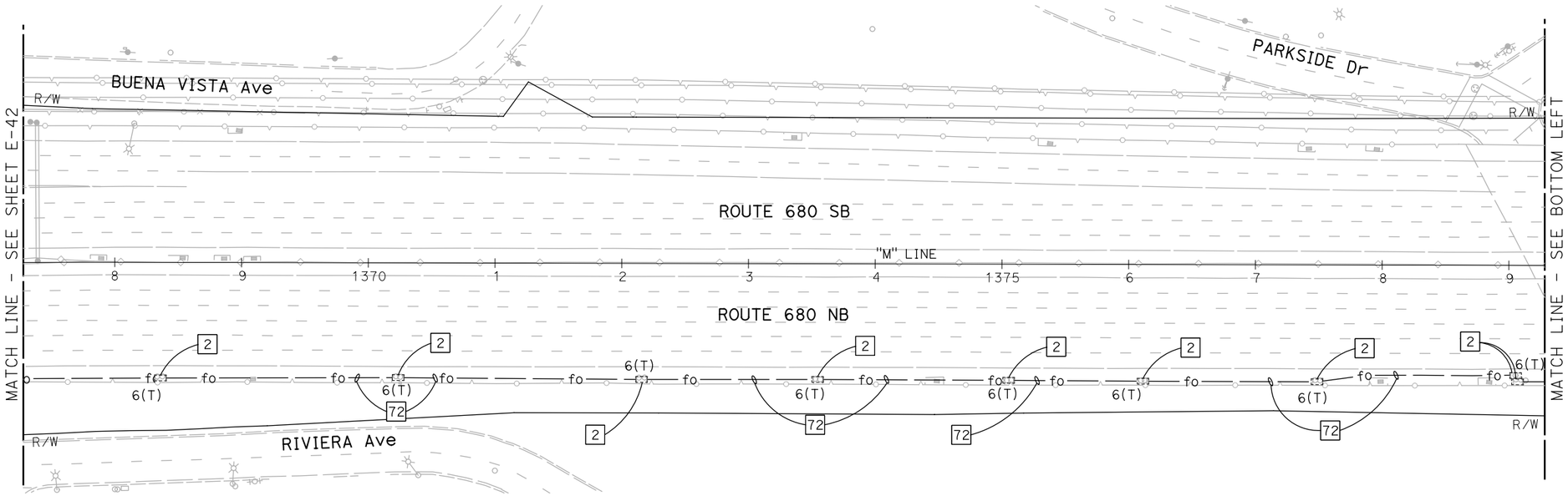

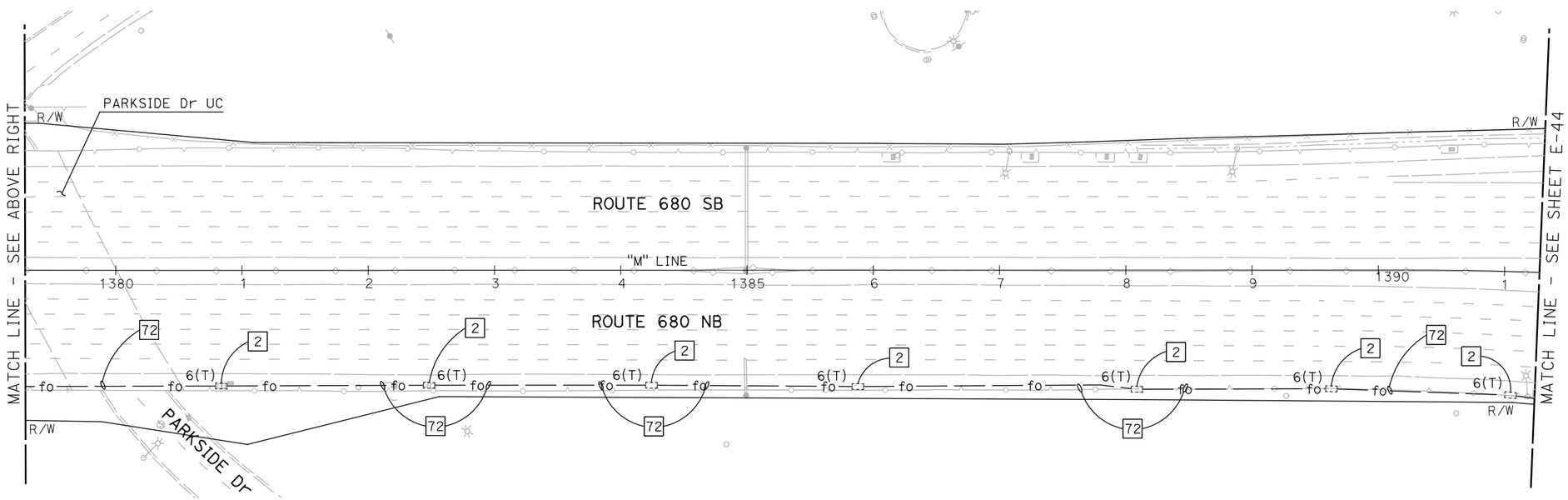

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NOTE:

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-43

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	111	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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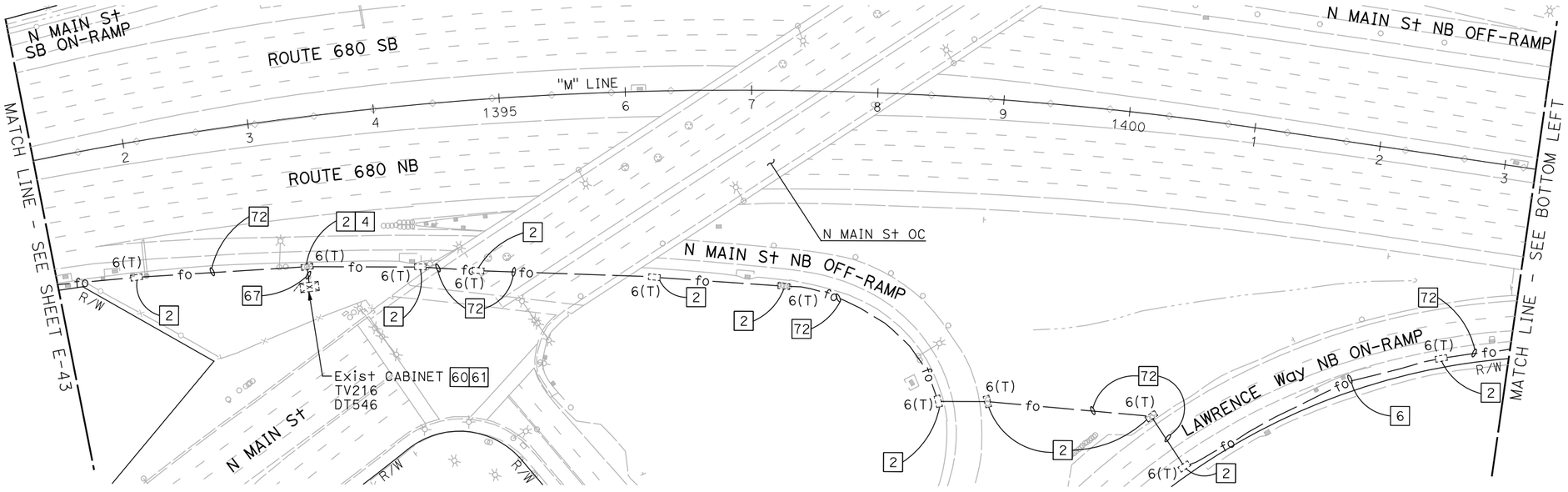

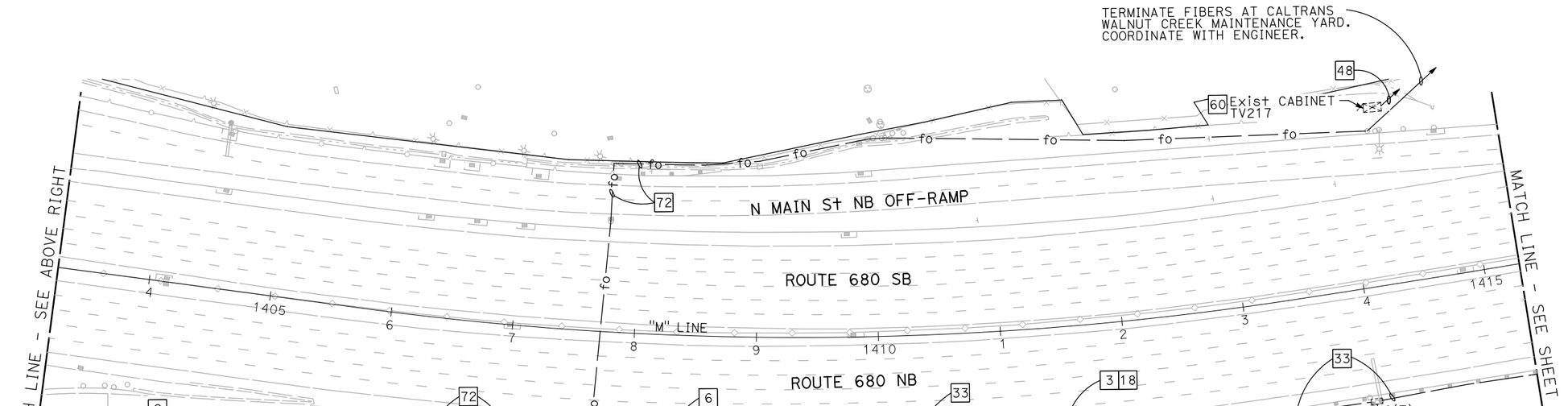

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-44

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	112	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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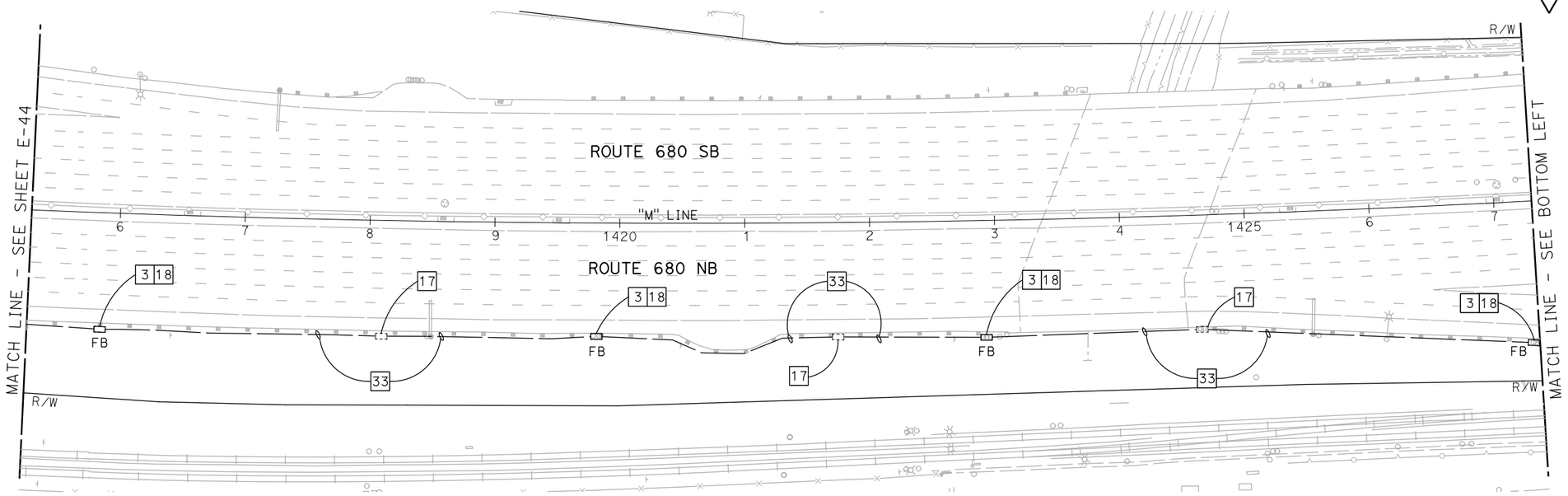

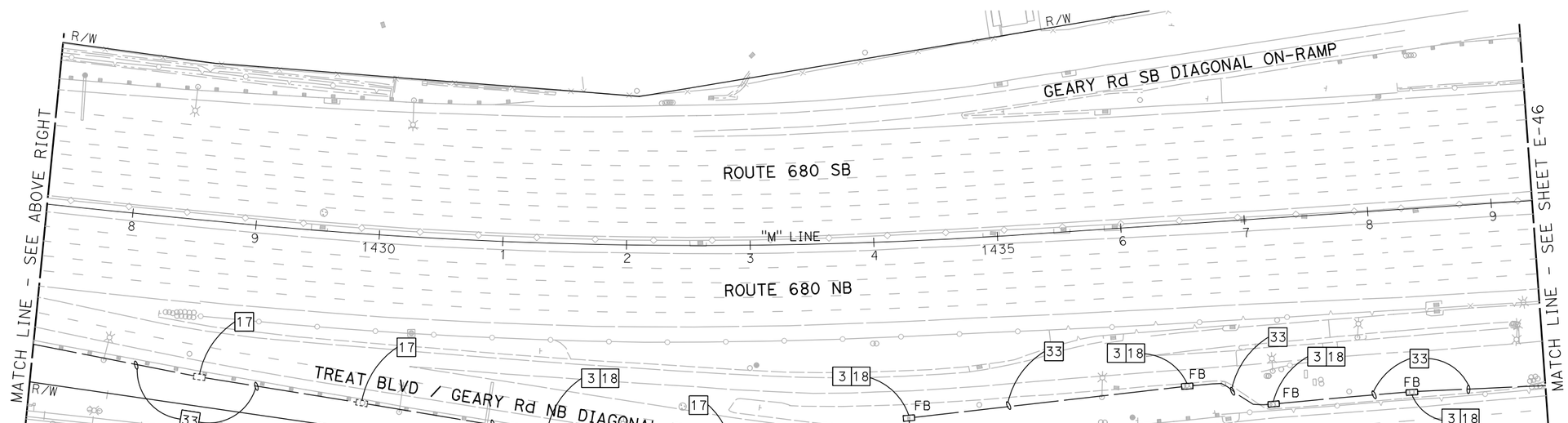

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-45

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04	Ala,CC	680	20.2/21.9, 0.0/24.6	113	175

REGISTERED ELECTRICAL ENGINEER DATE

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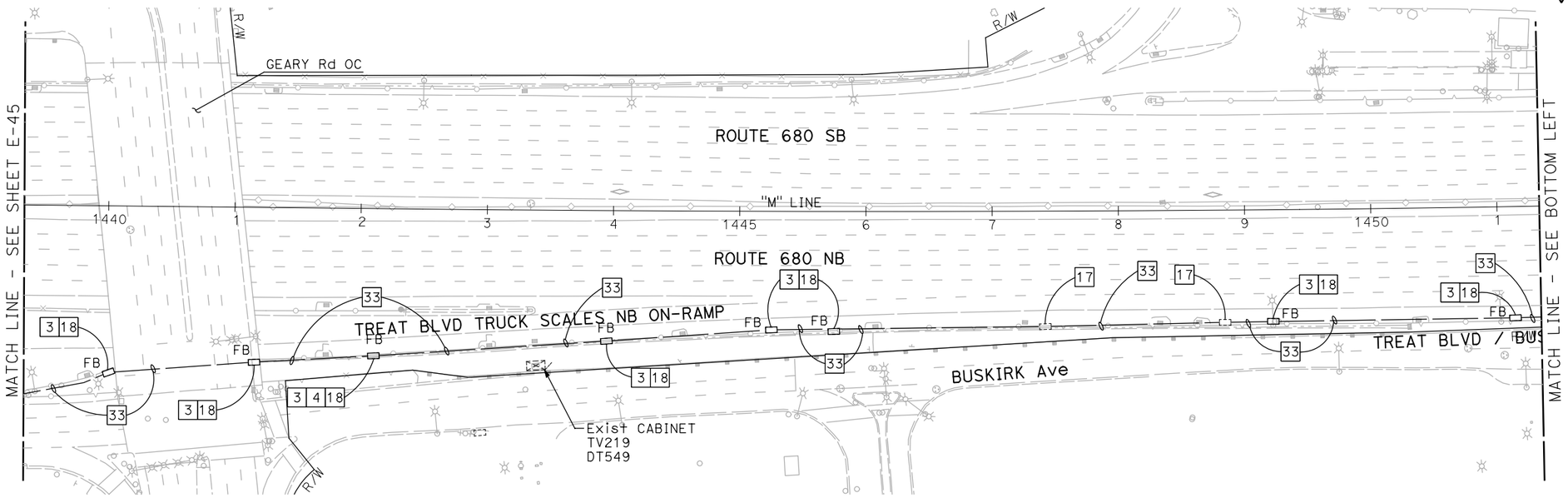

