



United States Department of the Interior

NATIONAL PARK SERVICE

Yosemite National Park
P. O. Box 577
Yosemite, California 95389

IN REPLY REFER TO:
L7615(YOSE-PM)

Memorandum

To: Michael Pieper, Project Manager, Yosemite National Park
From: Superintendent, Yosemite National Park
Subject: NEPA and NHPA Clearance: Parkwide Emergency Road Repairs (72117)

The Executive Leadership Team has reviewed the proposed project/action and completed its environmental assessment documentation, and we have determined the following:

- There will not be any effect on threatened, endangered, or rare species and/or their critical habitat.
- There will be no adverse effect on historical, cultural, or archeological resources.
- There will not be serious or long-term undesirable environmental or visual effects.

The subject proposed project is now cleared for all NEPA and NHPA compliance requirements as presented above. Project plans and specifications are approved and construction and/or project implementation can commence.

For the proposed project actions to be within compliance requirements during construction and/or project implementation, this project must adhere to the following mitigations:

- Historic road features will be photo-documented prior to repair. Historic features to be rebuilt using in-kind materials and methods.
- The project manager must consult the appropriate district ranger before creating a traffic control/delay plan for each site.
- Contract will include specifications for inspection and approval of sources of rock, gravel, soil, and other types of earth material proposed for use on this project, in order to prevent introduction of nonnative plant propagules.
- Contract will include specifications for cleaning, inspection, and approval of earth moving equipment prior to entering the park, in order to prevent introduction of nonnative plant propagules.

For complete compliance information see PEPC Project 72117.

//Palmer L. Jenkins //
Palmer L. Jenkins (Acting Superintendent)

Enclosure (with attachments)

cc: Statutory Compliance File

*The signed original of this document is on file at the
Environmental Planning and Compliance Office in
Yosemite National Park.*



Categorical Exclusion Form

Project: 2017-012 Parkwide Emergency Road Repairs

PEPC Project Number: 72117

Description of Action (Project Description):

This emergency repair project includes storm damage repairs on four of the primary roads in Yosemite National Park (Big Oak Flat Road, Wawona Road, Valley Loop Road, and El Portal Road). There are 19 locations needing repair, the specific repairs include:

- Embankment stabilization
- Reconstructing sections of the existing stone guard walls and curbs
- Replacing damaged roadway pavement
- Cleaning of culverts and repairing headwalls
- Replacement of undersized and/or failed culverts
- Removal of slide debris from drainages to re-establish the original drainage channels
- Removal of slide debris from along roadways and adjacent ditches
- Rock bolting and scaling
- Repaving shoulders and ditches and concrete curb repairs

In addition, this project will regrade many road shoulders and ditches and stabilize multiple road shoulders and ditches with rock rip rap.

Project Locations:

Mariposa County, CA
Tuolumne County, CA

Mitigation(s):

- Historic road features will be photo-documented prior to repair. Historic features to be rebuilt using in-kind materials and methods.
- The project manager must consult the appropriate district ranger before creating a traffic control/delay plan for each site.
- Contract will include specifications for inspection and approval of sources of rock, gravel, soil, and other types of earth material proposed for use on this project, in order to prevent introduction of nonnative plant propagules.
- Contract will include specifications for cleaning, inspection, and approval of earth moving equipment prior to entering the park, in order to prevent introduction of nonnative plant propagules.

CE Citation: C.9 Repair, resurfacing, striping, installation of traffic control devices, repair/replacement of guardrails, etc., on existing roads.

CE Justification:

Decision: I find that the action fits within the categorical exclusion above. Therefore, I am categorically excluding the described project from further NEPA analysis. No extraordinary circumstances apply.

Superintendent: // Palmer L. Jenkins //

Date: 4/24/2017

Palmer L. Jenkins (Acting Superintendent)

Extraordinary Circumstances:

If implemented, would the proposal...	Yes/No	Notes
A. Have significant impacts on public health or safety?	No	
B. Have significant impacts on such natural resources and unique geographic characteristics as historic or cultural resources; park, recreation, or refuge lands; wilderness areas; wild or scenic rivers; national natural landmarks; sole or principal drinking water aquifers; prime farmlands; wetlands (Executive Order 11990); floodplains (Executive Order 11988); national monuments; migratory birds; and other ecologically significant or critical areas?	No	
C. Have highly controversial environmental effects or involve unresolved conflicts concerning alternative uses of available resources (NEPA section 102(2)(E))?	No	
D. Have highly uncertain and potentially significant environmental effects or involve unique or unknown environmental risks?	No	
E. Establish a precedent for future action or represent a decision in principle about future actions with potentially significant environmental effects?	No	
F. Have a direct relationship to other actions with individually insignificant, but cumulatively significant, environmental effects?	No	
G. Have significant impacts on properties listed or eligible for listing on the National Register of Historic Places, as determined by either the bureau or office?	No	
H. Have significant impacts on species listed or proposed to be listed on the List of Endangered or Threatened Species, or have significant impacts on designated Critical Habitat for these species?	No	
I. Violate a federal, state, local or tribal law or requirement imposed for the protection of the environment?	No	
J. Have a disproportionately high and adverse effect on low income or minority populations (EO 12898)?	No	
K. Limit access to and ceremonial use of Indian sacred sites on federal lands by Indian religious practitioners or adversely affect the physical integrity of such sacred sites (EO 130007)?	No	
L. Contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of such species (Federal Noxious Weed Control Act and Executive Order 13112)?	No	



ENVIRONMENTAL SCREENING FORM (ESF)

Updated Sept 2015 per NPS NEPA Handbook

A. PROJECT INFORMATION

Project Title: 2017-012 Parkwide Emergency Road Repairs
PEPC Project Number: 72117
Project Type: Repair/Rehabilitation (REHAB)
Project Location:
 County, State: Mariposa, California
 County, State: Tuolumne, California
Project Leader: Michael Pieper

B. RESOURCE IMPACTS TO CONSIDER:

Resource	Potential for Impact	Potential Issues & Impacts
Air Air Quality	None	
Biological Nonnative or Exotic Species	Potential	To prevent the introduction of nonnative plant propagules, the contract will include specifications for inspection and approval of sources of fill material (e.g. rock, gravel, soil) being used on this project, as well as specifications for cleaning and inspection of equipment.
Biological Species of Special Concern or Their Habitat	None	
Biological Vegetation	None	
Biological Wildlife and/or Wildlife Habitat including terrestrial and aquatic species	None	
Cultural Archeological Resources	None	
Cultural Cultural Landscapes	None	
Cultural Ethnographic Resources	Potential	El Portal Road mile post 0.6 is near an identified ethnographic site named Bear Guardian Rock. The project will not affect the site and recommendations have been made for the project to not stage or perform work near this site. El Portal Road mile post 4.5 is near an identified ethnographic site named Jerky Rock. The project will not affect the site and recommendations have been made for the project to not stage or perform work near this site. No other recorded ethnographic sites are near

Resource	Potential for Impact	Potential Issues & Impacts
		the proposed project areas. Tribal notification sent via Tribal Spreadsheet in May 2017.
Cultural Museum Collections	None	
Cultural Prehistoric/historic structures	None	
Geological Geologic Features	Potential	There will be digging within road prisms to remove and replace failed pavement and culverts and to repair ditches and embankments. Fill will be replaced in areas it has been washed away.
Geological Geologic Processes	None	
Lightscapes Lightscapes	None	
Other Human Health and Safety	Potential	This project will improve the safety of the primary road ways in Yosemite National Park.
Other Operational	Potential	There is the potential for temporary lane closures and traffic delays while repairs are taking place.
Socioeconomic Land Use	None	
Socioeconomic Minority and low- income populations, size, migration patterns, etc.	None	
Socioeconomic Socioeconomic	None	
Soundscapes Soundscapes	Potential	There will be temporary use of heavy equipment and drills during regular working hours until repairs are complete.
Viewsheds Viewsheds	None	
Visitor Use and Experience Recreation Resources	None	
Visitor Use and Experience Visitor Use and Experience	Potential	During road repairs there is the potential for traffic delays or lane closures.
Water Floodplains	None	
Water Marine or Estuarine Resources	None	

Resource	Potential for Impact	Potential Issues & Impacts
Water Water Quality or Quantity	None	
Water Wetlands	None	
Water Wild and Scenic River	None	
Wilderness Wilderness	None	



ASSESSMENT OF ACTIONS HAVING AN EFFECT ON HISTORIC PROPERTIES

A. DESCRIPTION OF UNDERTAKING

1. **Park:** Yosemite National Park

2. **Project Description:**

Project Name: 2017-012 Parkwide Emergency Road Repairs

Prepared by: Kristin Anderson **Date Prepared:** 04/19/2017 **Telephone:** 209-379-1002

PEPC Project Number: 72117

Locations:

County, State: Mariposa, CA

County, State: Tuolumne, CA

Area of potential effects (as defined in 36 CFR 800.16[d])

Work will be occurring in 19 different locations along major park roads including Big Oak Flat Road, Wawona Road, El Portal Road, and the Valley Loop Road.

3. **Has the area of potential effects been surveyed to identify historic properties?**

☐ No
☒ Yes

Source or reference: Merced River Flood Recovery (various surveys)

4. **Potentially Affected Resource(s):**

Archeological resources affected:

Name and number(s): Yosemite Valley Archeological District

NR status: 1 - Listed in Register and documented

Name and number(s): Merced Canyon Travel Corridor

NR status: 5 - Found eligible for 106 purposes through consultation with the SHPO

Historical Structures/Resources Affected:

Name and number(s): Yosemite Valley Historic District

NR status: 1 - Listed in Register and documented

Name and number(s): Merced Canyon Travel Corridor

NR status: 5 - Found eligible for 106 purposes through consultation with the SHPO

Name and number(s): Big Oak Flat Road Historic District

Historical Structures/Resources Notes: Wawona Road has not been formally determined eligible but is treated as such by the park under the 99 PA.

Ethnographic Resources Affected Notes: El Portal Road Mile Post 0.6 is near an identified Ethnographic

Assessment of Effect Form - Parkwide Emergency Road Repairs - PEPC ID: 72117

Site named Bear Guardian Rock. The project will not affect the site and recommendations have been made for the project to not stage or perform work near this site. El Portal Road Mile Post 4.5 is near an identified Ethnographic Site named Jerky Rock. The project will not affect the site and recommendations have been made for the project to not stage or perform work near this site. No other recorded ethnographic sites are near the proposed project areas.

5. The proposed action will: (check as many as apply)

- ☐ No Destroy, remove, or alter features/elements from a historic structure
- ☐ Yes Replace historic features/elements in kind
- ☐ Yes Add non-historic features/elements to a historic structure
- ☐ No Alter or remove features/elements of a historic setting or environment (inc. terrain)
- ☐ No Add non-historic features/elements (inc. visual, audible, or atmospheric) to a historic setting or cultural landscape
- ☐ No Disturb, destroy, or make archeological resources inaccessible
- ☐ No Disturb, destroy, or make ethnographic resources inaccessible
- ☐ Yes Potentially affect presently unidentified cultural resources
- ☐ No Begin or contribute to deterioration of historic features, terrain, setting, landscape elements, or archeological or ethnographic resources
- ☐ No Involve a real property transaction (exchange, sale, or lease of land or structures)
- ☐ Other (please specify): _____

6. Supporting Study Data:

(Attach if feasible; if action is in a plan, EA or EIS, give name and project or page number.)

B. REVIEWS BY CULTURAL RESOURCE SPECIALISTS

The park 106 coordinator requested review by the park's cultural resource specialist/advisors as indicated by check-off boxes or as follows:

☒ [X] 106 Advisor

Name: Kimball Koch

Date: 04/19/2017

Comments: Based on the CRM team's assessment, this project will not adversely affect known historic/cultural resources.

Check if project does not involve ground disturbance ☐ []

Assessment of Effect: ☐ No Potential to Cause Effect ☐ No Historic Properties Affected ☒ X No

Adverse Effect ☐ Adverse Effect ☐ Streamlined Review

Recommendations for conditions or stipulations:

☒ [X] Anthropologist

Name: Eirik Thorsgard

Date: 04/19/2017

Comments: El Portal Road Mile Post 0.6 is near an identified Ethnographic Site named Bear Guardian Rock. The project will not affect the site and recommendations have been made for the project to not stage or perform work near this site. El Portal Road Mile Post 4.5 is near an identified Ethnographic Site named Jerky Rock. The project will not affect the site and recommendations have been made for the project to not stage or perform work near this

site. No other recorded ethnographic sites are near the proposed project areas. Tribal notification sent via Tribal Spreadsheet on May 2017 TSS.

Check if project does not involve ground disturbance ☐

Assessment of Effect: ☐ No Potential to Cause Effect ☐ No Historic Properties Affected ☒ No

Adverse Effect ☐ Adverse Effect ☐ Streamlined Review

Recommendations for conditions or stipulations:

☒ Archeologist

Name: Scott Carpenter

Date: 04/19/2017

Check if project does not involve ground disturbance ☐

Assessment of Effect: ☐ No Potential to Cause Effect ☒ No Historic Properties Affected ☐ No

Adverse Effect ☐ Adverse Effect ☐ Streamlined Review

Recommendations for conditions or stipulations:

Doc Method: Park Specific or Other Programmatic Agreement

☒ Historical Architect

Name: Scott Carpenter

Date: 04/19/2017

Check if project does not involve ground disturbance ☐

Assessment of Effect: ☐ No Potential to Cause Effect ☐ No Historic Properties Affected ☒ No

Adverse Effect ☐ Adverse Effect ☐ Streamlined Review

Recommendations for conditions or stipulations:

Doc Method: Park Specific or Other Programmatic Agreement

☒ Historical Landscape Architect

Name: Kimball Koch

Date: 04/19/2017

Comments: Road work is for repair following storms. No alignment changes will be made. Repair/replacement of headwalls associated with damaged culverts would be completed with in-kind materials.

Check if project does not involve ground disturbance ☐

Assessment of Effect: ☐ No Potential to Cause Effect ☐ No Historic Properties Affected ☒ No

Adverse Effect ☐ Adverse Effect ☐ Streamlined Review

Recommendations for conditions or stipulations:

Doc Method: Park Specific or Other Programmatic Agreement

No Reviews From: Curator, Historian, Other Advisor

C. PARK SECTION 106 COORDINATOR'S REVIEW AND RECOMMENDATIONS

1. Assessment of Effect:

☐ No Potential to Cause Effects
☐ No Historic Properties Affected
☒ No Adverse Effect
☐ Adverse Effect

2. Documentation Method:

☐ A. STANDARD 36 CFR PART 800 CONSULTATION

Further consultation under 36 CFR Part 800 is needed.

☐ B. STREAMLINED REVIEW UNDER THE 2008 SERVICEWIDE PROGRAMMATIC AGREEMENT (PA)

The above action meets all conditions for a streamlined review under section III of the 2008 Servicewide PA for Section 106 compliance.

APPLICABLE STREAMLINED REVIEW Criteria

(Specify 1-16 of the list of streamlined review criteria.)

☐ C. PLAN-RELATED UNDERTAKING

Consultation and review of the proposed undertaking were completed in the context of a plan review process, in accordance with the 2008 Servicewide PA and 36 CFR Part 800.

Specify plan/EA/EIS:

☒ D. UNDERTAKING RELATED TO ANOTHER AGREEMENT

The proposed undertaking is covered for Section 106 purposes under another document such as a statewide agreement established in accord with 36 CFR 800.7 or counterpart regulations.

1999 PA as amended in 2016

☐ E. COMBINED NEPA/NHPA Document

Documentation is required for the preparation of an EA/FONSI or an EIS/ROD has been developed and used so as also to meet the requirements of 36 CFR 800.3 through 800.6

☐ G. Memo to SHPO/THPO

☐ H. Memo to ACHP

SHPO/THPO Notes:

3. Additional Consulting Parties Information:

Additional Consulting Parties: No

4. Stipulations and Conditions:

Following are listed any stipulations or conditions necessary to ensure that the assessment of effect above is consistent with 36 CFR Part 800 criteria of effect or to avoid or reduce potential adverse effects.

Historic road features will be photo-documented prior to repair. Historic features to be rebuilt using in-kind materials and methods.

5. Mitigations/Treatment Measures:

Measures to prevent or minimize loss or impairment of historic/prehistoric properties:

(Remember that setting, location, and use may be relevant.)

- Assessment of Effect - Historic Structures - Historic road features will be photodocumented prior to repair. Historic features to be rebuilt using in-kind materials and methods.

D. RECOMMENDED BY PARK SECTION 106 COORDINATOR:

Historic Preservation Officer

Kimball Koch //Kimball Koch //

Date: 4/19/2017

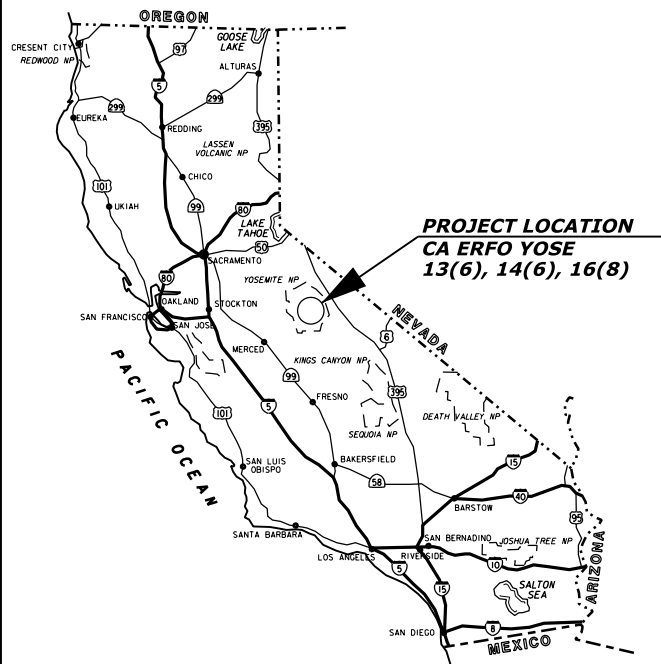
E. SUPERINTENDENT'S APPROVAL

The proposed work conforms to the NPS *Management Policies* and *Cultural Resource Management Guideline*, and I have reviewed and approve the recommendations, stipulations, or conditions noted in Section C of this form.

Superintendent: // Palmer L. Jenkins // **Date:** 4/24/2017
Palmer L. Jenkins (Acting Superintendent)

*The signed original of this document is on file at the
Environmental Planning and Compliance Office in
Yosemite National Park.*

3/23/2017 2:08:45 PM N:\CA\yose13(6)14(6)16(8)\Roadway\CADD_Sheets\A-Gen_sht\TTL-YOSE_13(6)14(6)16(8).dgn User: Michael.Daigler



KEY MAP OF CALIFORNIA

TYPE OF CONSTRUCTION:
Road repairs, embankment reconstruction, paving

U.S. CUSTOMARY DIMENSIONS:
Slopes are expressed as RISE:RUN

SPECIFICATIONS:
"STANDARD SPECIFICATIONS FOR
CONSTRUCTION OF ROADS AND BRIDGES
ON FEDERAL HIGHWAY PROJECTS, FP-14"



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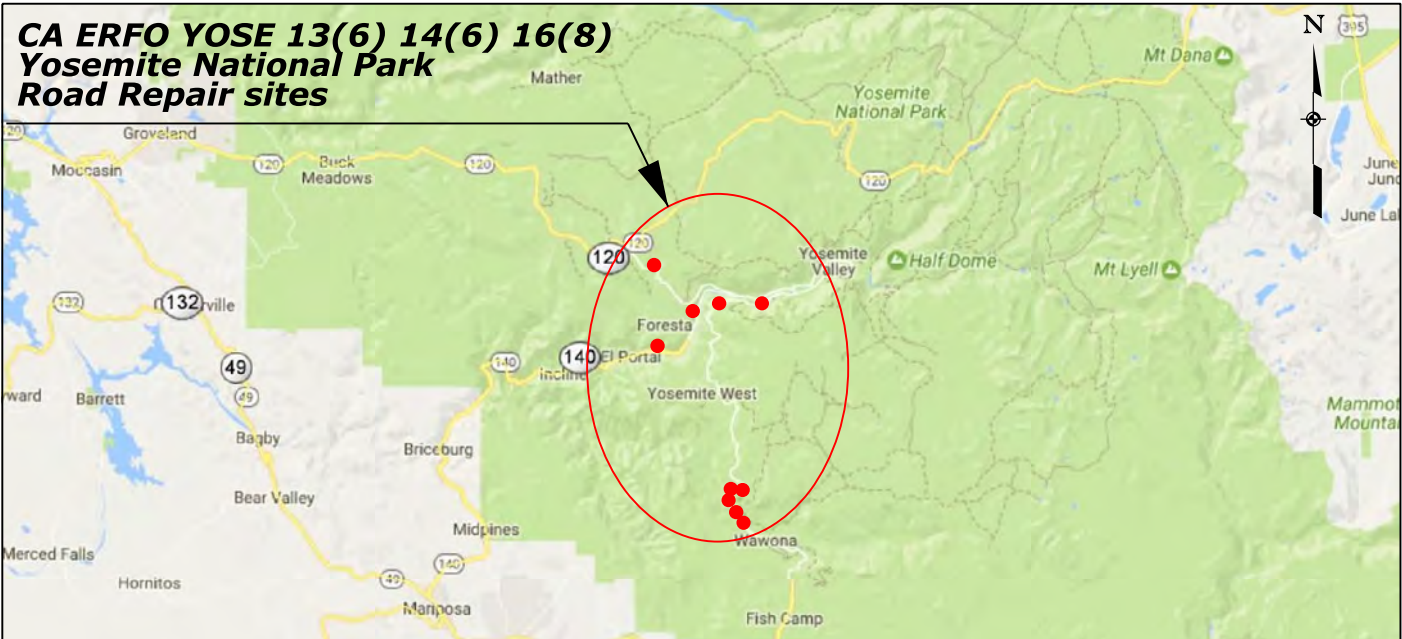
PROJECT MANAGER	LEAD DESIGNER
NATE ALLEN	MIKE DAIGLER