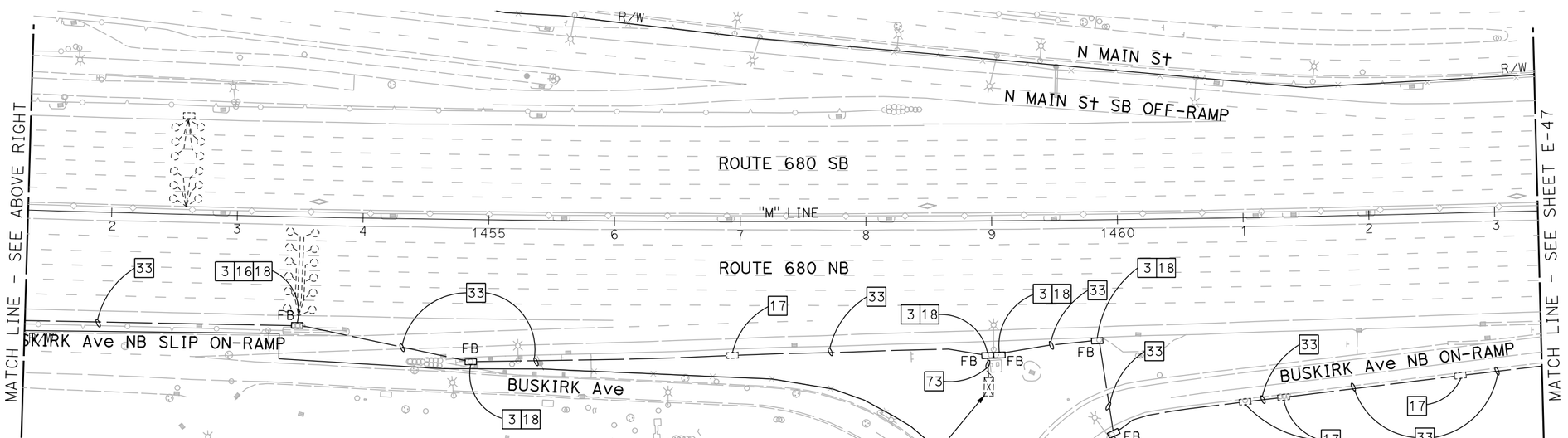

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NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-46

REVISED BY | DATE REVISED
PATRICK RAMIREZ | KEVIN AGUIGUI
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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	114	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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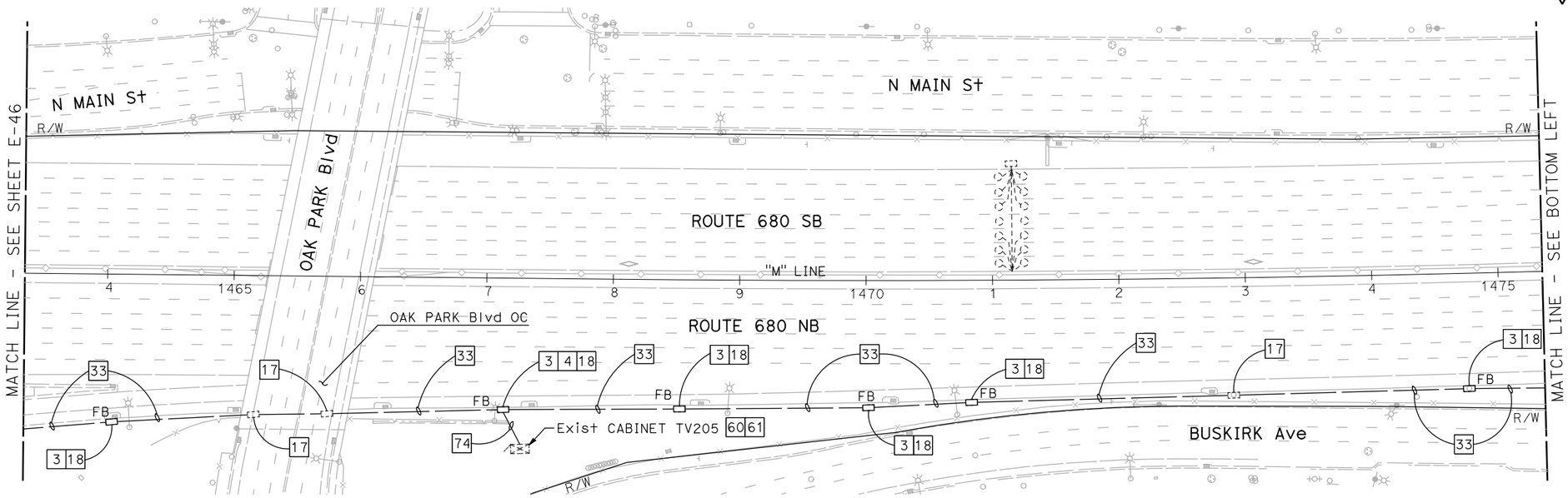

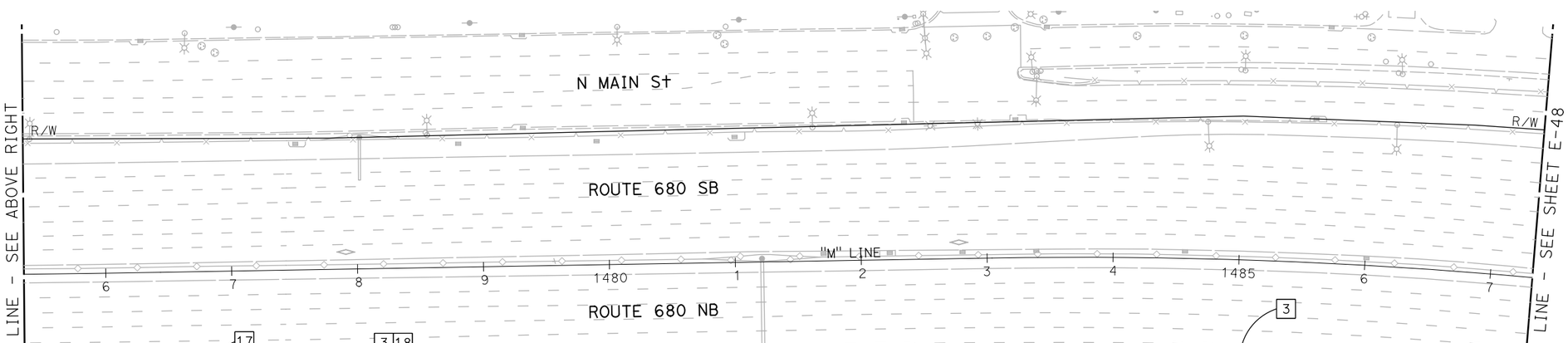

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NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-47

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	115	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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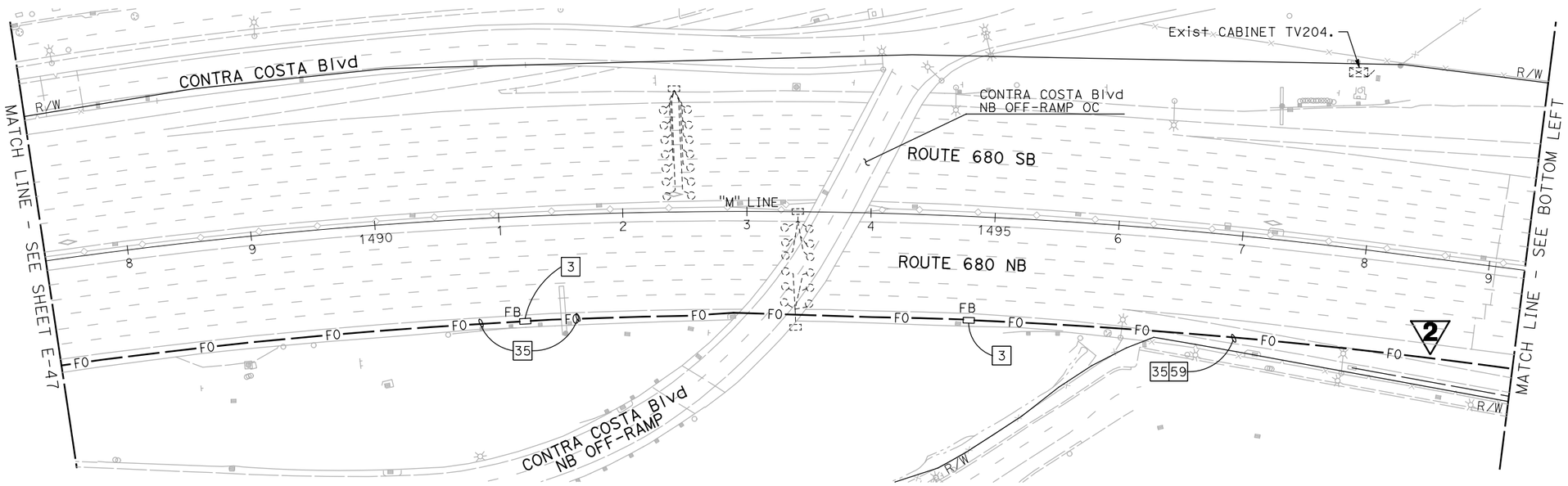

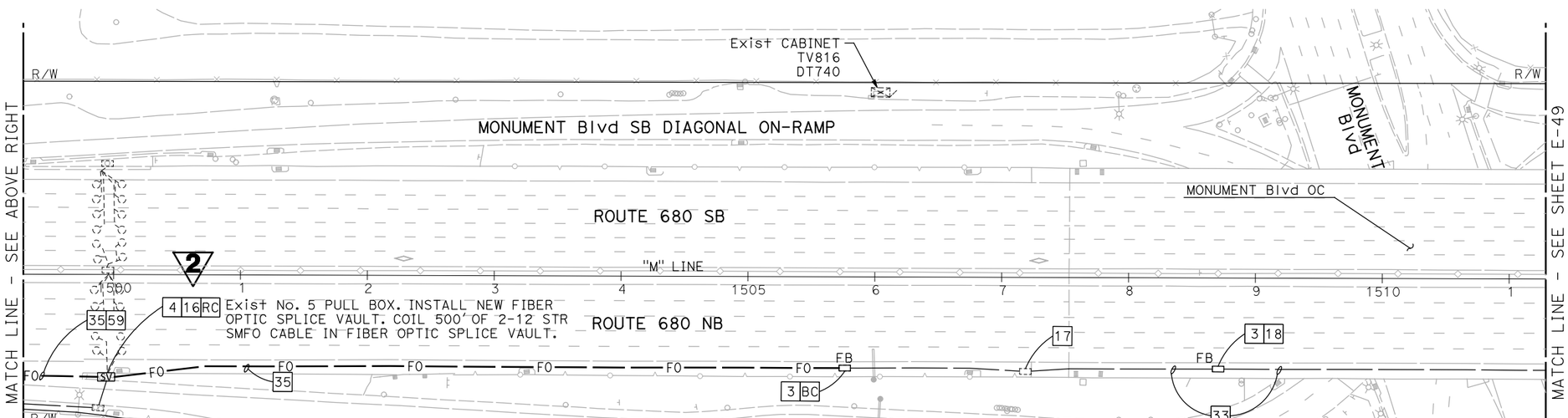

NOTE: 2 **REVISED PER ADDENDUM No. 2**

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-48

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	118	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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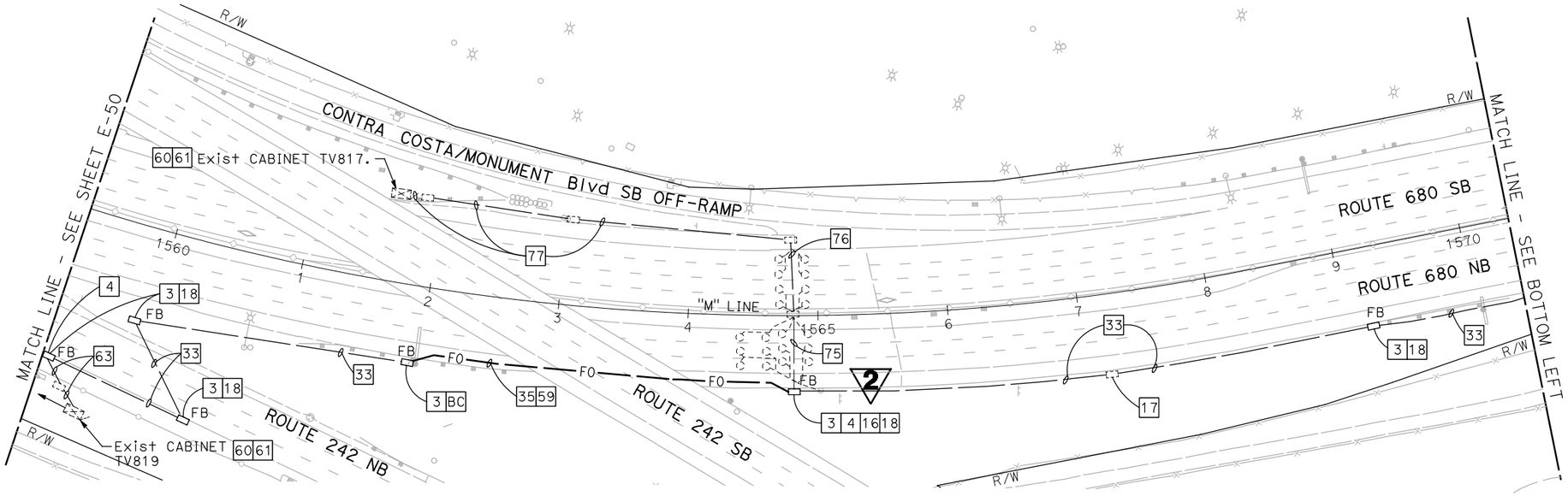
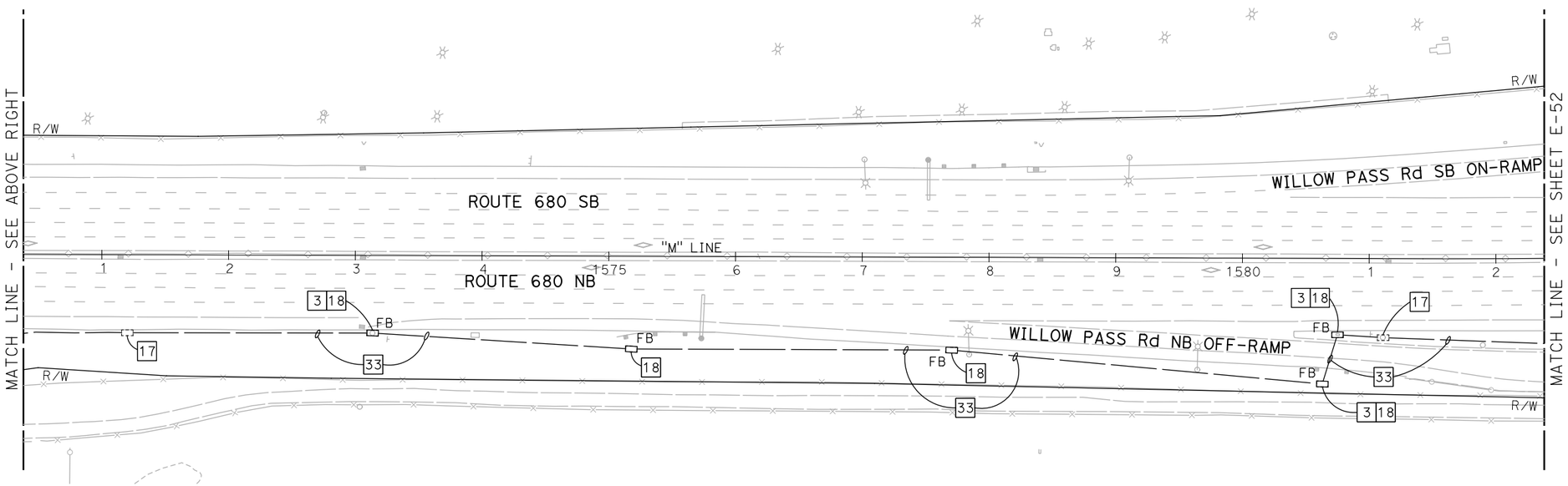
OAKLAND, CA 94607