U.S. DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE

PLANS FOR PROPOSED

CA ERFO YOSE 13(6), 14(6), 16(8) REPAIRS AT YOSEMITE NP

YOSEMITE NATIONAL PARK
MARIPOSA COUNTY
LENGTH 0.66 miles



STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	A1

NPS PMIS NO.: 241047

INDEX TO SHEETS

SHEET	DESCRIPTION
A1	TITLE SHEET
A2	SITE MAP
B1	SUMMARY OF QUANTITIES
C1 - C6	YOSEMITE NP - ROAD REPAIR SITE PLANS
E1-E3	EROSION CONTROL DETAILS
G1	SPECIAL 252A - SPECIAL ROCK EMBANKMENT
G2	SPECIAL 260-A - ROCK BOLTING
K1	SPECIAL 403-A - ASPHALT PAVED SHOULDER
K2	SPECIAL 418A - FLEXIBLE PAVEMENT FULL DEPTH PATCH TYPE 1 & 2
T1	SPECIAL 609A - CURBS AND PAVED DITCHES
T2	DETAIL C634.50 - CENTERLINE STRIPING AND TOP LIFT PAVEMENT JOINT
V1-V4	STANDARD PLANS - TEMPORARY TRAFFIC CONTROL

PLANS PREPARED BY



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION
DENVER, COLORADO

RECOMMENDED:

CHIEF OF ENGINEERING
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

APPROVED:

SUPERINTENDENT, YOSEMITE NATIONAL PARK

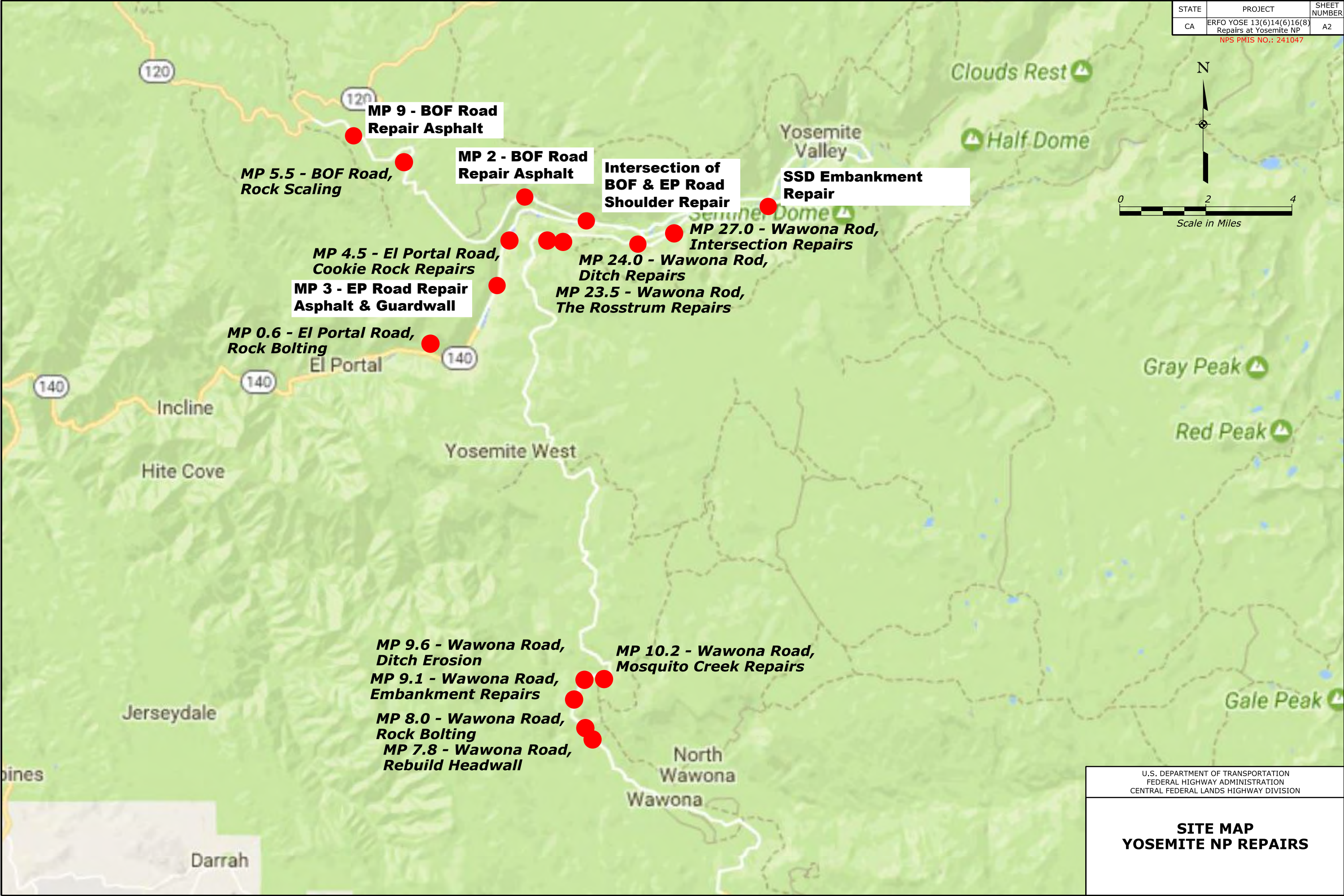
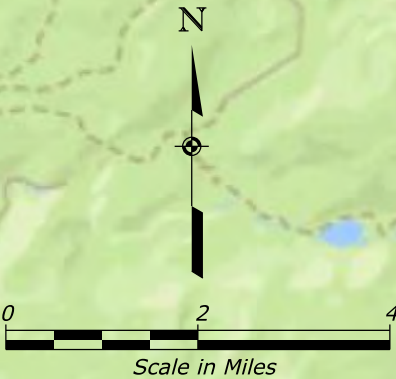
PRELIMINARY 95%
MARCH 2017
NOT FOR CONSTRUCTION

DATE: _____

DATE: _____

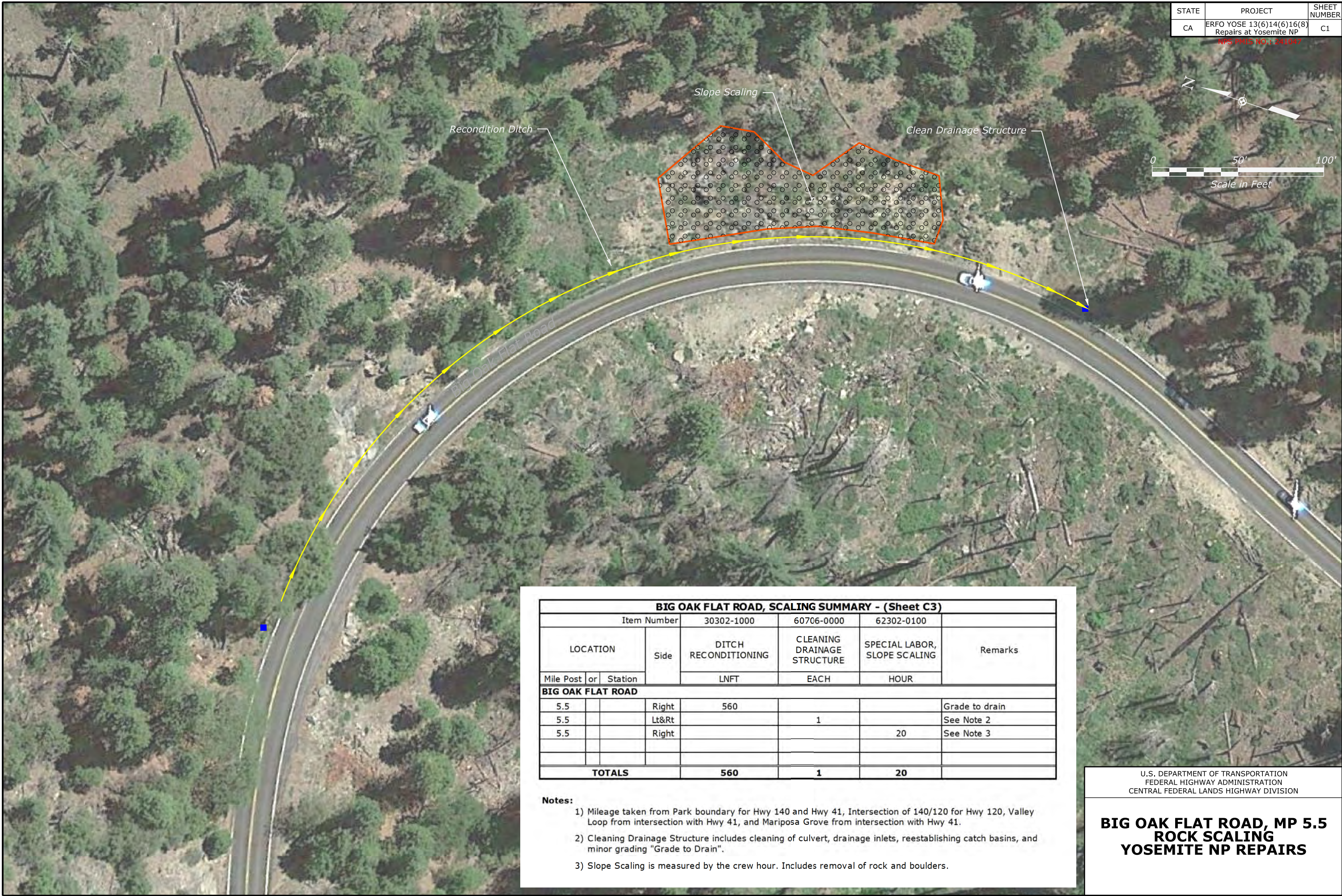
STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	A2

NPS PMIS NO.: 241047



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**SITE MAP
YOSEMITE NP REPAIRS**



STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP RPS FILE NO.: 331047	C1

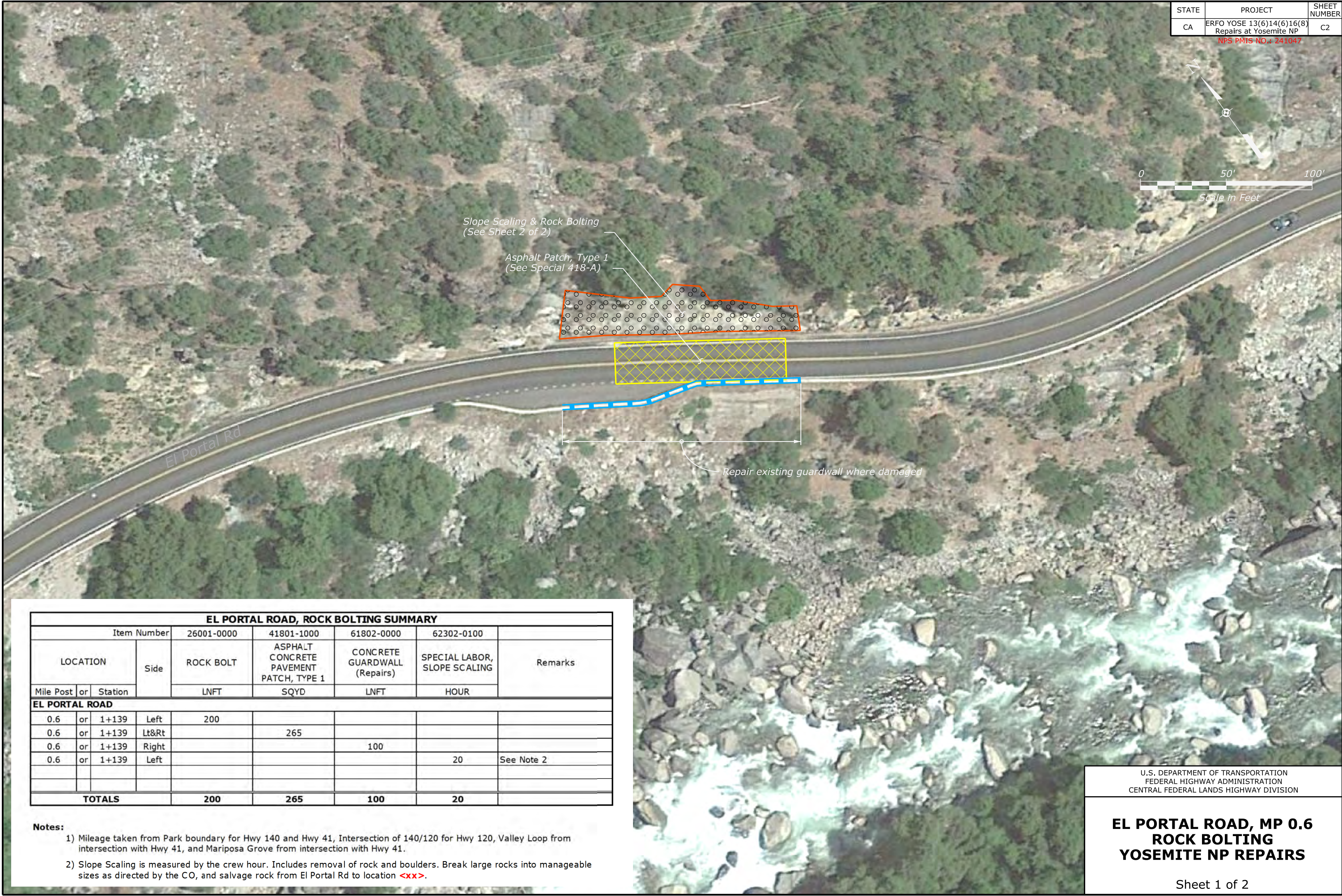
BIG OAK FLAT ROAD, SCALING SUMMARY - (Sheet C3)							
Item Number			30302-1000		60706-0000	62302-0100	
LOCATION			Side	DITCH RECONDITIONING	CLEANING DRAINAGE STRUCTURE	SPECIAL LABOR, SLOPE SCALING	Remarks
				LNFT	EACH	HOUR	
Mile Post	or	Station					
BIG OAK FLAT ROAD							
5.5			Right	560			Grade to drain
5.5			Lt&Rt		1		See Note 2
5.5			Right			20	See Note 3
TOTALS				560	1	20	

- Notes:**
- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.
 - 2) Cleaning Drainage Structure includes cleaning of culvert, drainage inlets, reestablishing catch basins, and minor grading "Grade to Drain".
 - 3) Slope Scaling is measured by the crew hour. Includes removal of rock and boulders.

U.S. DEPARTMENT OF TRANSPORTATION
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CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**BIG OAK FLAT ROAD, MP 5.5
ROCK SCALING
YOSEMITE NP REPAIRS**

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP NPS PMIS NO. J 241047	C2



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**EL PORTAL ROAD, MP 0.6
ROCK BOLTING
YOSEMITE NP REPAIRS**

EL PORTAL ROAD, ROCK BOLTING SUMMARY								
Item Number				26001-0000	41801-1000	61802-0000	62302-0100	
LOCATION			Side	ROCK BOLT	ASPHALT CONCRETE PAVEMENT PATCH, TYPE 1	CONCRETE GUARDWALL (Repairs)	SPECIAL LABOR, SLOPE SCALING	Remarks
Mile Post	or	Station		LNFT	SQYD	LNFT	HOURL	
EL PORTAL ROAD								
0.6	or	1+139	Left	200				
0.6	or	1+139	Lt&Rt		265			
0.6	or	1+139	Right			100		
0.6	or	1+139	Left				20	See Note 2
TOTALS				200	265	100	20	

Notes:

- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.
- 2) Slope Scaling is measured by the crew hour. Includes removal of rock and boulders. Break large rocks into manageable sizes as directed by the CO, and salvage rock from El Portal Rd to location <xx>.

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	C3

NPS PMIS NO.: 241047



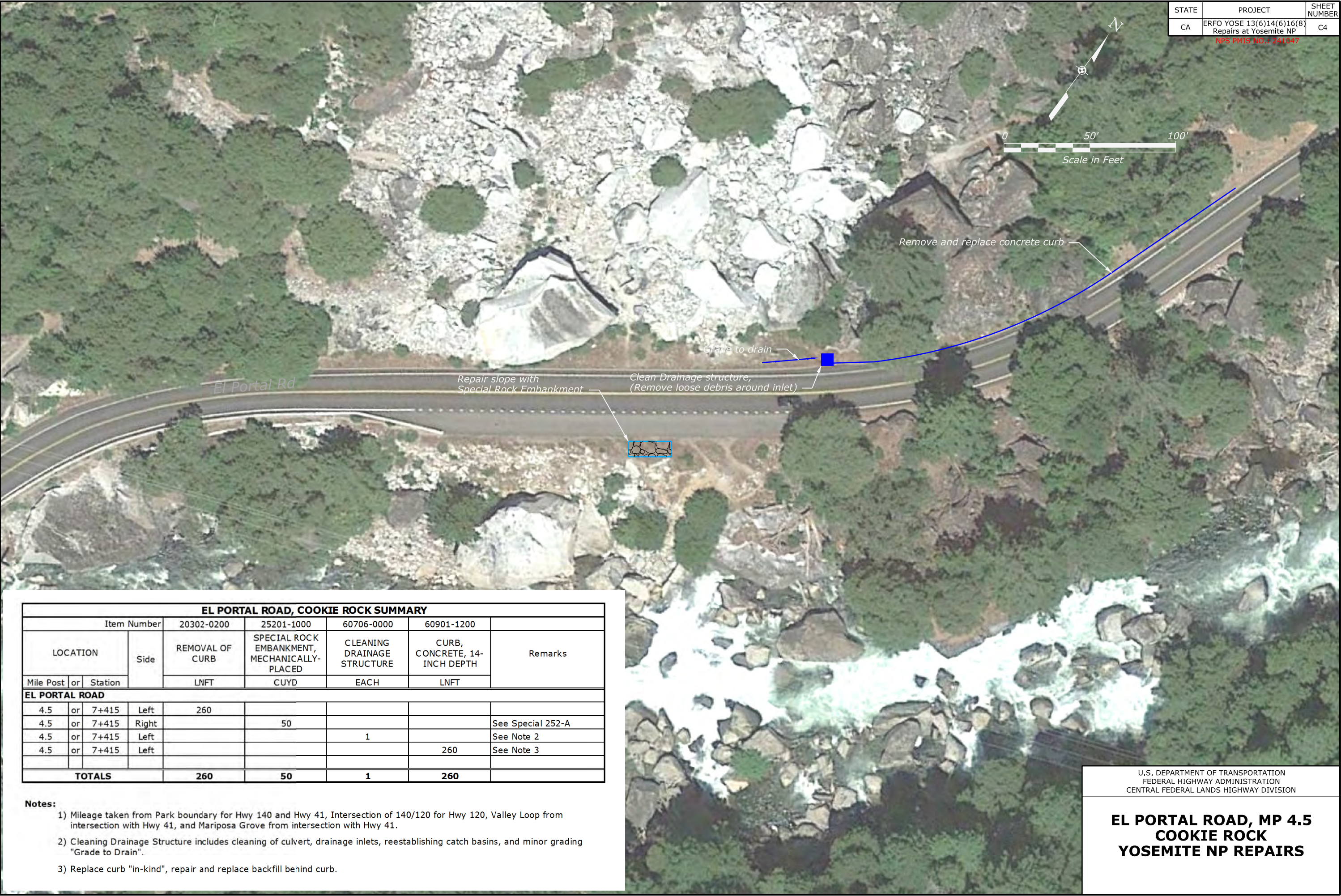
Photo 1: El Portal rock bolt location



Photo 2: El Portal rock bolt location

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**EL PORTAL ROAD, MP 0.6
ROCK BOLTING
YOSEMITE NP REPAIRS**



STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP NPS PMIS NO. J 341047	C4

EL PORTAL ROAD, COOKIE ROCK SUMMARY								
Item Number				20302-0200	25201-1000	60706-0000	60901-1200	
LOCATION			Side	REMOVAL OF CURB	SPECIAL ROCK EMBANKMENT, MECHANICALLY-PLACED	CLEANING DRAINAGE STRUCTURE	CURB, CONCRETE, 14-INCH DEPTH	Remarks
				Mile Post	or	Station	LNFT	
EL PORTAL ROAD								
4.5	or	7+415	Left	260				
4.5	or	7+415	Right		50			See Special 252-A
4.5	or	7+415	Left			1		See Note 2
4.5	or	7+415	Left				260	See Note 3
TOTALS				260	50	1	260	

Notes:

- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.
- 2) Cleaning Drainage Structure includes cleaning of culvert, drainage inlets, reestablishing catch basins, and minor grading "Grade to Drain".
- 3) Replace curb "in-kind", repair and replace backfill behind curb.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

EL PORTAL ROAD, MP 4.5
COOKIE ROCK
YOSEMITE NP REPAIRS

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	C5

NPS PMIS NO.: 241047



Place Riprap, class 2
Rebuild Stone Masonry Headwall
(Salvage and reuse existing rock)
Asphalt Concrete Patch, Type 1