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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-51

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	122	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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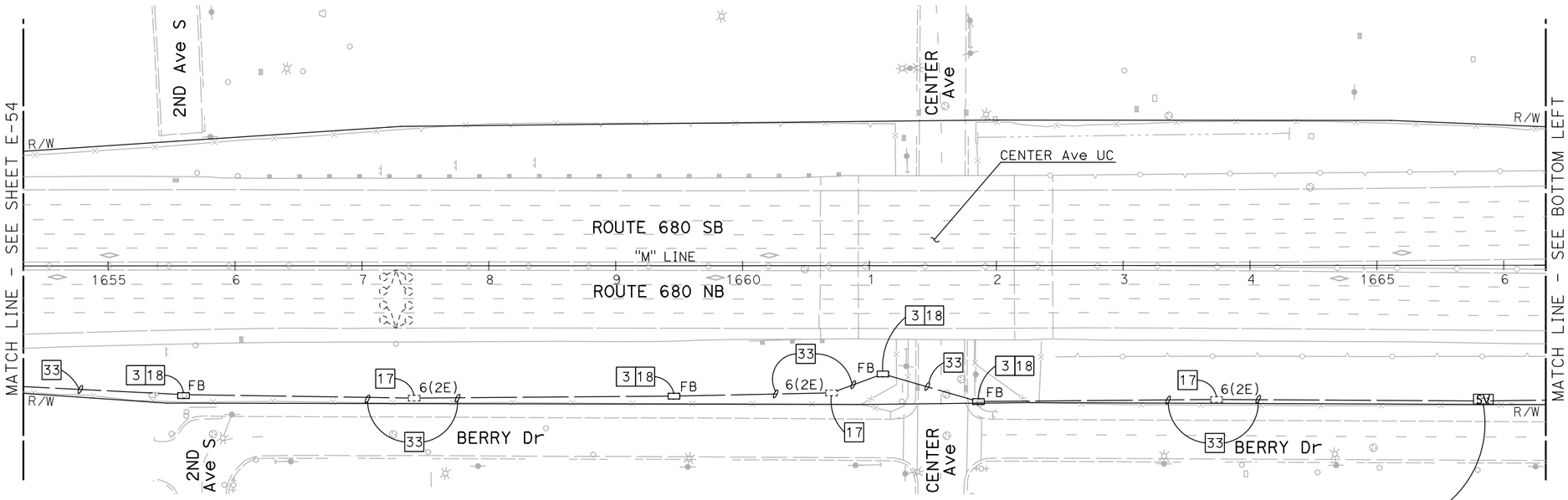
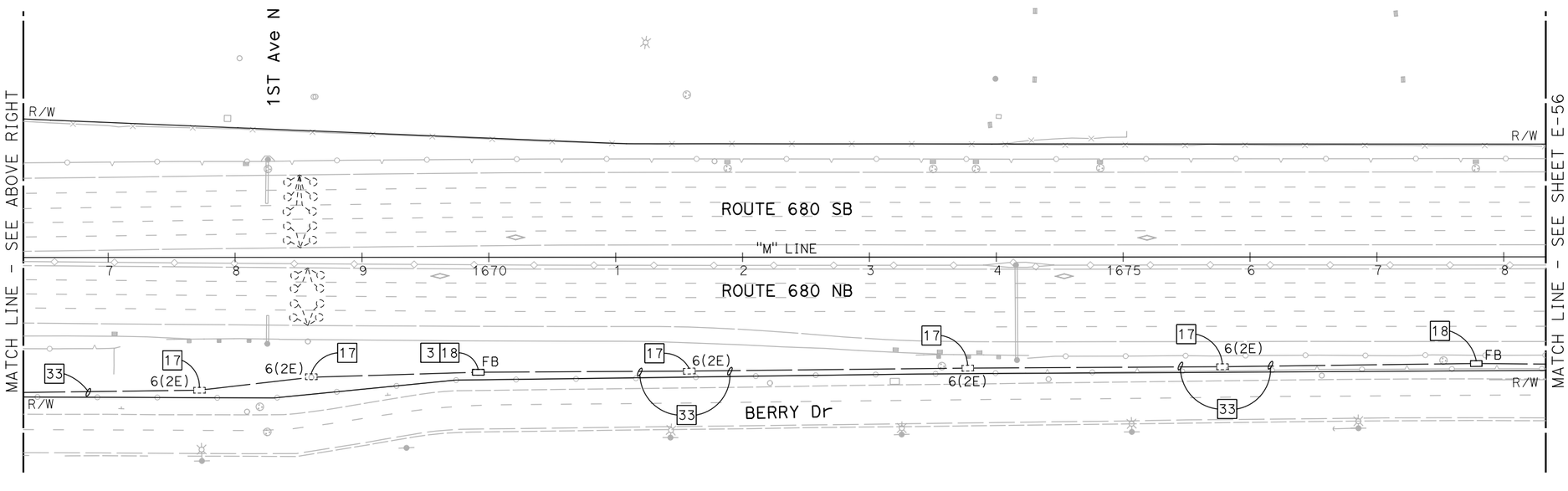


RC Exist No. 6 PULL BOX. INSTALL NEW FIBER OPTIC SPLICE VAULT. COIL 500' OF 1-144 STR SMFO CABLE IN FIBER OPTIC SPLICE VAULT.



2 REVISED PER ADDENDUM No. 2

NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-55

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BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => ...\dms01797\0414000490ua055.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	124	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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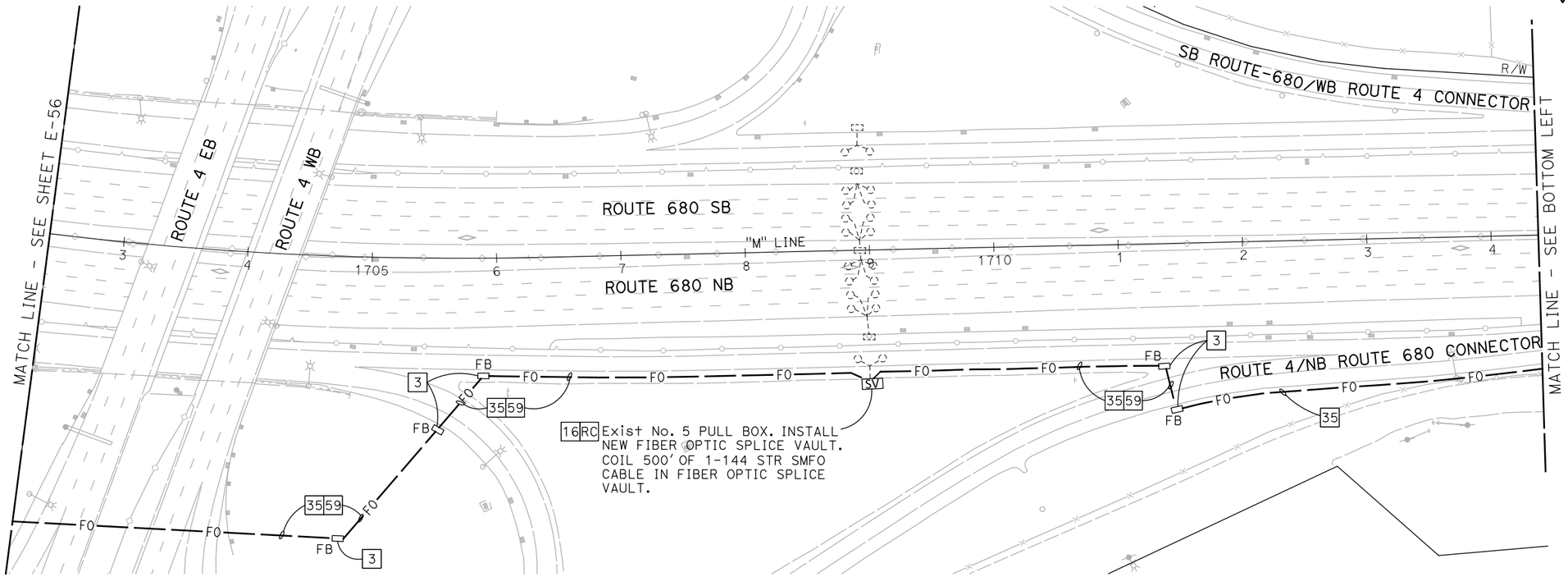
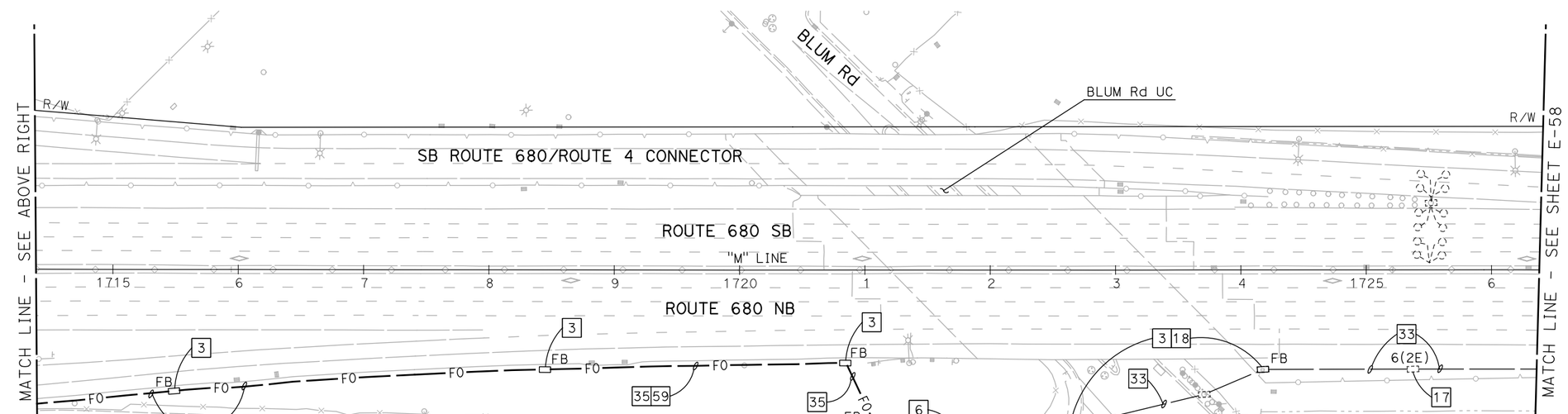
OAKLAND, CA 94607





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NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-57

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LAST REVISION 00-00-00 | DATE PLOTTED => 6/24/2015 | TIME PLOTTED => 11:25:53 AM

BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490ua057.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	128	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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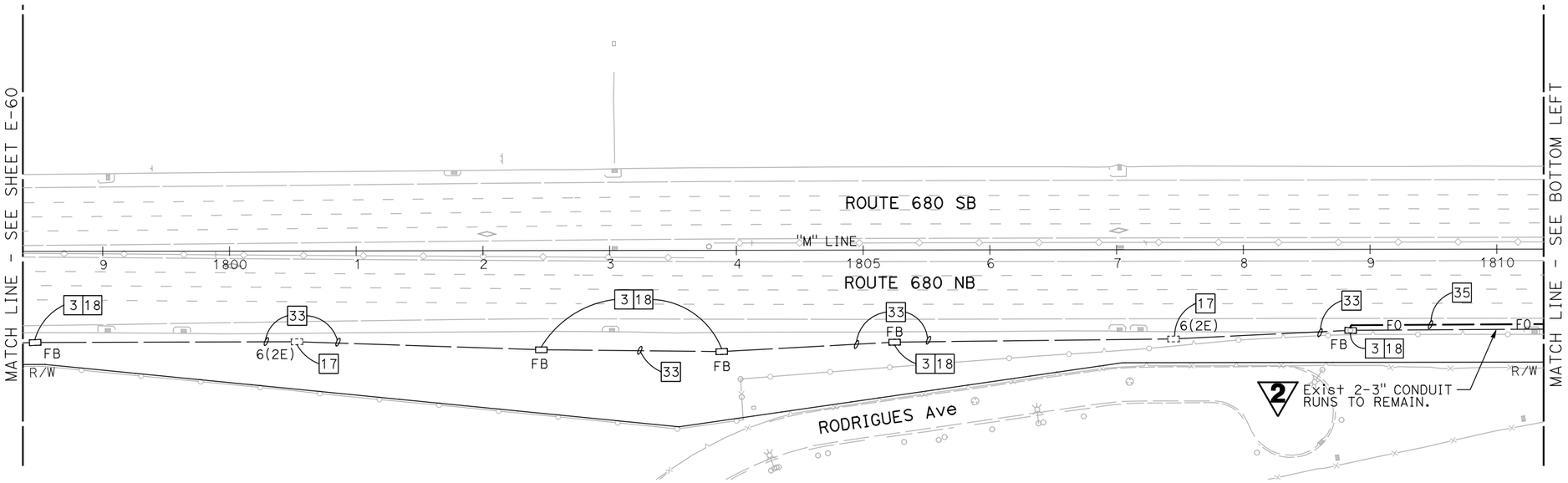
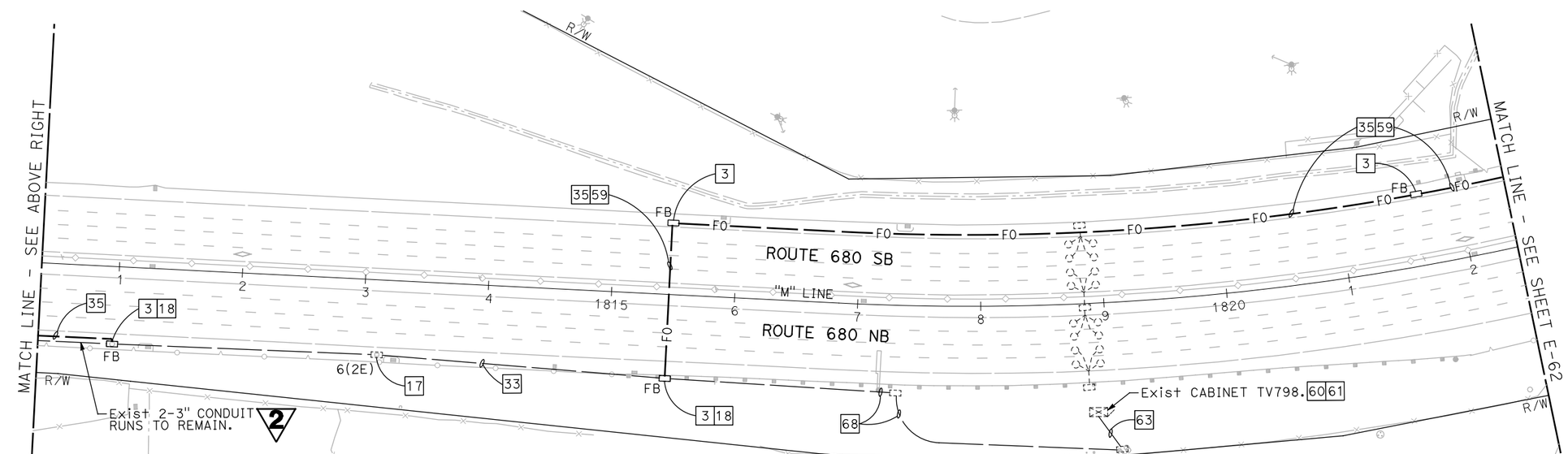
101 EIGHTH STREET
OAKLAND, CA 94607





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NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-61

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	129	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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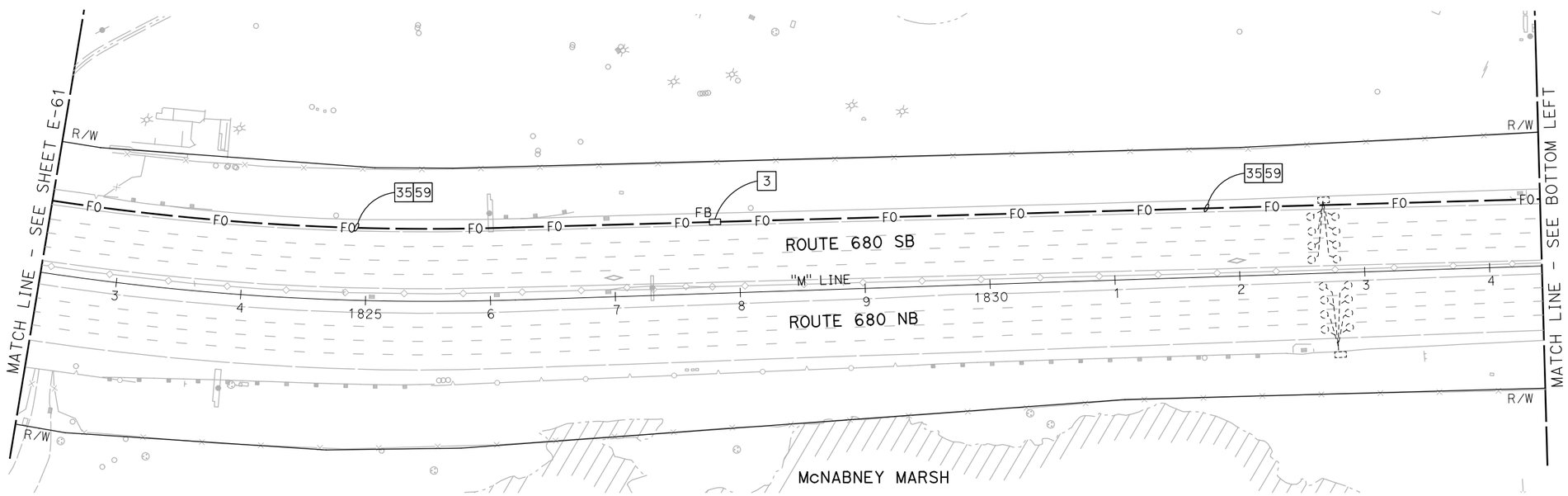
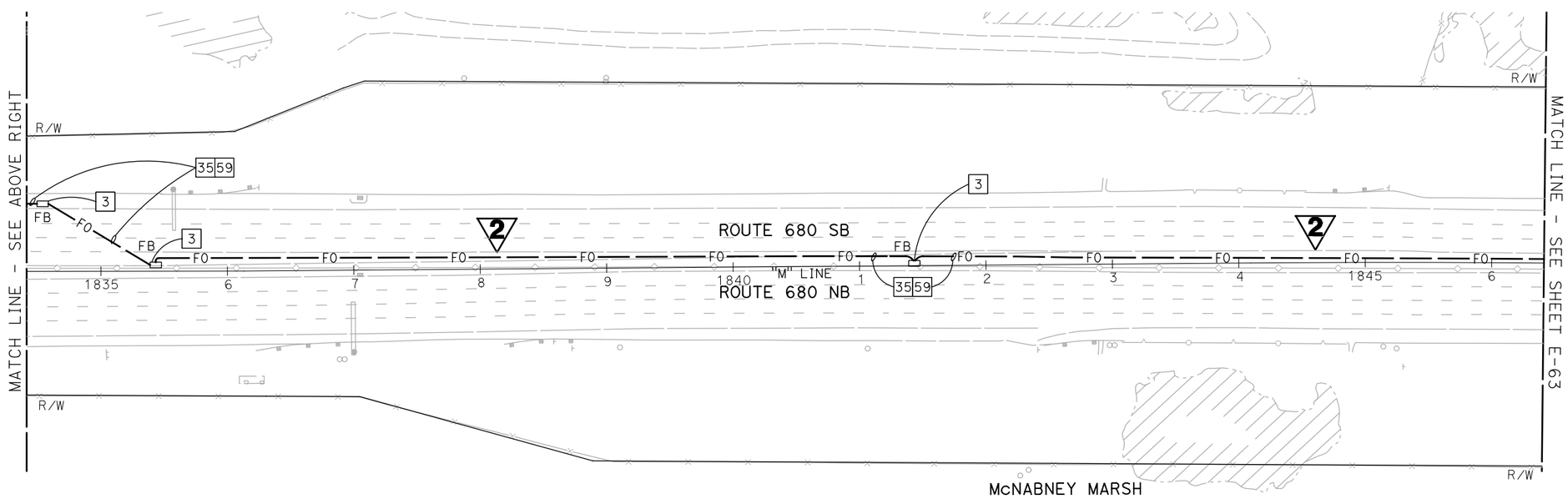
OAKLAND, CA 94607





2 **REVISED PER ADDENDUM No. 2**

NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

E-62

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BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490ua062.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	130	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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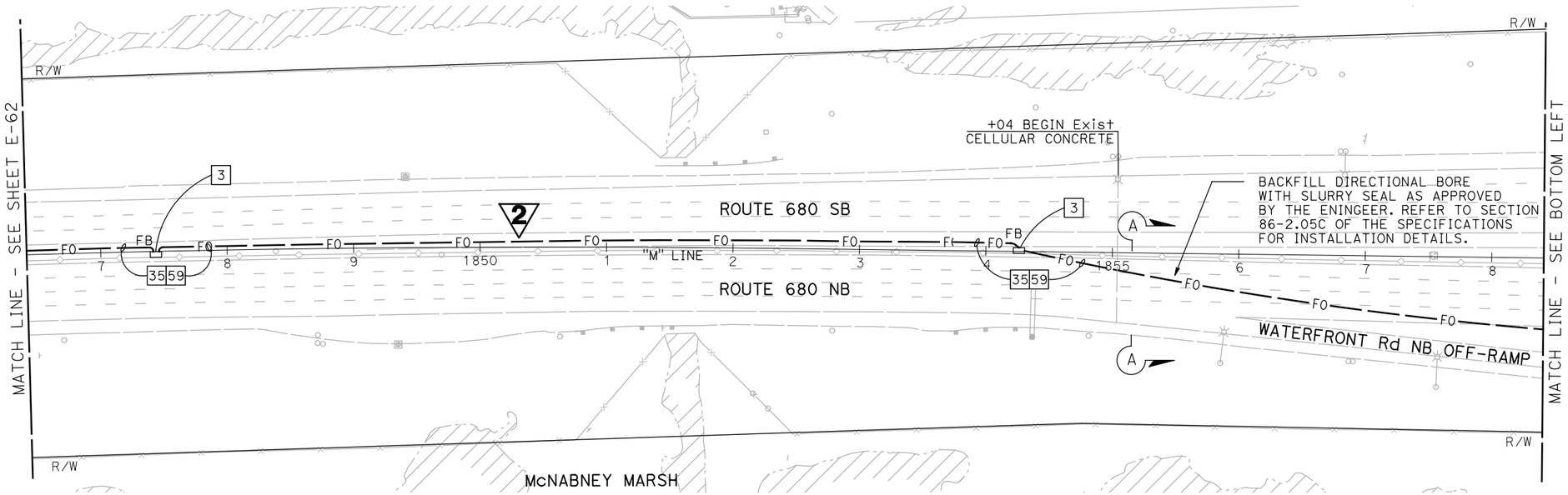
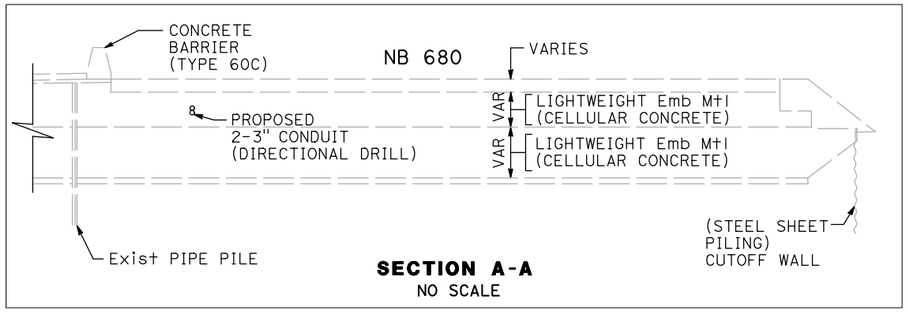
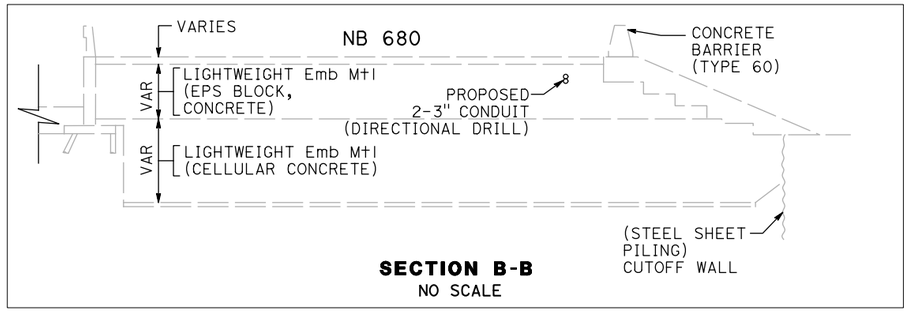
OAKLAND, CA 94607

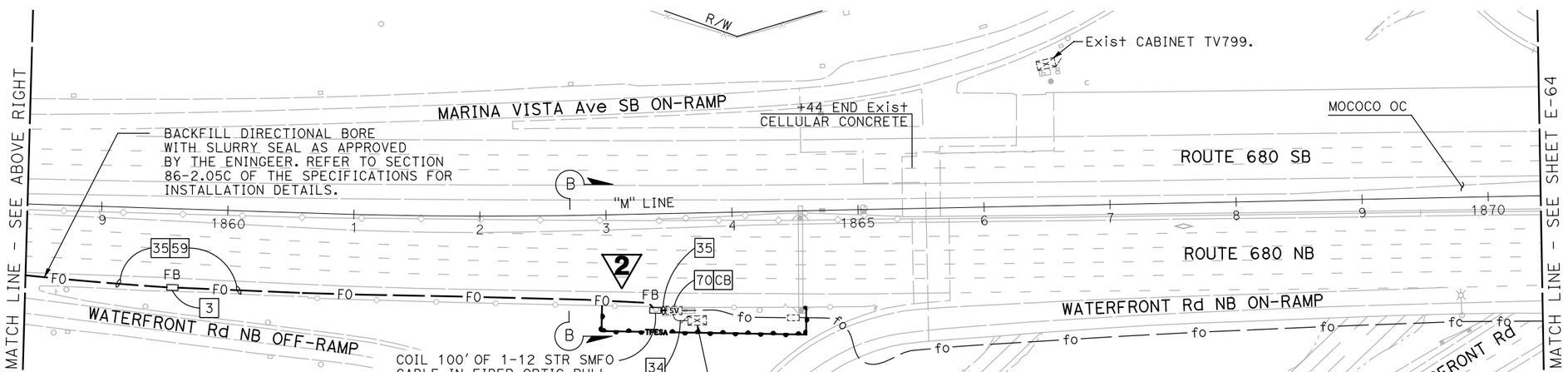




SECTION A-A
NO SCALE



SECTION B-B
NO SCALE



BACKHAUL COMMUNICATIONS SYSTEM
(ROUTE 680 CORRIDOR)

SCALE: 1" = 50'

NOTE: 2 **REVISED PER ADDENDUM No. 2**

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490ua063.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	131	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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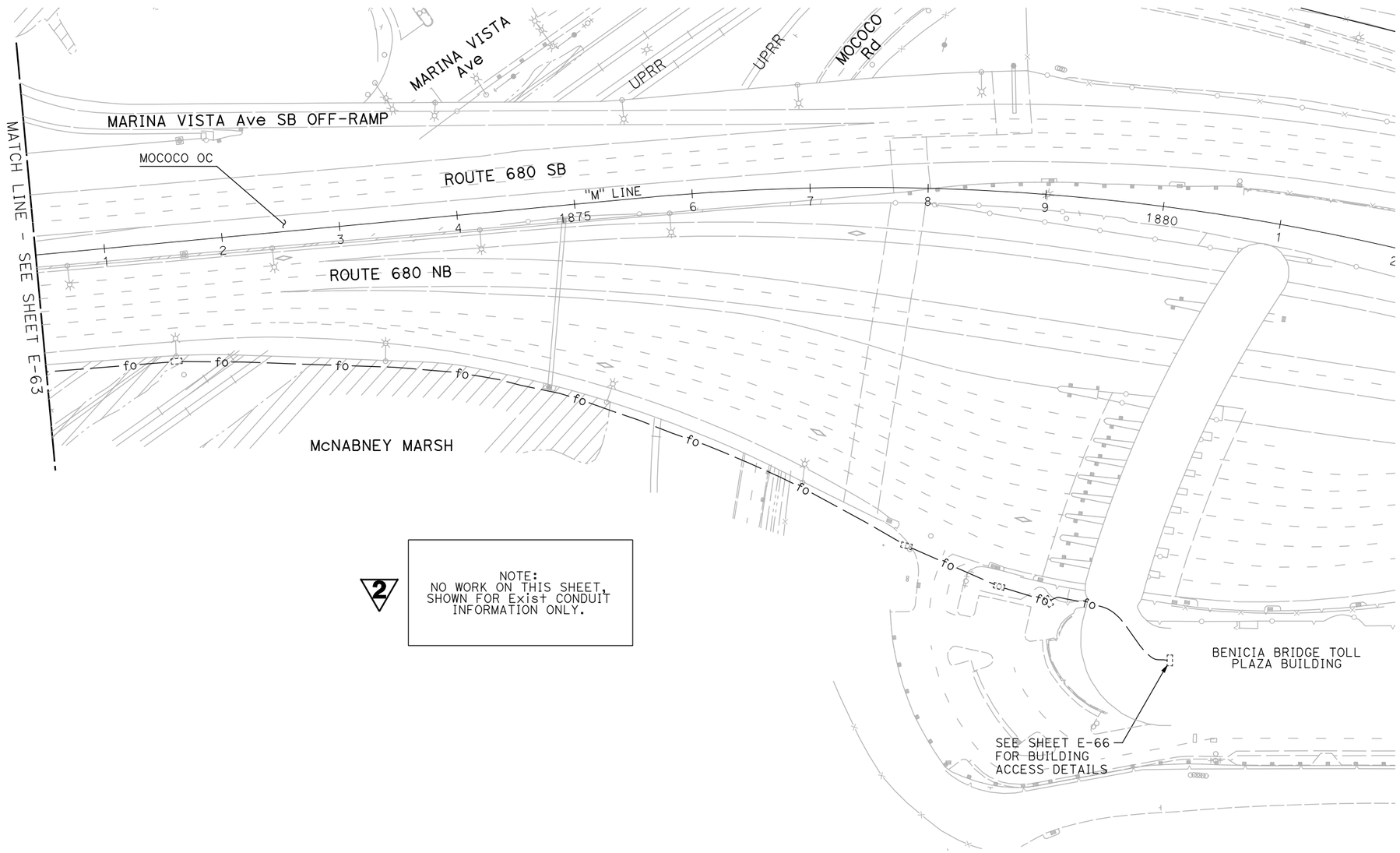
OAKLAND, CA 94607



2 NOTE: NO WORK ON THIS SHEET, SHOWN FOR Exist CONDUIT INFORMATION ONLY.

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

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BACKHAUL COMMUNICATIONS SYSTEM
(BENICIA TOLL PLAZA)

SCALE: 1" = 50'