WAWONA ROAD, HEADWALL REBUILD SUMMARY								
Item Number				25101-0200	41801-1000	60706-0000	62011-0500	Remarks
LOCATION		Side		PLACED RIPRAP, METHOD A, CLASS 2	ASPHALT CONCRETE PAVEMENT PATCH, TYPE 1	CLEANING DRAINAGE STRUCTURE	STONE MASONRY HEADWALL FOR 24-INCH PIPE CULVERT	
				CUYD	SQYD	EACH	EACH	
Mile Post	or	Station						
EL PORTAL ROAD								
4.5	or	7+415	Left	1.4				
4.5	or	7+415	Right		10			See Special 418-A
4.5	or	7+415	Left			1		See Note 2
4.5	or	7+415	Left				1	Salvage & reuse rock
TOTALS				1.4	10	1	1	

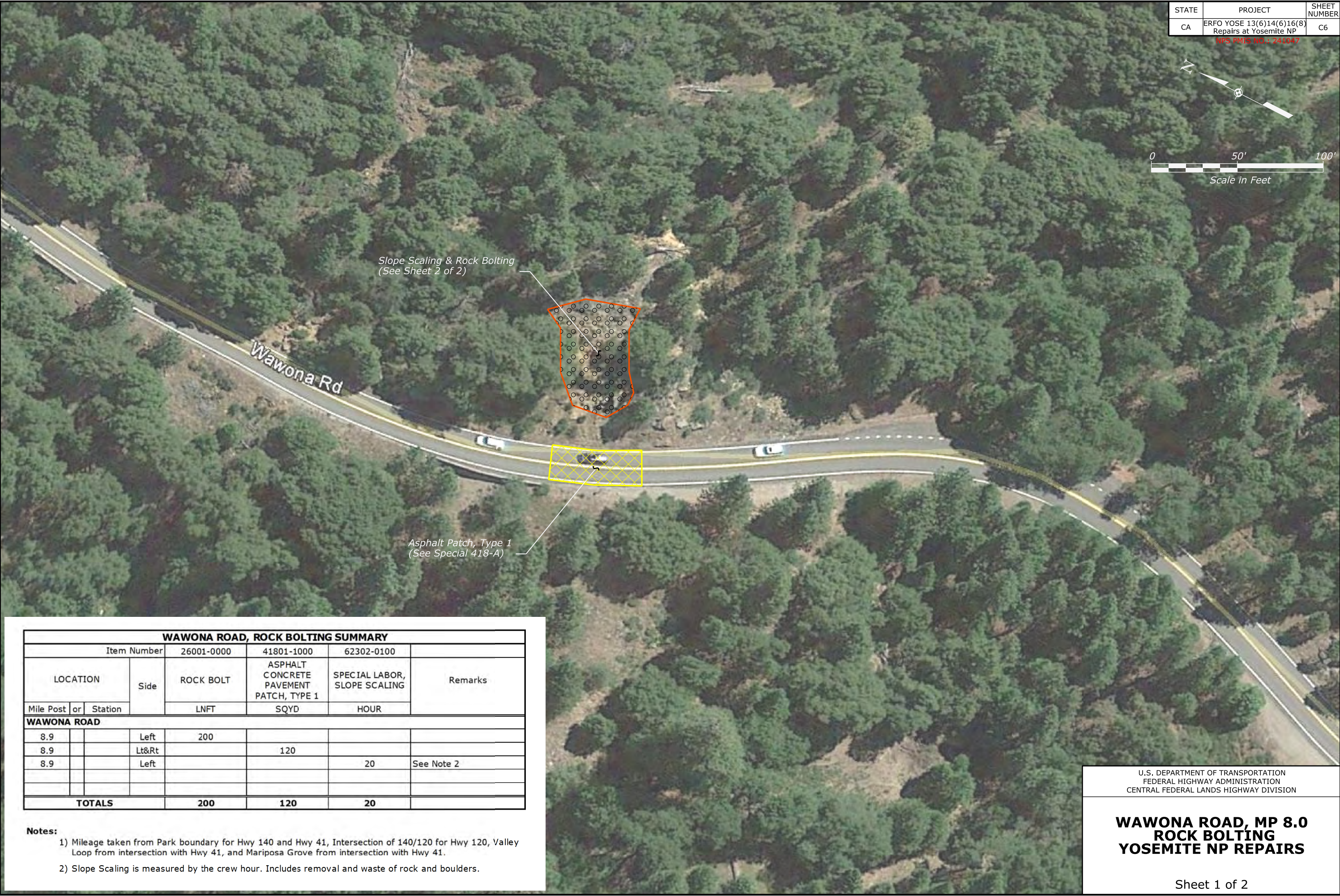
Notes:

- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.
- 2) Cleaning Drainage Structure includes cleaning of culvert, drainage inlets, reestablishing catch basins, and minor grading "Grade to Drain".

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

WAWONA ROAD, MP 7.8
HEADWALL REBUILD
YOSEMITE NP REPAIRS

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP <small>KPS PMIS #13-241047</small>	C6



WAWONA ROAD, ROCK BOLTING SUMMARY							
Item Number			26001-0000	41801-1000	62302-0100		
LOCATION		Side	ROCK BOLT	ASPHALT CONCRETE PAVEMENT PATCH, TYPE 1	SPECIAL LABOR, SLOPE SCALING	Remarks	
			LNFT	SQYD	HOUR		
WAWONA ROAD							
8.9			Left	200			
8.9			Lt&Rt		120		
8.9			Left			20	See Note 2
TOTALS			200	120	20		

Notes:

- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.
- 2) Slope Scaling is measured by the crew hour. Includes removal and waste of rock and boulders.

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

WAWONA ROAD, MP 8.0
ROCK BOLTING
YOSEMITE NP REPAIRS

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	C7

NPS PMIS NO.: 241047



Photo 1: Wawona rock bolt location



Photo 2: Wawona rock bolt location

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**WAWONA ROAD, MP 8.0
ROCK BOLTING
YOSEMITE NP REPAIRS**

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP <small>RF# PMIS 83-1 241047</small>	C8



Remove and replace pavement and
base "in-kind" for full lane width

Repair slope with
Special Rock Embankment



WAWONA ROAD, EMBANKMENT REPAIR SUMMARY							
Item Number				25201-1000	30202-2000	40301-0000	
LOCATION			Side	SPECIAL ROCK EMBANKMENT, MECHANICALLY-PLACED	ROADWAY AGGREGATE, METHOD 2	ASPHALT CONCRETE PAVEMENT	Remarks
				CUYD	TON	TON	
Mile Post	or	Station					
WAWONA ROAD							
9.1			Left	450			
9.1			Left		42		
9.1			Left			30	
TOTALS				450	42	30	

Notes:

- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.
- 2) Pavement removal is considered subsidiary to Special Rock Embankment.

U.S. DEPARTMENT OF TRANSPORTATION
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CENTRAL FEDERAL LANDS HIGHWAY DIVISION

WAWONA ROAD, MP 9.1
EMBANKMENT REPAIRS
YOSEMITE NP REPAIRS



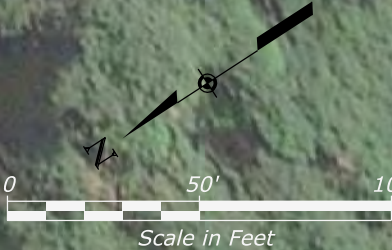
Shoulder and Ditch Reconditioning
(Supplement with Aggregate Base
as directed by the CO)

WAWONA ROAD, DITCH EROSION SUMMARY						
Item Number			30202-2000	30302-3000		
LOCATION			Side	ROADWAY AGGREGATE, METHOD 2	SHOULDER AND DITCH RECONDITIONING	Remarks
				TON	LNFT	
Mile Post	or	Station				
EL PORTAL ROAD						
9.6			Right	100		
9.6			Right		500	
TOTALS				100	500	

Notes:

- 1) Mileage taken from Park boundary for Hwy 140 and Hwy 41, Intersection of 140/120 for Hwy 120, Valley Loop from intersection with Hwy 41, and Mariposa Grove from intersection with Hwy 41.

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP NPS PMIS NO. 1 241047	C9



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

WAWONA ROAD, MP 9.6
DITCH EROSION
YOSEMITE NP REPAIRS

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	C10

NPS PMIS NO.: 241047



Pave 10' wide drainage flume leading into 10' wide riprap rundown. Existing rock can be salvaged for use onsite. Will also require embankment to replace eroded material between parking area and the drainage area. Existing spoils piles on Wawona road from road crews could be used for fill. Cover with RECP.

Pave 15' wide parking area adjacent to roadway and 10' roadway aggregate shoulder.

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CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**WAWONA ROAD, MP 10.2
MOSQUITO CREEK
YOSEMITE NP REPAIRS**



STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	C11

NPS PMIS NO.: 241047

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**WAWONA ROAD, MP 23.5
THE ROSSTRUM
YOSEMITE NP REPAIRS**

General Note: Photo document existing headwalls and reconstruct to match existing stone headwall style, type of stone and joints, where reasonably possible.

Add a new 24" CMP overflow culvert. Add stone to existing headwall and shotgun outlet. (Ensure riprap stabilized slope below outfall to match existing)

Repair existing paved ditch

Replace existing 18" CMP with Two New 36" CMP's With Bituminous Coating. Reconstruct stone headwall on inlet side and shotgun outlet side (Ensure Rip Rap Stabilized Slope Below Outfall)

End reconstruct asphalt paved shoulder (see Special 403-A)

Curb backfill

Place riprap at eroded embankment area

Locate & clean culvert inlet at ponding area

Place riprap at eroded culvert outlet

Place riprap at eroded embankment area

Rebuild headwall at culvert inlet

Rebuild Wingwall at culvert inlet

Start reconstruct asphalt paved shoulder (see Special 403-A)

Replace existing 24" CMP-Stove Pipe with new 24" CMP Culvert With Bituminous Coating. Reconstruct stone headwall on inlet side and shotgun outlet side (Ensure Rip Rap Stabilized Slope Below Outfall)