E-64

REVISED BY | DATE REVISED
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BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490ua064.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	132	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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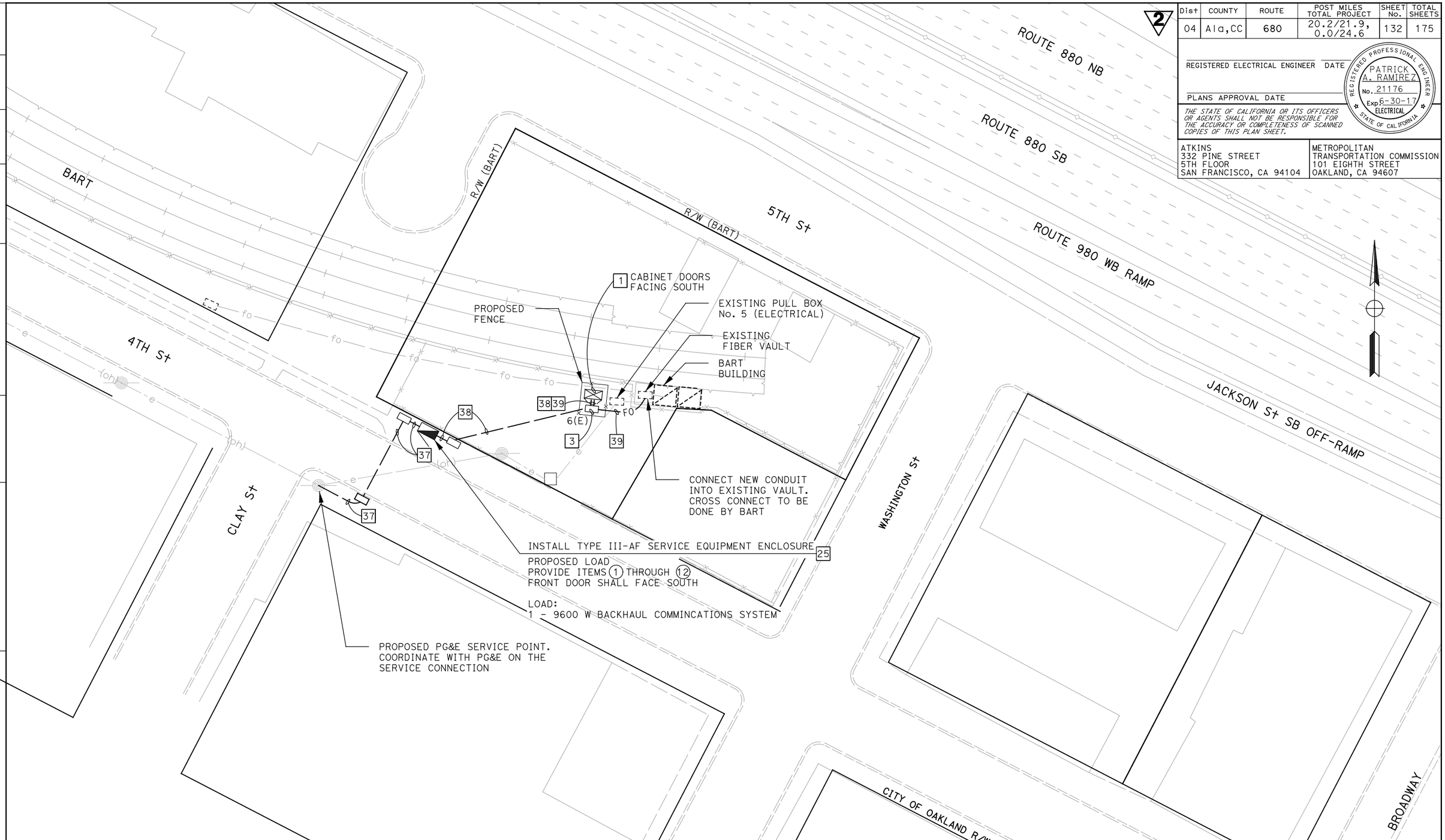

2 **REVISED PER ADDENDUM No. 2**

NOTE:

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FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET E-1

BACKHAUL COMMUNICATIONS SYSTEM
(BAIFA OAKLAND HUB)

NO SCALE

E-65

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FUNCTIONAL SUPERVISOR	KAI CHAN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	133	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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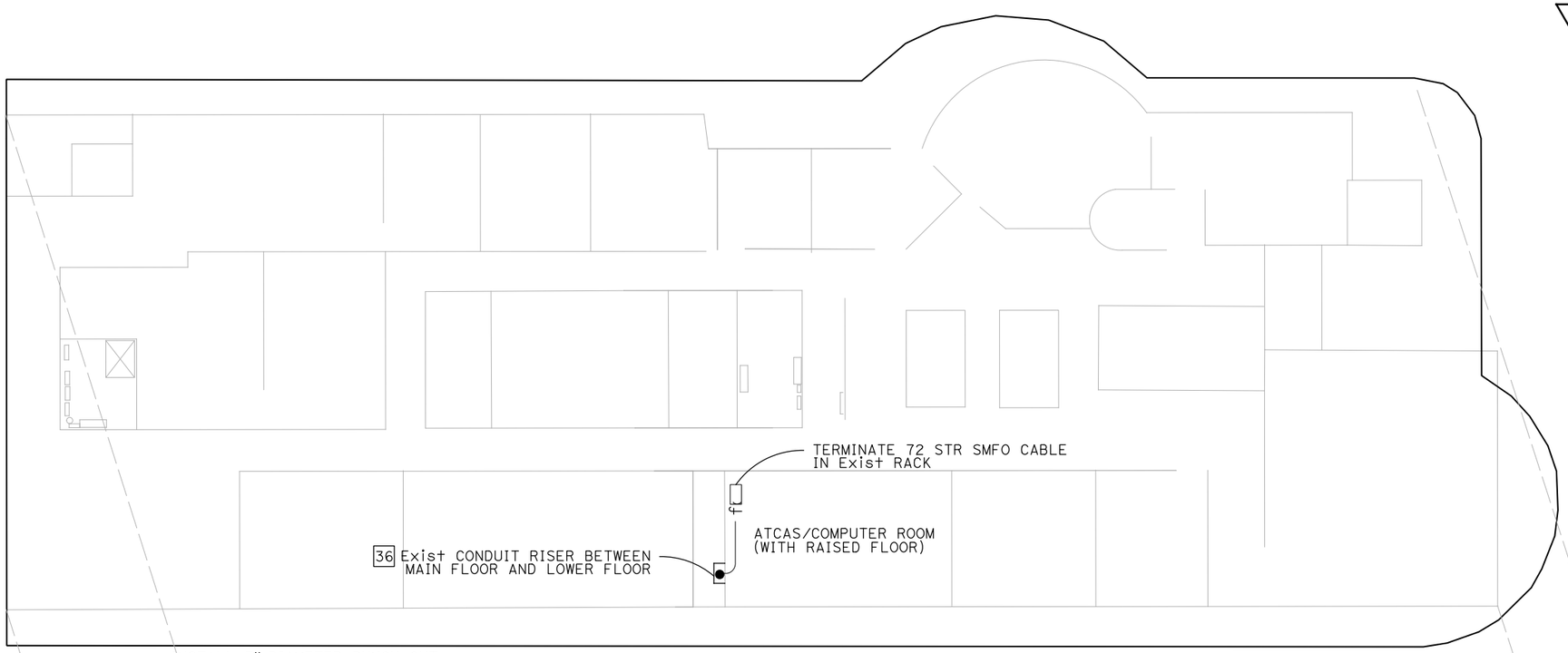
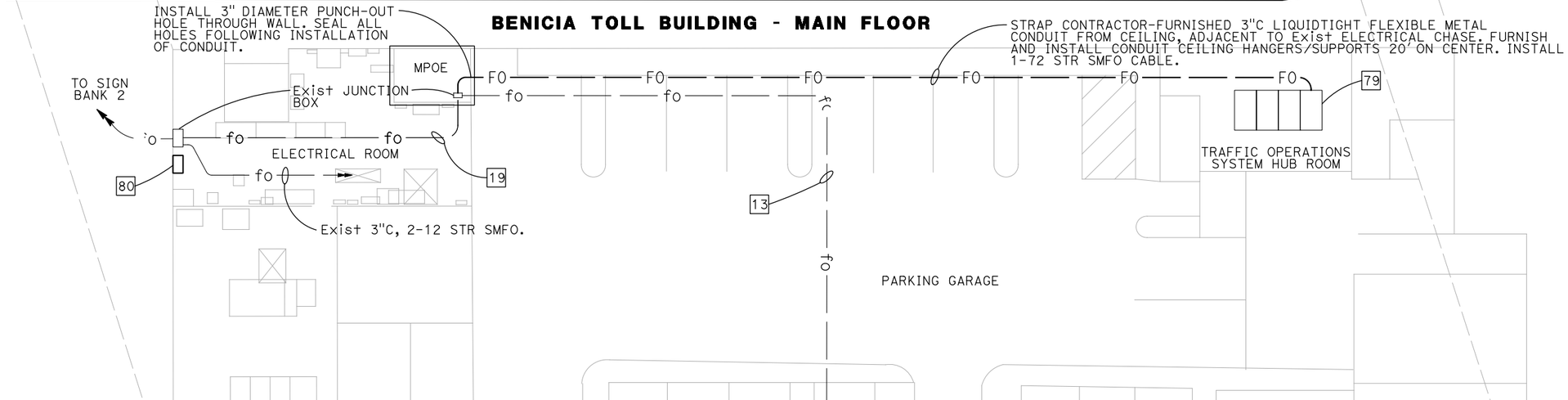


BENICIA TOLL BUILDING - MAIN FLOOR



BENICIA TOLL BUILDING - LOWER FLOOR

BACKHAUL COMMUNICATIONS SYSTEMS
(BENICIA TOLL PLAZA)

NO SCALE

2 REVISED PER ADDENDUM No. 2

E-66

REVISED BY	DATE REVISED

PATRICK RAMIREZ — KEVIN AGUIGUI

CALCULATED-DESIGNED BY — CHECKED BY

FUNCTIONAL SUPERVISOR — KAI CHAN

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	139	175

REGISTERED ELECTRICAL ENGINEER DATE

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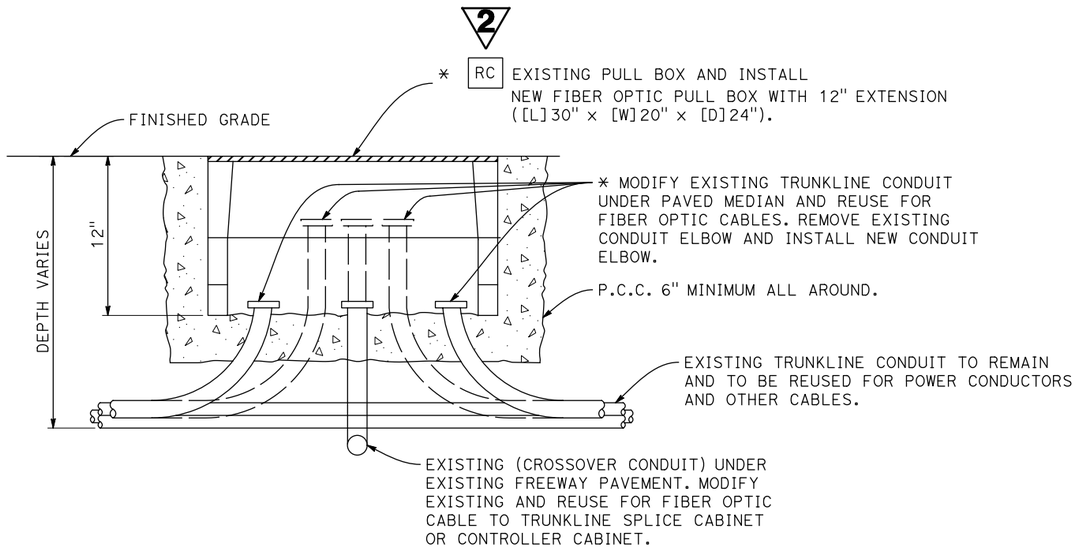
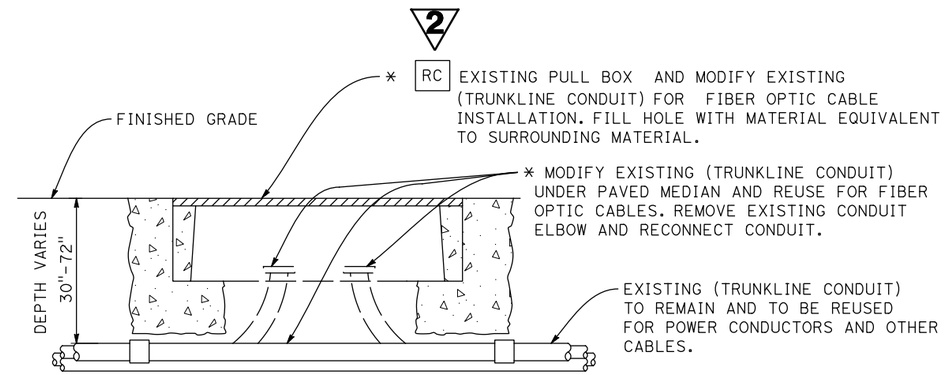


* DO NOT DAMAGE EXISTING TRUNKLINE CONDUIT RUNS. ALL EXISTING TRUNKLINE CONDUIT RUNS WERE INSTALLED IN THE SAME TRENCH UNDER MEDIAN PAVEMENT. MODIFIED CONDUIT SHALL HAVE A MINIMUM CONDUIT BENDING RADIUS OF 20"

DETAIL A

TRUNKLINE TRAFFIC PULL BOX REPLACEMENT
TRUNKLINE AND CROSSOVER CONDUIT MODIFICATION



* DO NOT DAMAGE EXISTING TRUNKLINE CONDUIT RUNS. ALL EXISTING TRUNKLINE CONDUIT RUNS WERE INSTALLED IN THE SAME TRENCH UNDER MEDIAN PAVEMENT.

DETAIL B

TRUNKLINE CONDUIT MODIFICATION
TRUNKLINE PULL BOX REMOVAL

2 **REVISED PER ADDENDUM No. 2**

ELECTRICAL DETAILS
(PULL BOX MODIFICATION)

NO SCALE

E-72

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04	Ala,CC	680	20.2/21.9, 0.0/24.6	146	175

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REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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NOTES:

1. CONTRACTOR SHALL BE ALLOWED UP TO FIVE (5) TRUNK SPLICES BETWEEN BACKHAUL COMMUNICATION HUB CABINETS AT WEST DUBLIN AND WALNUT CREEK TO ACCOMMODATE FIBER OPTIC CABLE REEL LENGTHS. CONTRACTOR SHALL BE ALLOWED UP TO THREE (3) TRUNK SPLICES BETWEEN BACKHAUL COMMUNICATION HUB CABINETS AT WALNUT CREEK AND BENICIA TOLL PLAZA TO ACCOMMODATE FIBER OPTIC CABLE REEL LENGTHS. CONTRACTOR SHALL SUBMIT PROPOSED TRUNK SPLICE LOCATIONS TO ENGINEER FOR APPROVAL.

BACKHAUL COMMUNICATIONS SYSTEM QUANTITIES

SHEET No.	CONDUIT [*]		SINGLEMODE FIBER OPTIC CABLE [*]						PULL BOXES [*]			FIBER OPTIC SPLICE VAULT [*]	REMOVE EXISTING PULL BOXES [*]	MODIFY CONDUIT IN EXISTING PULL BOX [*]	OBJECT MARKER [*]	FIBER OPTIC SPLICE CLOSURE [*]	FIBER SPLICES AND TERMINATIONS [*]	FIBER OPTIC DISTRIBUTION UNIT [*]					COMMUNICATIONS CABINET (TYPE 333) [*]	ETHERNET ACCESS SWITCH [*]	ETHERNET DISTRIBUTION SWITCH [*]	TYPE III SERVICE EQUIPMENT ENCLOSURE [*]
	2"	3"	6	12	24	48	72	144	#5	#6 (T)	FIBER OPTIC PULL BOX							12 STRAND	24 STRAND	48 STRAND	72 STRAND	144 STRAND				
	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
E-3		90	224		970		90	550	1	1		1				1	240		1			1	1	1	2	
E-4								1,250							2											1
E-5				317				2,716							4	2	48									
E-6				134				3,121							2	1	24									
E-7				154				2,703							3	1	24									
E-8				131				1,547								1	24									
E-9								2,840							2											
E-10				125				3,670							3	1	36									
E-11				95				2,100								1										
E-12				145				2,901			1		1	1	2	2	36									
E-13				170				2,960							4	1	12									
E-14				120				2,551			1		1	1		1	12									
E-15								2,830							2											
E-16				155				2,861			1				2	2	36									
E-17				162				2,876			1			1	2	1	36									
E-18				170				3,080					1	1	3	1	24									
E-19				101				2,569			1		1	1		1	24									
E-20				87				2,486							1	1	24									
E-21				88				2,644			1		1	1		1	24									
E-22								2,850							2		12									
E-23				101				2,559								1	24									
E-24				170				2,940							2		12									
E-25				169				3,012			1					1	24									
E-26				407				2,976			1				2	1	36									
E-27				90				2,890			1		1		2	1	24									
E-28								2,540																		
E-29				98				2,834							2	1	24									
E-30								2,840							2											
E-31				96				2,648			1				2	1	24									
E-32				93				2,595		2	3				2	1	24									
E-33				409				2,720							4	2	24									
E-34				90				2,590							2	1	24									
E-35				584				2,710							6	1	24									
E-36				402				2,960								1	24									
E-37				10				2,780			1		1	1		1	24									
E-38								2,470																		
E-39		52		100				3,750			1		2	2		2	48									
E-40				38				2,760			1		1		1	1	24	1								
E-41	98	74		25	85		35	2,950	2		1	1	1	1	2	2	168	2					1	1	2	
E-42	1,118	1,156				1,156			5		4				5											1
E-43				15				3,090							2											
E-44								4,099			2		4	1	6	2	288				1					
E-45								2,870			10		16	16	10											
E-46				15				3,030			14		20	20	14		24									
E-47		775		60				2,890			10		14	14	11		24	1								
E-48		1,570		1,000				2,690			5	1	3	3	6	1	48	2								
SUB-TOTAL	1,216	3,717	224	6,124	1,055	1,156	125	123,297	8	3	62	3	68	64	117	40	1,572	6	1		1	1	2	2	4	2

[*] NOT A SEPARATE ITEM, QUANTITY PROVIDED FOR INFORMATION ONLY

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ELECTRICAL QUANTITIES
(BACKHAUL)

NO SCALE

E-79

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04	Ala,CC	680	20.2/21.9, 0.0/24.6	147	175

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PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER PATRICK A. RAMIREZ No. 21176 Exp 6-30-17 ELECTRICAL STATE OF CALIFORNIA

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NOTES:

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BACKHAUL COMMUNICATIONS SYSTEM QUANTITIES

SHEET No.	CONDUIT [*]		SINGLEMODE FIBER OPTIC CABLE [*]						PULL BOXES [*]			FIBER OPTIC SPLICE VAULT [*]	REMOVE EXISTING PULL BOXES [*]	MODIFY CONDUIT IN EXISTING PULL BOX [*]	OBJECT MARKER [*]	FIBER OPTIC SPLICE CLOSURE [*]	FIBER SPLICES AND TERMINATIONS [*]	FIBER OPTIC DISTRIBUTION UNIT [*]					COMMUNICATIONS CABINET (TYPE 333) [*]	ETHERNET ACCESS SWITCH [*]	ETHERNET DISTRIBUTION SWITCH [*]	TYPE III SERVICE EQUIPMENT ENCLOSURE [*]
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	LF	LF	LF	LF	LF	LF	LF	LF	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA
E-49				179				2,830			9		17	17	10	1	12									
E-50								2,790			8		12	12	8											
E-51		310		416				2,930	1		10		12	12	9	1	48	2								
E-52				292				2,830			9		13	13	9	1	24	1								
E-53								2,760			10		20	20	10											
E-54				484				2,830			11		14	14	10	1	24	1								
E-55								3,140			6	1	14	14	7											
E-56	10	1,373		25				3,060			7		6	6	11	1	24	1								
E-57		3,980						3,990			11	1	4	4	10											
E-58		1,299						2,850			9		10	10	4											
E-59				247				2,900			7		11	11	7	1	24	1								
E-60				20				2,930			8		12	12	8											
E-61		1,571		232				2,930	1		8		10	10	8	1	24	1								
E-62		4,732						2,950			4				4											
E-63		3,349		100				2,930			4						24									
E-64																	8									
E-65	180	40				40			2		1						96			2			1	1	2	1
E-66								203									144				1	1				
E-67								1,734								1	12									
E-68								1,391								1	80							1	2	
E-69																	240									
SUB-TOTAL	190	16,654		1,994		40		47,977	4		122	2	155	155	115	9	784	7		2	1	1	1	2	4	1
MAXIMUM TRUNK SPLICES																	1,152									
GRAND TOTAL	1,406	20,371	224	8,118	1,055	1,196	125	171,274	12	3	184	5	223	219	232	49	3,508	13	1	2	2	2	3	4	8	3

[*] NOT A SEPARATE ITEM, QUANTITY PROVIDED FOR INFORMATION ONLY

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ELECTRICAL QUANTITIES
(BACKHAUL)

NO SCALE

E-80

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PATRICK RAMIREZ | KEVIN AGUIGUI

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04	Ala,CC	680	20.2/21.9, 0.0/24.6	154A	175

REGISTERED ELECTRICAL ENGINEER DATE

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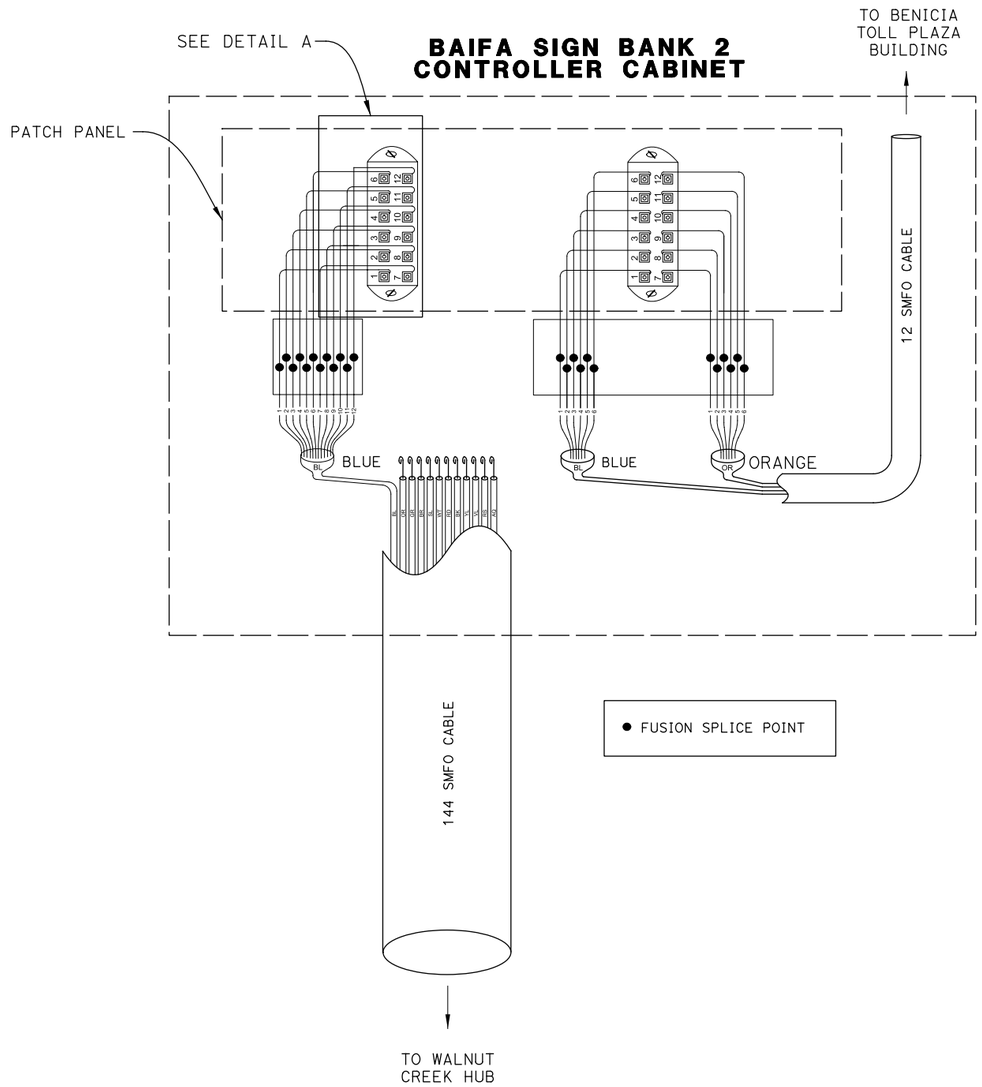

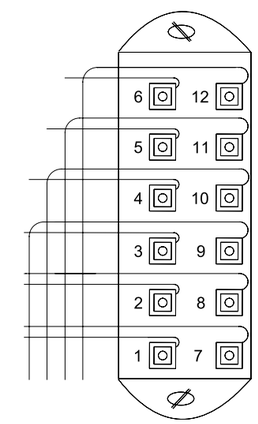

DETAIL A
FIBER PATCH PANEL

2 **ADDED PER ADDENDUM No. 2**

ELECTRICAL DETAILS
(BAIFA SIGN BANK 2 FIBER OPTIC SPLICE DIAGRAM)
NO SCALE

E-87A

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FUNCTIONAL SUPERVISOR	KAI CHAN

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BORDER LAST REVISED 7/2/2010 | USERNAME => CHAN2418 | DGN FILE => 0414000490ua087a.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0750 | PROJECT NUMBER & PHASE 04140004901

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Ala,CC	680	20.2/21.9, 0.0/24.6	155	175

REGISTERED ELECTRICAL ENGINEER DATE

PLANS APPROVAL DATE

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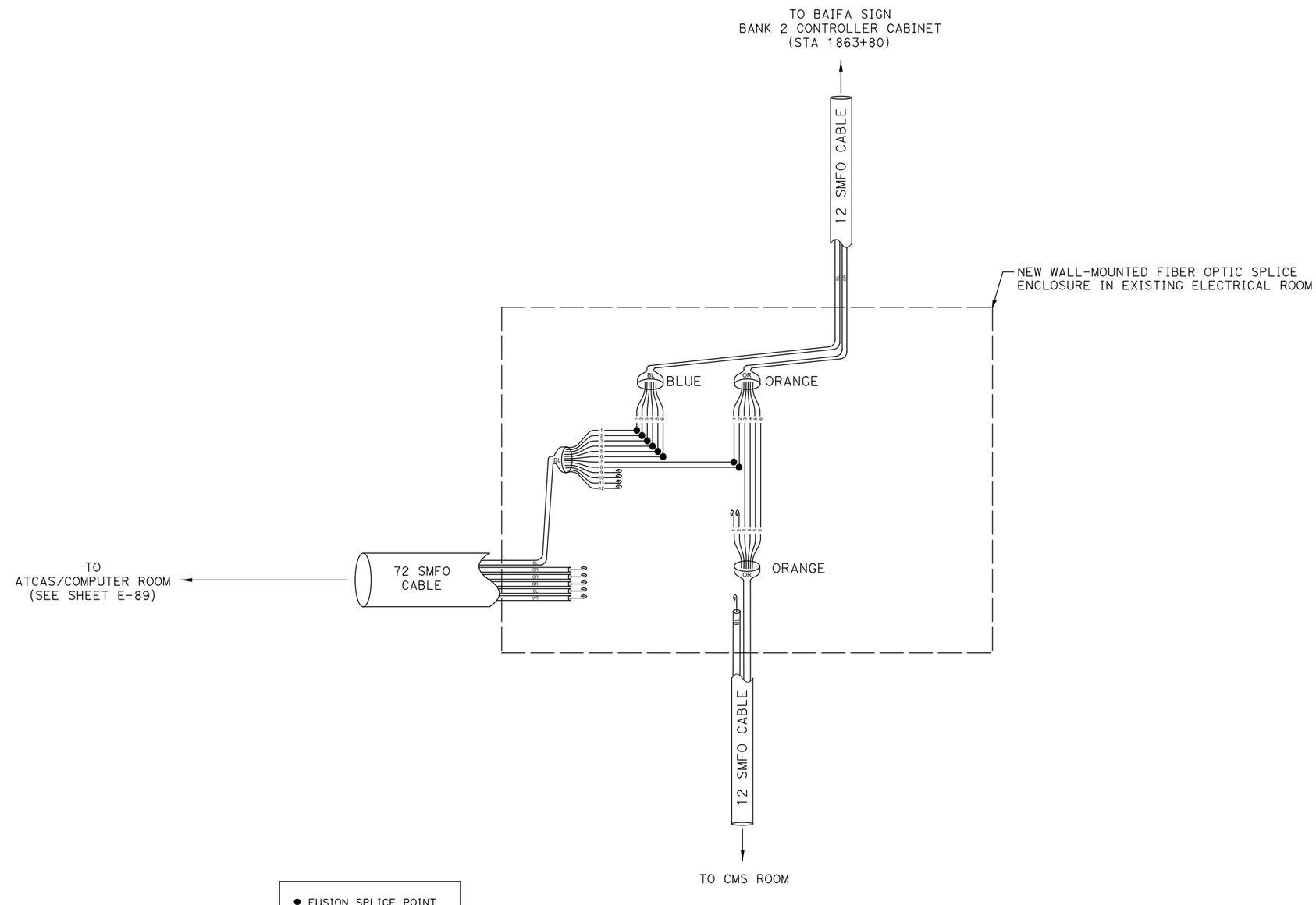

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ELECTRICAL DETAILS
(BENICIA TOLL PLAZA FIBER OPTIC SPLICE DIAGRAM)

NO SCALE

E-88

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KEVIN AGUIGUI	

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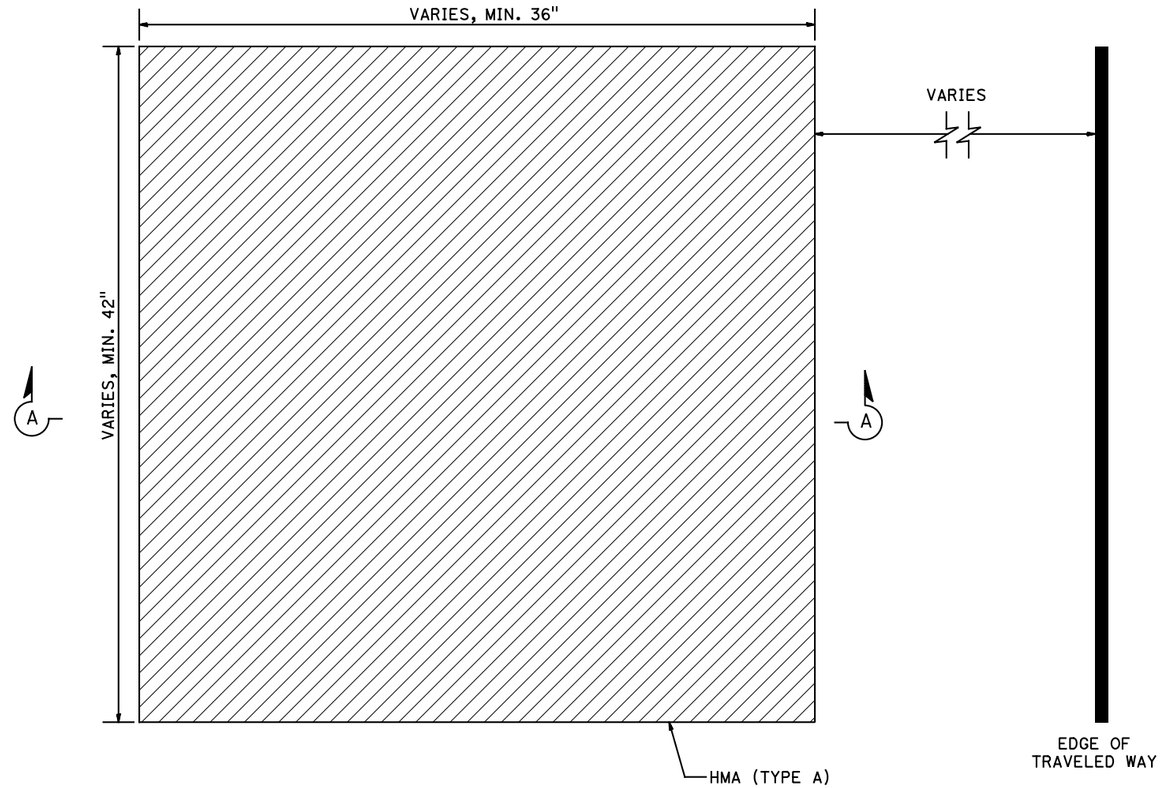
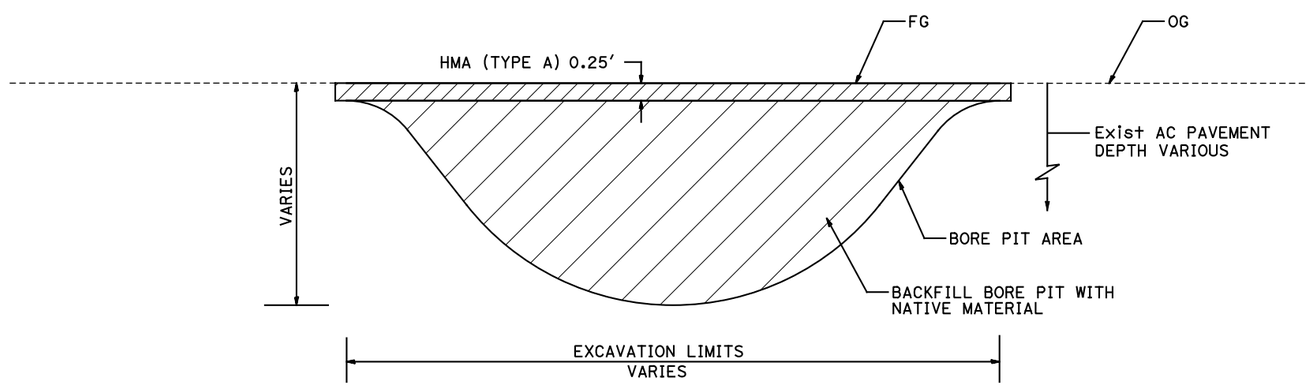
OAKLAND, CA 94607

NOTES:

1. BORE PITS SHALL ONLY BE USED AT LOCATIONS WHERE PULL BOXES OR FIBER SPLICE VAULTS ARE PROPOSED. ONCE ALL WORK HAS BEEN PROPERLY COMPLETED BACKFILL IN ACCORDANCE WITH DETAIL E-70 OR E-71.
2. BORE PIT SHALL BE BACKFILLED IN ACCORDANCE WITH THIS DETAIL WHEN EXCAVATED LOCATIONS CANNOT BE PROPERLY COMPLETED WITHIN THE SAME DAY.
3. WHERE PULL BOX AND TRECNHING ACTIVITIES CANNONT BE PROPERLY COMPLETED WITHIN THE SAME DAY, BACKFILL ALL WORK AREAS IN ACCORDANCE WITH THE DETAIL SHOWN ON THIS SHEET AS APPROVED BY THE ENGINEER. 2
4. PAVEMENT SURFACE SHALL SIT FLUSH WITH THE SURFACE OF THE EXISTING PAVEMENT.
5. NATIVE SOIL USED AS BACKFILL MUST BE FREE OF LOOSE AND EXTRANEOUS MATERIAL.
6. AGGREGATES MUST BE CLEAN AND FREE FROM DELETERIOUS SUBSTANCES.
7. COMPACT THE NATIVE SOIL AND HMA PAVEMENT TO 95 PERCENT RELATIVE COMPACTION. USE A PNEUMATIC TAMPER, PLATE COMPACTOR, OR EQUIVALENT TO ACHIEVE THOROUGH COMPACTION.
8. AGGREGATE GRADATION FOR HMA TYPE A SHALL BE ¾".
9. EXCAVATED MATERIAL SHALL BE PILED IN SUCH A MANNER THAT IT WILL NOT ENDANGER THE WORKERS, MOTORISTS, OR OBSTRUCT NATURAL WATERCOURSES.
10. PRIOR TO BACKFILLING BORE PIT, CONDUIT SHALL BE TEMPORARILY PLUGGED, CAPPED, OR OTHERWISE PROTECTED FROM THE ENTRANCE OF DUST, TRASH AND MOISTURE.