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	C13

NPS PMIS NO.: 241047



Southside Drive

Place Riprap to
backfill eroded road
embankment

Clean culvert inlet area
of debris

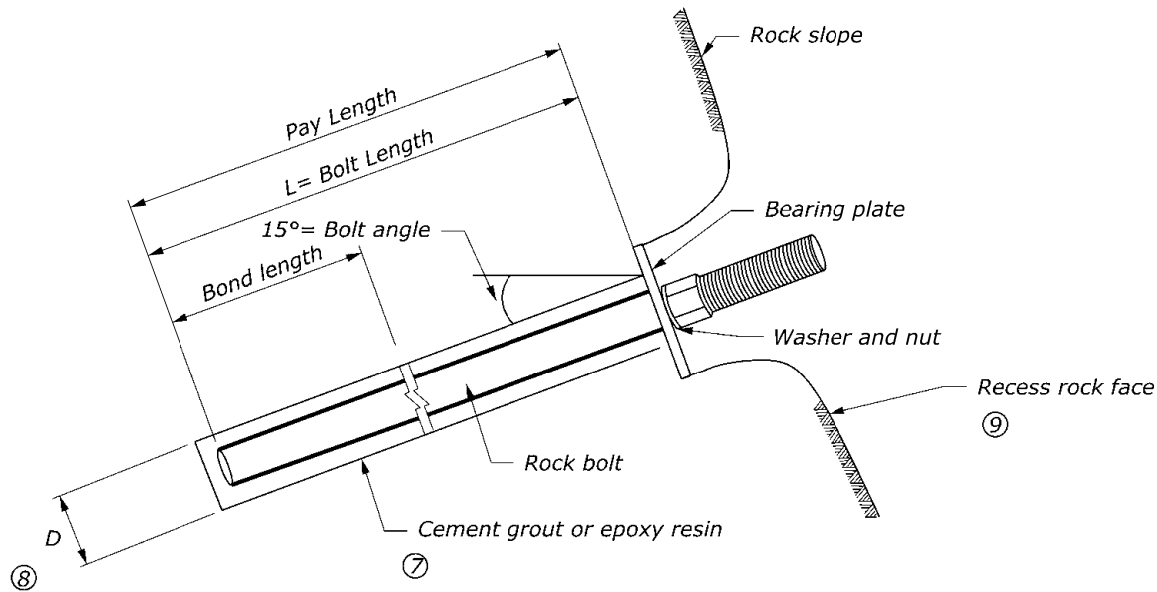
Curb Backfill

Wawona Road

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

**WAWONA ROAD, MP 27.0
INTERSECTION REPAIRS
YOSEMITE NP REPAIRS**

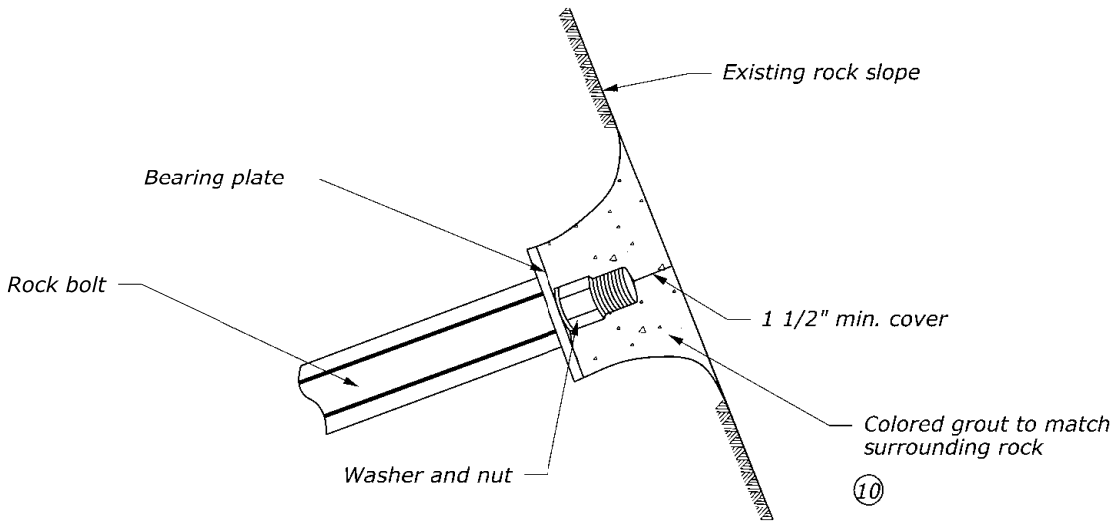
STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	G2
NPS PMIS NO.: 241047		



TYPICAL ROCK BOLT

- NOTE:
1. Use threaded, #8 - grade 75, epoxy coated reinforcement bars. Install bolts following the min. required active support parameters table.
 2. Locations, lengths, hole diameter and quantities of rock bolts to be determined during construction by the CO.
 3. Use 6 inch x 6 inch x 1/2 inch thick mild steel bearing plates.
 4. Install rock bolts to a length of 15 feet at the location designated in the plans or as directed by the CO. Locations and bolt length may be adjusted during construction.
 5. Use end hardware that is epoxy coated in the field in a color approved by the CO.
 6. Install bearing plates in direct contact with the rock slope or as directed by the CO.
 7. Use cement grout or epoxy resin for the installation of the rock dowels.
 8. Submit proposed bore diameter.
 9. Recess rock face so that all end hardware can be concealed with colored grout
 10. Submit color sample for approval prior to final application. Two colors likely necessary.

Minimum Required Active Support Parameters			
Design Element	UNIT	SITE 1	SITE 6
		El Portal	Wawona
Downward Bolt Angle	DEGREES	15	15
Minimum Bolt Length	LNFT	15	15
Minimum Bond Length	LNFT	8.5	8
Minimum Lock Off Load	KIPS	10	10



TYPICAL ROCK BOLT FINISHING DETAIL

NO SCALE

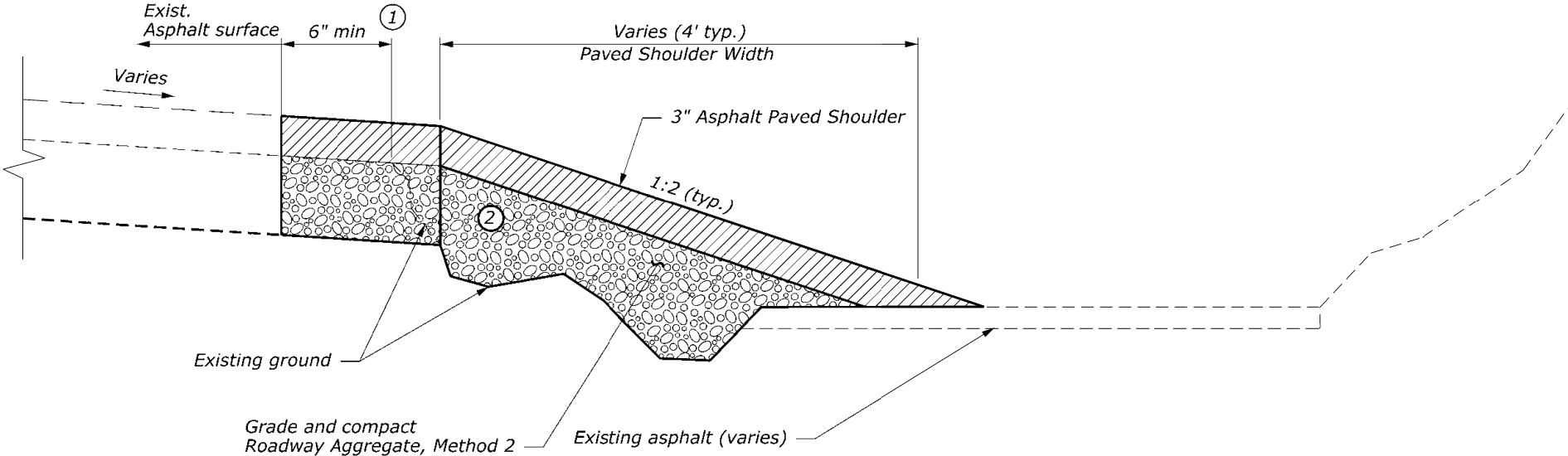
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION	
U.S. CUSTOMARY SPECIAL	
ROCK BOLTS	
	SPECIAL
	260-A

STATE	PROJECT	SHEET NUMBER
CA	ERFO YOSE 13(6)14(6)16(8) Repairs at Yosemite NP	K1

NOTE:

- ① Sawcut or clean edge and apply Tack as directed by CO.

Match the existing roadway pavement section and slope in areas where the shoulder is sawcut and replaced.
- ② Remove any loose damaged asphalt remaining within the existing ditch as directed by CO.



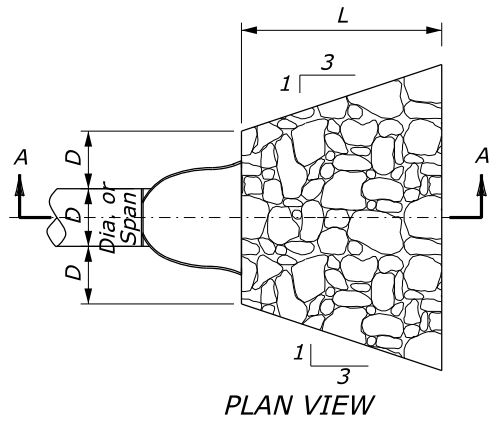
NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION	
U.S. CUSTOMARY SPECIAL	
ASPHALT PAVED SHOULDER	
	SPECIAL
	403-A

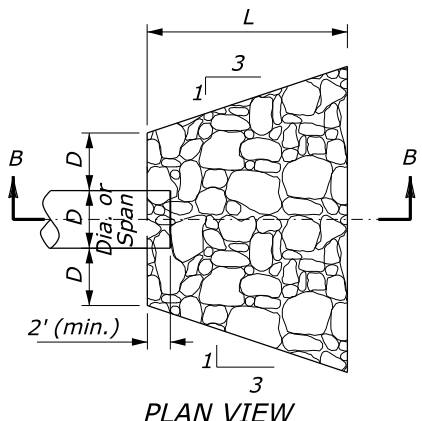
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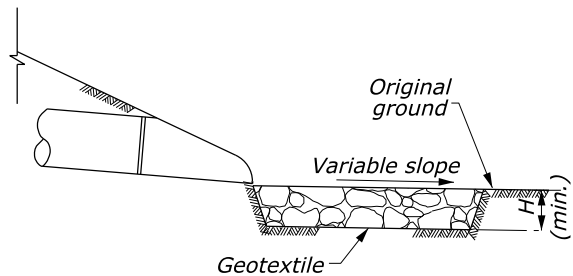
9/22/2014



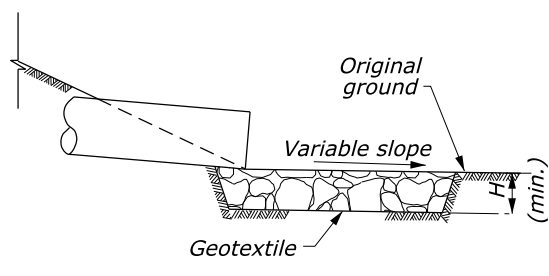
CULVERT WITH STANDARD
END SECTION



CULVERT WITHOUT STANDARD
END SECTION

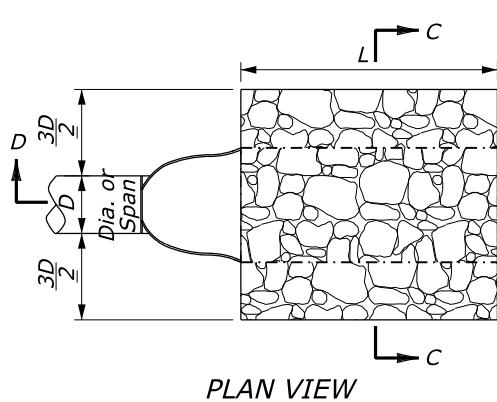


SECTION A-A

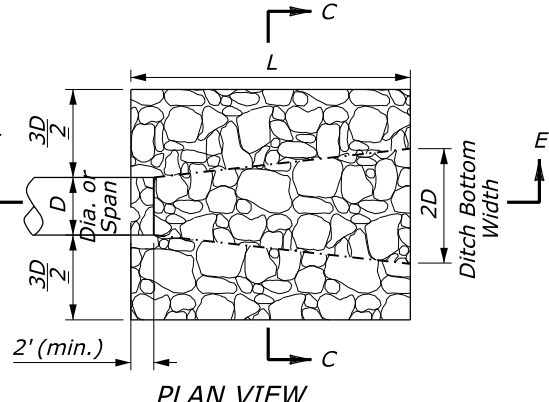


SECTION B-B

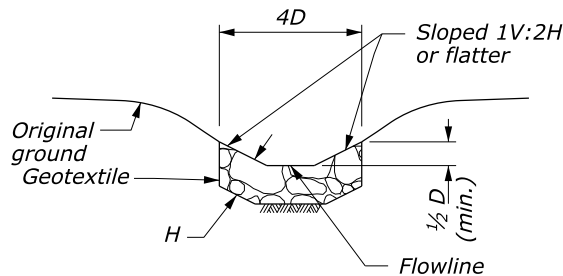
**PROTECTIVE APRON AT CULVERT OUTLET
WITHOUT DITCH**



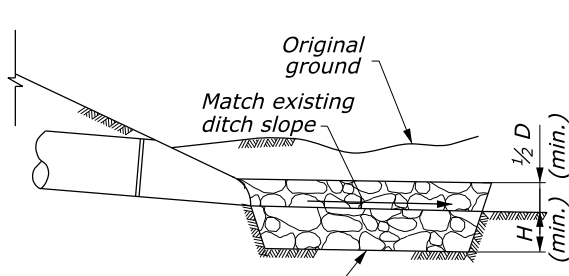
CULVERT WITH STANDARD
END SECTION



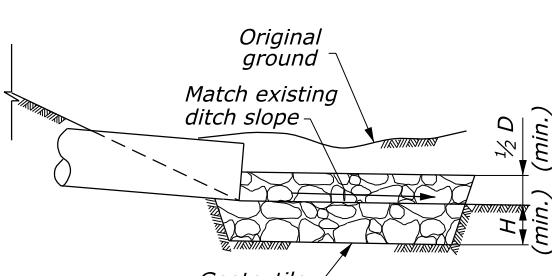
CULVERT WITHOUT STANDARD
END SECTION



SECTION C-C



SECTION D-D



SECTION E-E

**PROTECTIVE APRON AT CULVERT OUTLET
WITH DITCH**

OUTLET WITHOUT DITCH PROTECTIVE APRON DIMENSIONS AND ESTIMATED QUANTITIES						
	CULVERT SIZE D (inches)	RIPRAP CLASS	LENGTH OF APRON L (feet)	DEPTH OF APRON H (feet)	ESTIMATED RIPRAP QUANTITY (CY)	ESTIMATED GEOTEXTILE QUANTITY (SY)
WITH END SECTION	12	2	4	1.5	1	5
	18	2	6	1.5	2.2	9
	24	2	8	1.5	3.9	14
	30	3	12.5	2	10.9	28
	36	3	16	2	15.6	37
	42	4	21	2.5	34.1	63
WITHOUT END SECTION	48	4	24	2.5	44.5	79
	12	2	6	1.5	1.7	8
	18	2	8	1.5	3.2	12
	24	2	10	1.5	5.2	17
	30	3	14.5	2	13.3	33
	36	3	17	2	18.5	43
	42	4	23	2.5	38.7	70
	48	4	26	2.5	49.8	87

NOTE:

1. Use for aprons serving culverts with slopes of less than 10%.
2. Furnish geotextile conforming to Subsection 714.01(a).
3. Excavation for placement of riprap will not be measured for payment.

OUTLET WITH DITCH PROTECTIVE APRON DIMENSIONS AND ESTIMATED QUANTITIES						
	CULVERT SIZE D (inches)	RIPRAP CLASS	LENGTH OF APRON L (feet)	DEPTH OF APRON H (feet)	ESTIMATED RIPRAP QUANTITY (CY)	ESTIMATED GEOTEXTILE QUANTITY (SY)
WITH END SECTION	12	2	4	1.5	0.9	5
	18	2	6	1.5	2	8
	24	2	8	1.5	3.6	13
	30	3	12.5	2	9.3	24
	36	3	15	2	13.4	32
	42	4	21	2.5	27.3	53
WITHOUT END SECTION	48	4	24	2.5	35.6	65
	12	2	6	1.5	1.4	6
	18	2	8	1.5	2.7	10
	24	2	10	1.5	4.5	15
	30	3	14.5	2	10.8	27
	36	3	17	2	15.2	36
	42	4	23	2.5	29.9	57
	48	4	26	2.5	38.6	70

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION CENTRAL FEDERAL LANDS HIGHWAY DIVISION	
U.S. CUSTOMARY DETAIL	
PLACED RIPRAP AT CULVERT OUTLETS	
DETAIL APPROVED FOR USE	DETAIL
REVISED: 08/2014	C251-50



NOTES TO THE DESIGNER

Last Updated: August 2014

General Information

1. **Maximum slope.** Riprap aprons shown in this drawing can be used for culvert outlets with slopes up to 10%. For steeper applications, use alternate protective aprons, such as revet mattresses.

Applicable SCRs

1. Section 251:
<http://www.cflhd.gov/resources/design/constructspecs/scr/fp14/documents/S251-14.docx>

Typical Pay Items Used

- 25101-2200 Placed riprap, method B, class 2 and/or
- 25101-2300 Placed riprap, method B, class 3 and/or
- 25101-2400 Placed riprap, method B, class 4

- 60201-0700 [12-inch to 48-inch] pipe culvert
- 60210-0700 End section for [12-inch to 48-inch] pipe culvert

- Geotextile quantity is shown for information only

Updates

October 16, 2000

- Updated border to FLH Standard

February 2, 2005

- Updated to MicroStation V8

March 2009

- Added drawings of aprons in ditches
- Added quantity tables
- Moved riprap rundown at culvert inlet to template drawing

November 2010

- Revised Section C-C and quantity table for outlet with ditch

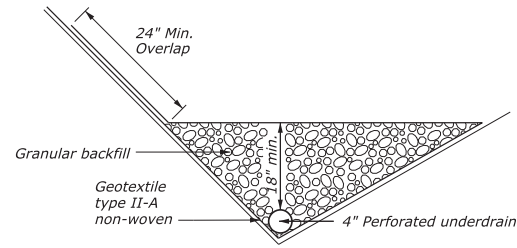
April 2011

- Eliminated riprap apron under end section

August 2014

- Updated for FP-14
- Updated border

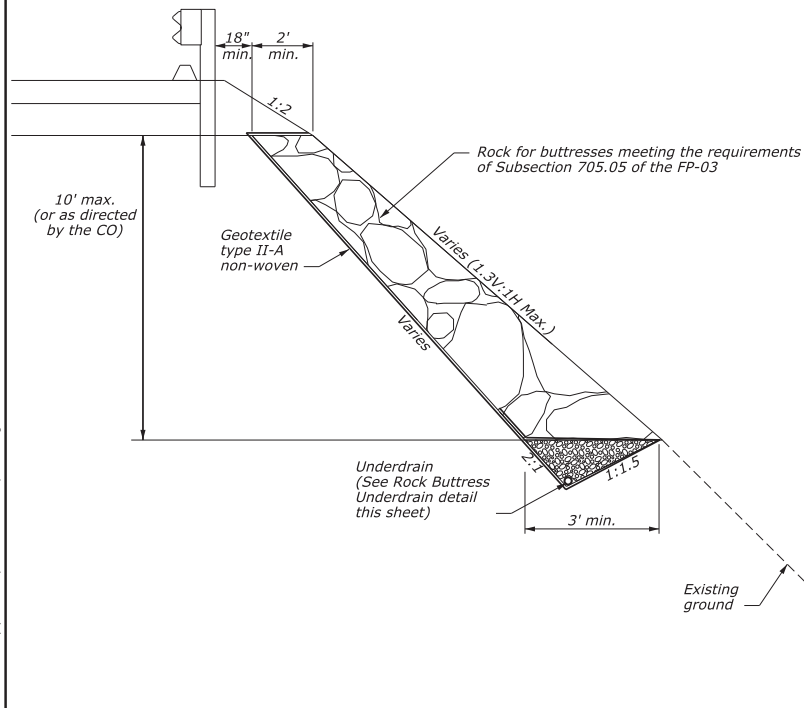
REG	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
5	CA	PFH 191-1(1) BUCHANAN RD	G7	G10



ROCK BUTTRESS UNDERDRAIN DETAIL

NOTE:

1. The height, length, and depth of rock buttress may be adjusted by the CO to suit field conditions.
2. Refer to Section 252 for more information on constructing rock buttress.
3. Slope underdrain at 2% minimum and daylight at ends of rock buttress and low points. Provide 4" non-perforated outlet pipe conforming to Subsection 605.02.
4. Cover the high end of the 4" perforated pipe with a cap and cover the outlet end with a screen according to Subsection 605.03. Secure the screen in place with standard coupling bands or by other approved means.
5. Furnish collector pipe, outlet pipe, and fittings conforming to Subsection 706.08(d).
6. Use granular backfill conforming to Subsection 703.03(a).
7. All work and materials associated with constructing rock buttress, including structure excavation, drainage pipes, granular backfill, and geotextile, will not be measured for payment but are incidental to rock buttress.