PLAN VIEW



SECTION A-A

2 **REVISED PER ADDENDUM No. 2**

CONSTRUCTION DETAILS
(BORE PIT BACKFILL)

NO SCALE

E-108

REVISED BY | DATE REVISED
PATRICK RAMIREZ | KEVIN AGUIGUI
CALCULATED-DESIGNED BY | CHECKED BY
FUNCTIONAL SUPERVISOR | KAI CHAN

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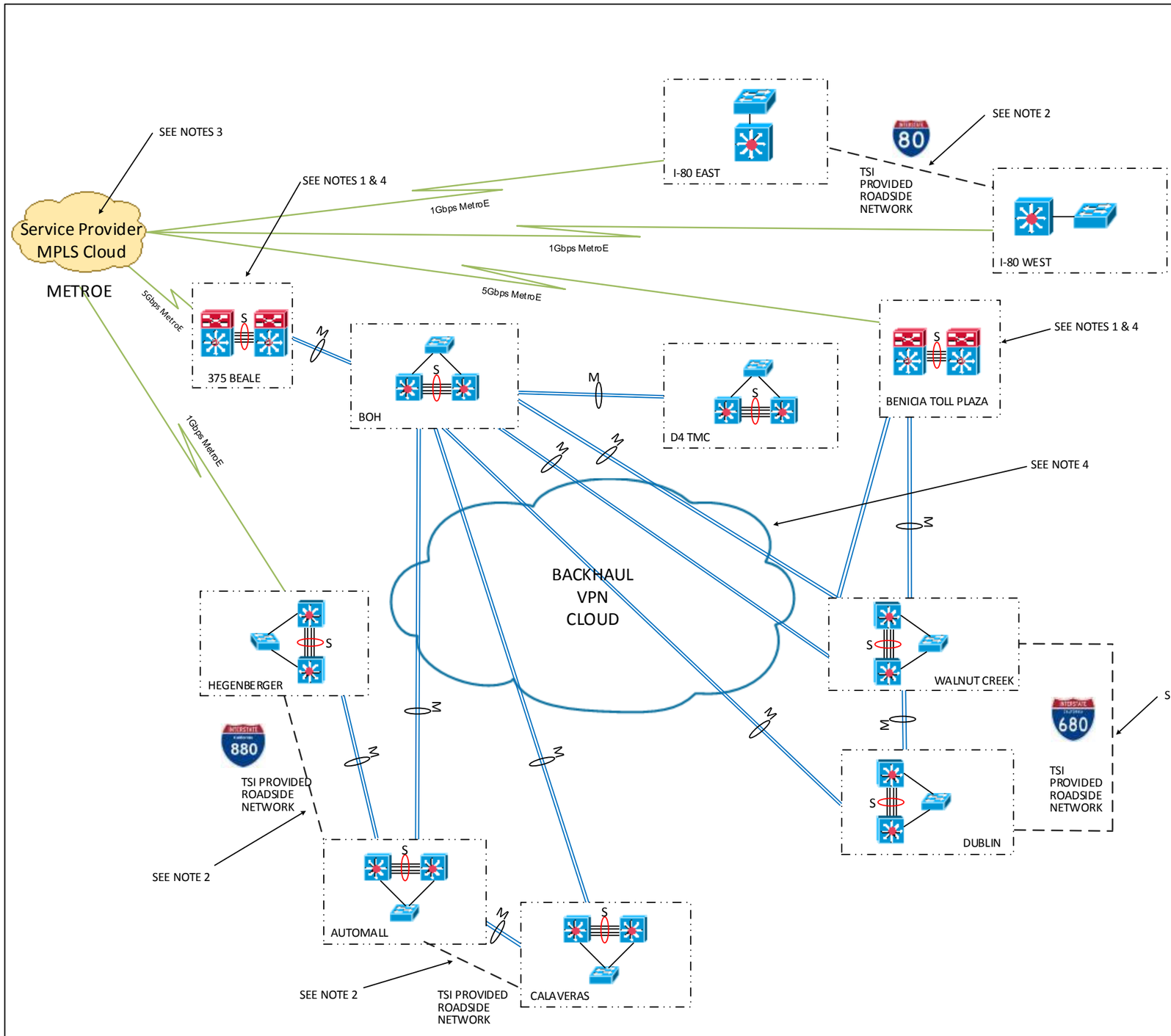
APPENDIX C

Logical Network Details

Replacement Diagrams



NOTES:

1. PRIMARY AND SECONDARY DATA CENTER LOCATIONS.
2. TOLL COLLECTION SYSTEM ROADSIDE NETWORK BY OTHERS.
3. 1 GBPS AND 5 GBPS METROE CONNECTIONS ARE PRELIMINARY ESTIMATES. FINAL BANDWIDTH WILL BE DETERMINED BY BAIFA.
4. CONFIGURE VIRTUAL PRIVATE NETWORK(S) TO PROVIDE SEPARATION OF TOLL SYSTEM TRAFFIC AT ALL BACKHAUL HUB AND DATA CENTER LOCATIONS

LEGEND:

- LOCATION GROUP
- BAIFA BACKHAUL HUB/DATA CENTER CORE SWITCH LOCATION WITH INTELLIGENT SWITCHING AND ROUTING NETWORK HARDWARE
- BAIFA BACKHAUL HUB L3 DISTRIBUTION SWITCH LOCATION WITH INTELLIGENT SWITCHING AND ROUTING NETWORK HARDWARE
- BAIFA BACKHAUL ACCESS LAYER 2 SWITCHING NETWORK HARDWARE
- BACKHAUL METROE CONNECTION (METROE)
- BAIFA BACKHAUL NETWORK FIBER OPTIC CABLE NEW OR PROVIDED BY OTHERS
- TOLL COLLECTION ROADSIDE NETWORK (NOT IN CONTRACT)
- M — LAYER 2 TRUNK LINKS
- S — ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION

No.	DATE	ISSUE / REVISION

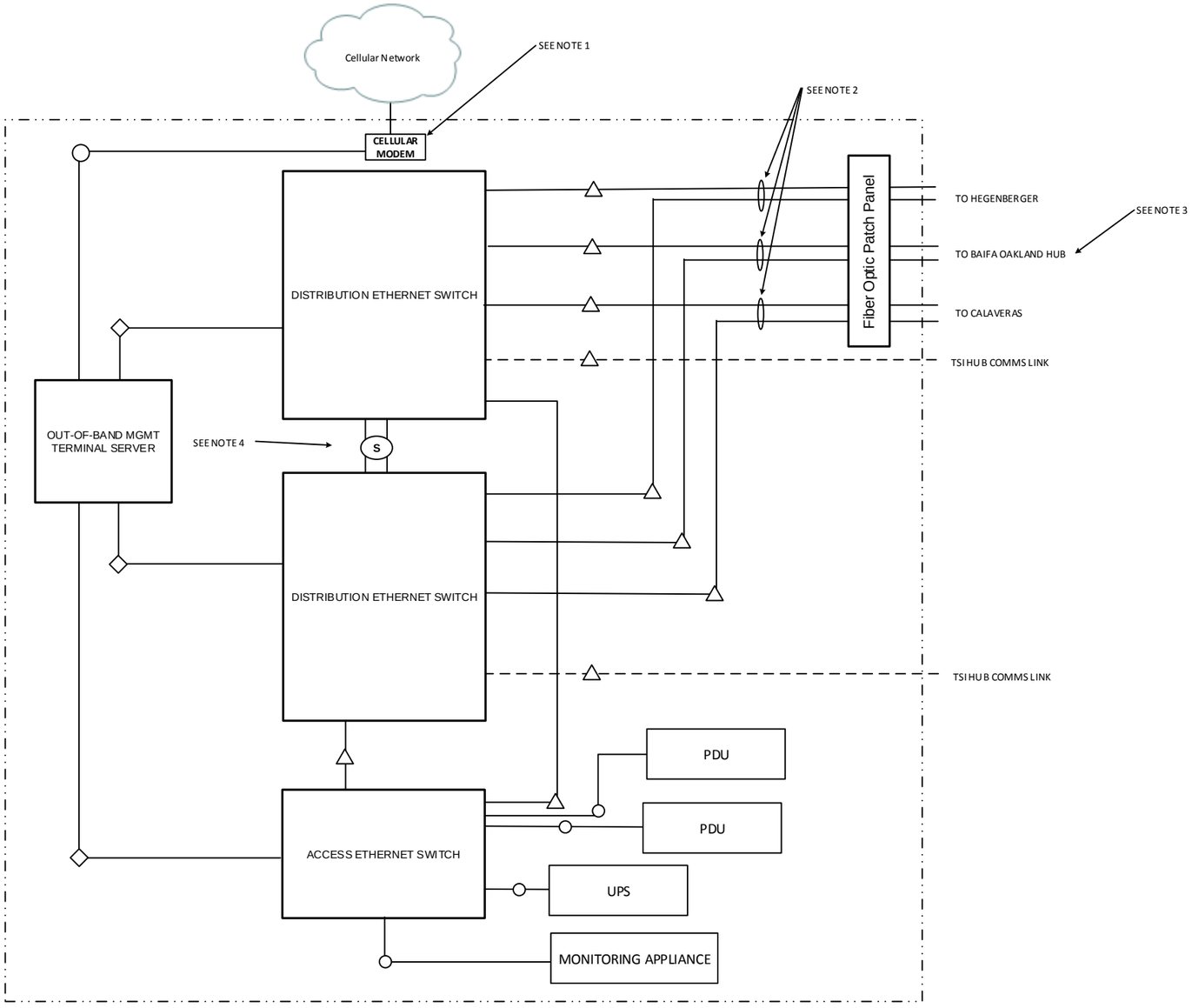
SUBMITTED BY:
ATKINS
332 Pine Street
5th Floor
San Francisco, CA 94104

PROJECT
BAIFA Backhaul Communications Network

TITLE
BACKHAUL OVERVIEW DIAGRAM

SCALE
None

PAGE



AUTOMALL

NOTES:

1. OUT-OF-BAND CELLULAR MODEM HARDWARE FURNISHED AND INSTALLED BY OTHERS
2. LAYER 2 CONFIGURED TRUNK LINKS TO/FROM ADJACENT HUBS
3. CONNECTION FROM AUTOMALL HUB TO BOH HUB VIA CROSS-CONNECTION AT FREMONT BART STATION AND SILICON VALLEY ITS TRAFFIC OPERATIONS CENTER
4. ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION

LEGEND:

- Location Group
- NEW NETWORK EQUIPMENT
- 10/100/1000 BASE-T
- 10GBASE-xR
- RS-232 SERIAL
- S — ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION
- NEW OR EXISTING BACKHAUL FIBER OPTIC NETWORK CABLE
- METRO ETHERNET COMM LINK
- ROADSIDE NETWORK CONNECTION(S) TO BACKHAUL NETWORK BY OTHERS
- OTHER NETWORK

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PROJECT

BAIFA Backhaul Communications Network

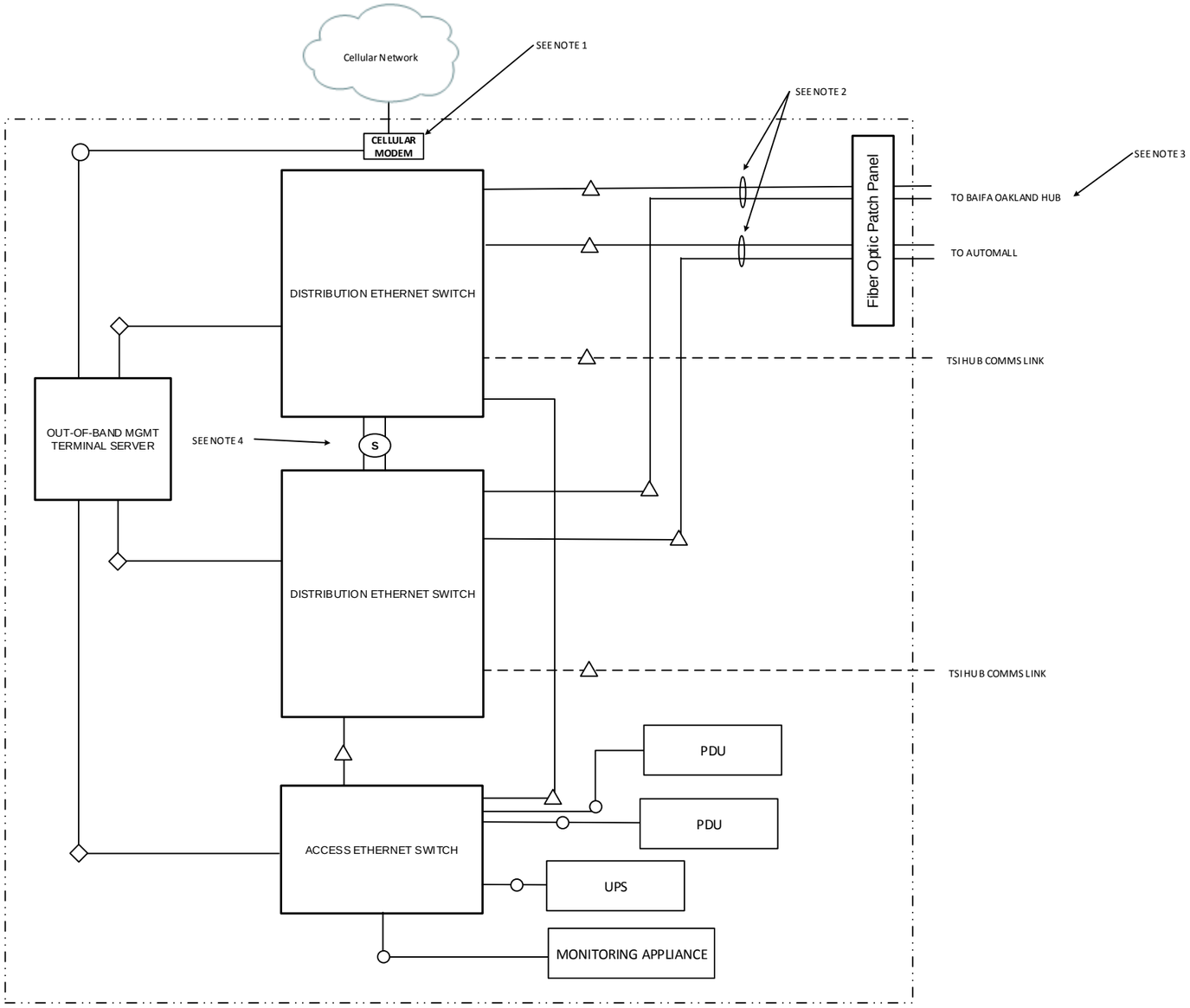
TITLE

Automall Physical Interconnections

SCALE

None

PAGE



CALAVERAS

NOTES:

1. OUT-OF-BAND CELLULAR MODEM HARDWARE FURNISHED AND INSTALLED BY OTHERS
2. LAYER 2 CONFIGURED TRUNK LINKS TO/FROM ADJACENT HUBS
3. CONNECTION FROM CALAVERAS HUB TO BOH HUB VIA CROSS-CONNECTION AT FREMONT BART STATION AND SILICON VALLEY ITS TRAFFIC OPERATIONS CENTER.
4. ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION

LEGEND:

- Location Group
- NEW NETWORK EQUIPMENT
- 10/100/1000 BASE-T
- 10GBASE-xR
- RS-232 SERIAL
- S — ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION
- NEW OR EXISTING BACKHAUL FIBER OPTIC NETWORK CABLE
- METRO ETHERNET COMM LINK
- ROADSIDE NETWORK CONNECTION(S) TO BACKHAUL NETWORK BY OTHERS
- OTHER NETWORK

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PROJECT

BAIFA Backhaul Communications Network

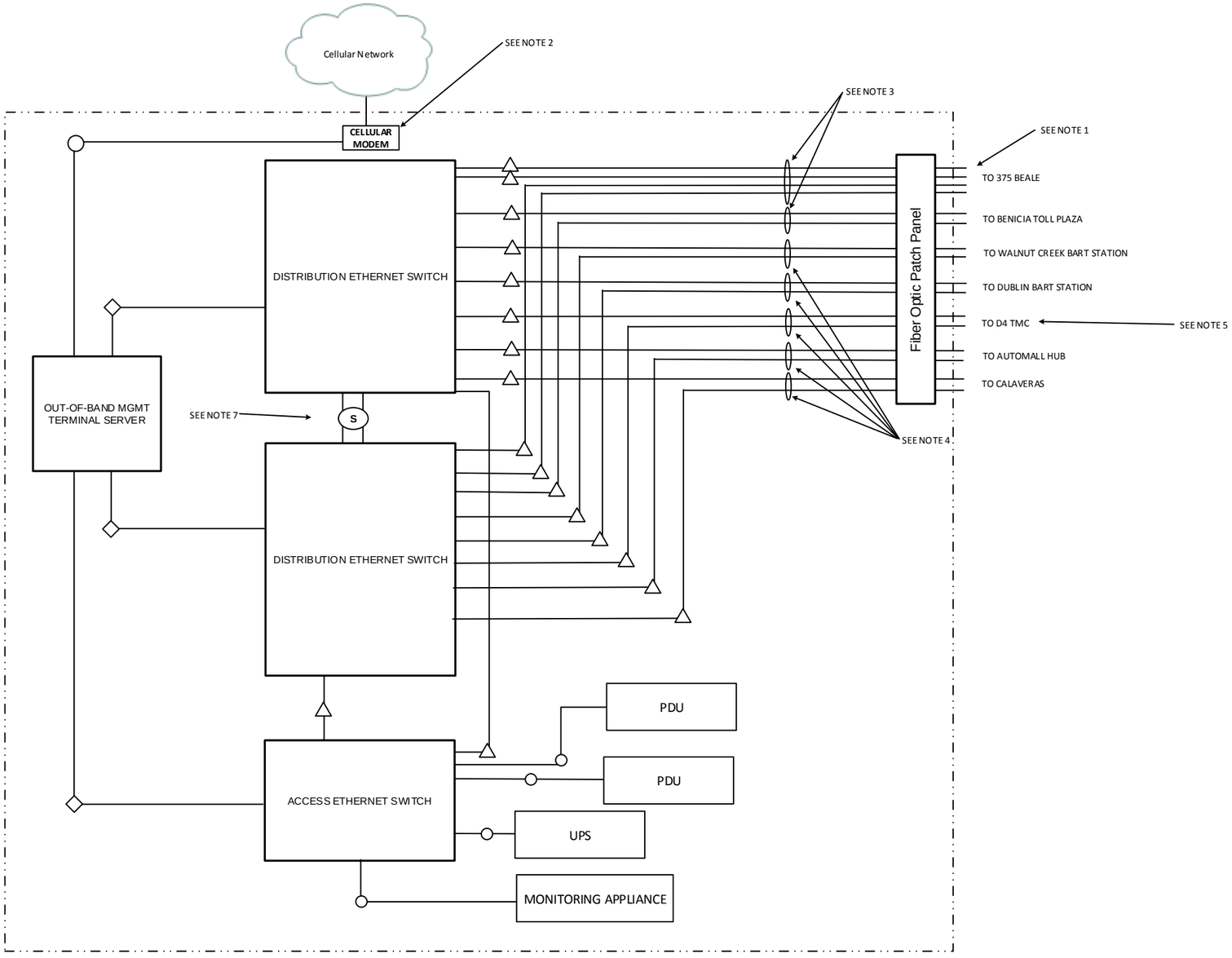
TITLE

Calaveras Physical Interconnections

SCALE

None

PAGE



BAIFA OAKLAND HUB (BOH)

NOTES:

1. CONNECTION IS PATCHED/CROSS-CONNECTED AT BART CFH AND EMBARCADERO FACILITIES BY OTHERS BEFORE CONTINUING TO CORE SWITCH(ES) AT 375 BEALE.
2. OUT-OF-BAND CELLULAR MODEM HARDWARE FURNISHED AND INSTALLED BY OTHERS.
3. LAYER 2 CONFIGURED TRUNK LINKS TO/FROM ADJACENT DATA CENTER LOCATION
4. LAYER 2 CONFIGURED TRUNK LINKS TO/FROM ADJACENT HUBS
5. CONNECTION FROM BOH TO CALTRANS TMC VIA CROSS-CONNECTION AT 19th STREET BART.
6. CONNECTION FROM BOH TO AUTOMALL HUB AND CALAVERAS HUB VIA CROSS-CONNECTION AT FREMONT BART STATION AND SILICON VALLEY ITS TRAFFIC OPERATIONS CENTER.
7. ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION

LEGEND:

- Location Group
- NEW NETWORK EQUIPMENT
- 10/100/1000 BASE-T
- 10GBASE-xR
- S — ETHERCHANNEL/VSS OR SIMILAR STACK CONNECTION
- RS-232 SERIAL
- NEW OR EXISTING BACKHAUL FIBER OPTIC NETWORK CABLE
- METRO ETHERNET COMM LINK
- ROADSIDE NETWORK CONNECTION(S) TO BACKHAUL NETWORK BY OTHERS
- OTHER NETWORK

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PROJECT

BAIFA Backhaul Communications Network

TITLE

BOH Physical Interconnections

SCALE

None

PAGE

ATTACHMENT 3

INVITATION FOR BIDS (IFB)
FOR EXPRESS LANES BACKHAUL COMMUNICATIONS NETWORK FIBER OPTIC CABLE AND NETWORK ELECTRONICS FURNISHING, INSTALLATION AND TESTING,
DATED MAY 28, 2015 AS AMENDED MAY 29, 2015

QUESTIONS RECEIVED FROM BIDDERS' CONFERENCE HELD ON JUNE 8, 2015 AND OTHER QUESTIONS SUBMITTED

Q1: Are there any Disadvantaged Business Enterprise (DBE) goals or other Small Business Enterprise (SBE) goals associated with this procurement?

A1: No, however BAIFA is committed to the participation of DBEs and SBEs in MTC contracting opportunities. BAIFA encourages Prime Contractors to utilize DBE and SBE subcontractors. Additionally, DBE and SBE firms are encouraged to submit proposals in response to BAIFA procurements.

Q2: IFB Part 1, <u>Invitation for Bid</u>, Bid Submission & Bid Opening, page 2, provides a bid submission deadline of June 30, 2015 and IFB Part 1, <u>Invitation for Bid</u>, Bidder Selection Timetable, page 4, states Monday, July 6, 2015. Which one is correct?

A2: See Addendum #1, Item #1 posted May 29, 2015.

Q3: IFB Addendum #1, Item #1 provides a bid submission deadline of 4:00 p.m., Monday, July 6, 2015 as the due date for bids is a few days after the July 4 weekend. Would you consider extending the date a few days?

A3: No, the bid submission deadline will not be extended.

Q4: Will BAIFA allow this minimum qualification to be met by either the Prime or the subcontractor? IFB Part 3, <u>Instructions to Bidders</u>, Article 3, Minimum Qualifications requires

Minimums which must be met by Bidder's direct firm experience:

> **The Bidder serving as the prime contractor will have successfully deployed or operated and maintained two or more fiber optic Metropolitan Area Networks (MAN) consisting of at least three (3) field communication hubs in the past five (5) years. For purposes of these minimum qualifications, MAN includes layer 2 and layer 3 network hardware installed in field cabinets and including software, protocols, network management and security configurations.**

A4: No.

Q5: Does the agency have a system integrator on the toll facility that is actively maintaining the system? If so, who is it?

A5: The express lanes toll system integrator (TSI), Transcore LP, has been selected through a separate contract and will install and maintain the express lanes tolls system. Contact information will be provided to the winning Bidder once the Backhaul Contract is awarded.

Q6: It seems that there is an inadequate time to get this job done. Is there an urgency to get this project running?

A6: BAIFA believes there is adequate time to complete the work as described.

Q7: 1) Is it true that the Caltrans permits are not acquired yet? 2) We are supposed to bid on a contract without knowing the permit restrictions?

A7: 1) See IFB Part 3, Instructions to Bidders, Article 13, Award or Rejection of Bids, second and third paragraphs on page 28.
2) The work in Segment I has been under review with Caltrans over the last ten months. Special provisions and restrictions resulting from the review to date are incorporated in Part 10.

Q8: Will we have to pay for permits?

A8: See IFB Part 6, Special Conditions, SC-7 Permits & Fees on pages 79 and 80.

Q9: IFB Appendix C, Logical Network Details, provides the Backhaul Overview Diagram and labels The Calaveras Hub equipment as "Not in Contract", however the project plans for Route 880 (E-3) shows the installation of the 333 cabinet, the installation of the fiber optic cable, the installation of the Fiber Patch Panel (E-125), and the installation of an Ethernet access switch and two Distribution switches on the electrical quantities page of the Plans (Page E-122). Please clarify what is in the contract and what is not in the contract at this location.

A9: See Addendum #2, Item #13. The Calaveras Hub equipment installation, as shown in the project plans, is in the contract scope. IFB Appendix C, Logical Network Details are revised to clarify that Calaveras Hub is in the contract scope.

Q10: IFB Part 3, Instructions to Bidders, On Page 14 of the project specifications, Walnut Creek BART Station is listed as a separate location from the Walnut Creek Hub location (where a new 333 hub cabinet is shown on page E-41 of the plans) for hardware installation with the statement "Contractor to utilize Caltrans furnished racks and power infrastructure". There is no Backhaul Overview Diagram for the Walnut Creek BART Station but there is one for the Walnut Creek Hub. There is also a statement on page 216 referring to installation of Equipment at the "Walnut Creek BART Station. Is The Walnut Creek BART the same facility as the Walnut Creek Hub, or are they different? Please clarify.

A10: See Addendum #2, Item #1. The Walnut Creek Hub at I-680/State Route 24 interchange is a separate location from the Walnut Creek BART Station. There will be worked performed at the Walnut Creek BART Station. However, the Walnut Creek BART Station is not a Hub Location and has been removed from the list of Hub Locations.

Q11: On page 14 of IFB Part 3, Instruction to Bidders, Section 1, Scope of Work, there is a facility called "19th Street Bart Station" listed. It states that network devices, software, and ancillary components are to be furnished, configured, and tested there. This location is not shown in the Backhaul Overview Diagram. Is there any work to be performed at this location? Please Clarify.

A11: See Addendum #2, Item #1. Yes, there will be work performed at the 19th Street BART Station. However, the 19th Street BART Station is not a Hub Location and has been removed from the list of Hub Locations.

Q12: For work within the medians of the expressways, will lane closures during regular working hours be allowed for this work (typically one lane in each direction) or will this work need to be completed during a second or third shift?

A12: See Addendum #2, Item #6 & Item #7.

Q13: To ensure that each party takes responsibility for their own actions without taking on liability for actions outside their control, we request that the following changes, highlighted in red, be made to:

1) IFB Part 6, Special Conditions, SC-1, Indemnification, page 69:

Consistent with California Civil Code Section 2782 and except where the injury, loss, damage or expense arises from the ~~sole or active~~ negligence or the willful misconduct of BAIFA or the following entities referred herein as "Stakeholder Agencies":
MTC,
BATA,
Caltrans,
BART,
City of Fremont,
City of Milpitas,
City of San Jose,
City of Walnut Creek,
City of Dublin,
City of Oakland, and
California Highway Patrol;

You agree to indemnify and hold BAIFA, Stakeholder Agencies and their commissioners, directors, officers, employees and agents harmless from all claims, demands, suits, losses, damages, injury, and liability, direct or indirect (including any and all reasonable costs and expenses in connection therewith), to the extent incurred by reason of any negligent act or omission or willful misconduct by you, your officers, agents, employees and subcontractors or any of them, under or in connection with this Contract, but excluding such claims, demands, suits, losses, damages, injury, and liability, direct or indirect, arising from the negligence or willful misconduct of BAIFA and BAIFA Indemnified Parties; and you agree at your own cost expense and risk to defend any and all claims, demands, suits, or other legal proceedings brought or instituted against BAIFA, Stakeholder Agencies, or their commissioners, directors, officers, agents, and employees, or any of them to the extent arising out of such negligent act or omission or willful misconduct, and to pay and satisfy any resulting judgments.
~~Except as otherwise provided by law, these requirements apply regardless of the existence or degree of fault of BAIFA or the Stakeholder Agencies.~~ Your defense and indemnity obligation will extend to Claims arising after the work is completed and accepted if the Claims are to the extent directly related to alleged negligent acts or omissions or willful misconduct by you that occurred during the course of the work. Any inspection of the work by BAIFA or the Stakeholder Agencies is not a waiver of full compliance with these requirements.

Your obligation to defend and indemnify is not excused because of your inability to evaluate liability or because you evaluate liability and determine that you are not liable. You must respond within thirty (30) days to the tender of any Claim for defense and indemnity by BAIFA or Stakeholder Agencies, unless this time has been extended by BAIFA. If you fail to accept or reject a tender of defense and indemnity within 30 days, in addition to any other remedy authorized by law, BAIFA may withhold such funds BAIFA reasonably considers necessary for its defense and indemnity until disposition has been made of the Claim or until the Contractor accepts or rejects the tender of defense, whichever occurs first. ~~With respect to third-party claims against you, you waive all rights of any type to express or implied indemnity against BAIFA, Stakeholder Agencies, its officers, employees, or agents (excluding agents who are design professionals).~~

2) **IFB Part 9, General Conditions, GC-2 Compliance with Laws and Regulations page 102:**

   Keep informed of, comply with, and cause all of your agents, employees, suppliers and subcontractors of any tier, to observe and comply with all applicable Federal, State, and local laws, regulations, and policies, including, but not limited to, all applicable terms and conditions prescribed for third party contracts by the U.S. Department of Transportation (DOT). You will indemnify, defend, and hold harmless the State, BAIFA, the Municipality or other entity within whose jurisdiction or on whose property the work is being performed, and Commissioners, their Board of Supervisors, Board of Directors, Councils, officers, agents, consultants and employees from any claim, liability, loss, injury or damage to the extent arising out of, or in connection with, the negligent acts, omissions, or willful misconduct in the performance of this Contract by you and/or your agents, employees or subcontractors, excepting only loss, injury or damage caused by the ~~active or sole~~ negligence or willful misconduct of personnel employed by the indemnities.

A13: BAIFA will not change these portions of IFB Part 6 or Part 9.

J:\CONTRACT\Procurements\Engineer&Architect\Express Lanes\Backhaul Network\Addendum #2 Q & A\Backhaul IFB Q & A Document Final.docx