ROCK BUTTRESS TYPICAL SECTION

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

U.S. CUSTOMARY SPECIAL

ROCK BUTTRESS

NO SCALE

SPECIAL
252-A

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24 August 2015 3:46 PM

STATE	PROJECT	SHEET NUMBER

METAL ROUND PIPE CULVERT																										
FILL HEIGHT AND METAL THICKNESS TABLE FOR HELICAL LOCKSEAM AND WELDED SEAM PIPE CULVERT																										
STEEL																ALUMINUM										
PIPE SIZE DIAMETER INCHES	MINIMUM COVER INCHES	2½" x ½" CORRUGATIONS					3" x 1" CORRUGATIONS					5" x 1" CORRUGATIONS					2⅔" x ½" CORRUGATIONS					3" x 1" CORRUGATIONS				
		METAL THICKNESS (INCH/GAGE)															METAL THICKNESS (INCH/GAGE)									
		0.064/16 0.079/14 0.109/12 0.138/10 0.168/8															0.064/16 0.079/14 0.109/12 0.138/10 0.168/8									
		MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)															MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)									
12	12	100	100	100	100	100											12	12	100	100	100	100	100			
15	12	100	100	100	100	100											15	12	100	100	100	100	100			
18	12	100	100	100	100	100											18	12	100	100	100	100	100			
21	12	100	100	100	100	100											21	12	88	100	100	100	100			
24	12	100	100	100	100	100											24	12	77	97	100	100	100			
30	12	85	100	100	100	100											30	12	62	77	100	100	100			
36	12	71	89	100	100	100	81	100	100	100	100						36	12	52	64	90	100	100			
42	12	61	76	100	100	100	70	87	100	100	100						42	12	44	55	77	99	100			
48	12	53	66	93	100	100	61	76	100	100	100	54	68	95	100	100	48	12				67	87	100		
54	12		59	83	100	100	54	68	95	100	100	48	60	85	100	100	54	18				54	71	88		
60	12			74	97	100	49	61	86	100	100	43	54	76	98	100	60	18				57	72	35		
66	12				87	100	44	55	78	100	100	39	49	69	89	100	66	18				58	32	40		
72	12				80	97	40	51	71	92	100	36	45	63	82	100	72	18				45	30	37		
78	12					87	37	47	66	85	100	33	42	58	75	92	78	24					34	48		
84	12					75	35	43	61	78	96	31	39	54	70	86	84	24						44		
90	12						32	40	57	73	90	29	36	51	65	80	90	24						41		
96	12							38	53	69	84		34	48	61	75	96	24						38		
102	18							36	50	65	79		32	45	57	71	102	24						46		
108	18								47	61	75			42	54	67	108	24						42		
114	18								45	58	71			40	52	63	114	24						45		
120	18								43	55	67			38	49	60	120	24						40		
126	18									52	64				47	57										
132	18									50	61				44	54										
138	18									48	58				42	52										
144	18										56					50										

NOTE:

1. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
2. Fill heights exceeding 100 feet require special analysis by the CO.
3. The fill heights in the table are for helical lockseam and welded seam pipe only. Fill heights for culvert pipe with annular corrugations are more restrictive than those of helical lockseam and welded seam pipe. Obtain approval before furnishing annular corrugation pipe.
4. Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavement.

METAL PIPE ARCH CULVERT																												
FILL HEIGHT AND METAL THICKNESS TABLE FOR HELICAL LOCKSEAM AND WELDED SEAM PIPE CULVERT																												
STEEL														ALUMINUM														
PIPE ARCH SIZE SPAN x RISE INCHES	EQUI- VALENT DIAMETER INCHES	MINIMUM CORNER RADIUS INCHES	MINIMUM COVER INCHES	2½" x ½" CORRUGATIONS				3" x 1" CORRUGATIONS				5" x 1" CORRUGATIONS				PIPE ARCH SIZE SPAN x RISE INCHES	EQUI- VALENT DIAMETER INCHES	MINIMUM CORNER RADIUS INCHES	MINIMUM COVER INCHES	2½" x ½" CORRUGATIONS				3" x 1" CORRUGATIONS				
				METAL THICKNESS (INCH/GAGE)																METAL THICKNESS (INCH/GAGE)								
				0.064/16	0.079/14	0.109/12	0.138/10	0.168/8	0.079/14	0.109/12	0.138/10	0.168/8	0.079/14	0.109/12	0.138/10					0.168/8	0.060/16	0.075/14	0.105/12	0.135/10	0.060/16	0.075/14	0.105/12	0.135/10
				MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)																MAXIMUM FILL HEIGHT ABOVE TOP OF PIPE (FEET)								
17 x 13	15	3	12	13														13										
21 x 15	18	3	12	12														12										
24 x 18	21	3	12	13														13										
28 x 20	24	3	12	13															13									
35 x 24	30	3	12	12															12									
42 x 29	36	3.5	12	12																12								
49 x 33	42	4	12		12																12							
57 x 38	48	5	12			12																12						
60 x 46	54	8	15							21					21								21					
64 x 43	54	6	12			12																						
66 x 51	60	9	15							21					21								21					
71 x 47	60	7	12				12																					
73 x 55	66	12	18							20					20													
77 x 52	66	8	12					12																				
81 x 59	72	14	18						17					17														
83 x 57	72	9	12					12																				
87 x 63	78	14	18						17					17														
95 x 67	84	16	18						17					17														
103 x 71	90	16	18							17				17														
112 x 75	96	18	21							16					16													
117 x 79	102	18	21							16					16													
128 x 83	108	18	24							16																		
137 x 87	114	18	24							16																		
142 x 91	120	18	24								16																	

U.S.
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MET

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
U.S. CUSTOMARY STANDARD	
METAL PIPE CULVERT	
STANDARD APPROVED FOR USE 12/1993 REVISED: 4/1994 6/2005	STANDARD 602-1

NO SCALE

2 September 2015 11:30 AM c:\myfiles\pw_production\dms52075\Std602-2.dgn [USC]

STATE	PROJECT	SHEET NUMBER

COUPLING BANDS FOR METAL PIPE CULVERT ^[1]					
CORRUGATION SIZE ^[2] INCHES	ROUND PIPE DIAMETER INCHES	PIPE ARCH SPAN × RISE INCHES	MINIMUM BAND WIDTH (INCHES)		
			ANNULAR CORRUGATED BANDS ^[3]	HELICALLY CORRUGATED BANDS ^[4]	SEMI-CORRUGATED BANDS ^[5]
1½ × ¼	underdrain ^[6]	-	10.5	7	10.5
2⅔ × ½	12 to 36	17 × 13 to 42 × 29	7	12	
	42 to 72	49 × 33 to 83 × 57	10.5	12	
	78 to 84	-	10.5	12	10.5
3 × 1	36 to 72	60 × 46 to 81 × 59	12	14	10.5
	78 to 144	87 × 64 to 142 × 91	12	14	10.5
5 × 1	36 to 72	60 × 46 to 81 × 59	20	22	
	78 to 144	87 × 64 to 142 × 91	20	22	

^[1] Fabricate annular, helical and semi-corrugated type coupling bands from the same metal as the connecting pipe. Provide coupling bands not more than 3 nominal sheet thicknesses thinner than the thickness of the pipe to be connected, and no thinner than 0.052 inch for steel or 0.048 inch for aluminum. Fasten coupling bands with the following diameter of bolt: ⅜" for 18" round culvert (21" × 15" pipe arch) or less ½" for 21" round culvert (24" × 18" pipe arch) or more

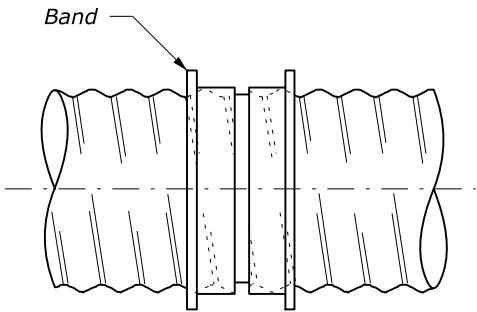
^[2] For helically corrugated pipe with rerolled ends, the nominal corrugations size refers to the dimension of the end corrugation in the pipe.

^[3] Use annular corrugated bands with pipes having annular corrugations or with helical pipe having rerolled end to form annular corrugations. A 10.5 inch band is acceptable on pipe ends rerolled with 2⅔" × ½" corrugations. A 12 inch band is acceptable on pipe ends rerolled with 3" × 1" pipe corrugations.

^[4] Use helical corrugated bands with pipes having helically corrugated ends.

^[5] The minimum band widths shown for 3" × 1" and 5" × 1" corrugated sizes apply to 2⅔" × ½" corrugations on rerolled pipe ends.

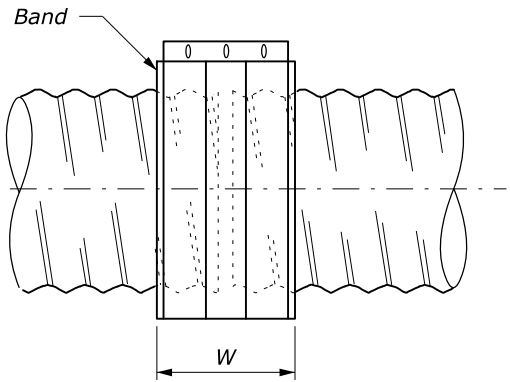
^[6] Smooth sleeve-type couplers and flat bands may be used for pipe diameters of 12" or less. Use a matching metal having a nominal thickness of not less than 0.040 inch for steel, or 0.036 inch for aluminum, or a plastic with an equivalent strength to metal.



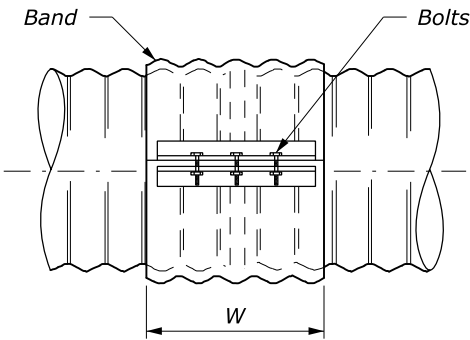
SLEEVE JOINT

Smoother sleeve with center stop.
Stab type joint

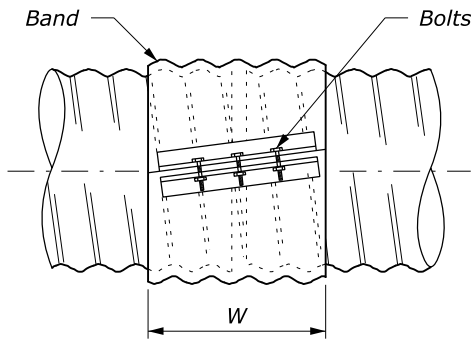
SMOOTH SLEEVE BAND



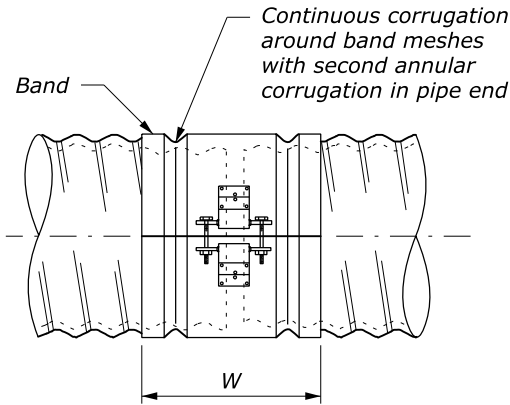
FLAT BAND



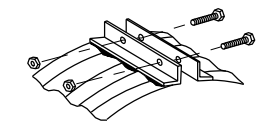
SIDE VIEW



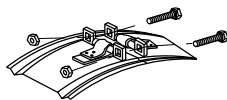
SIDE VIEW



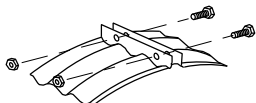
SIDE VIEW



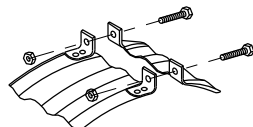
Band Angle



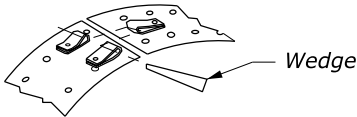
Bar & Strap



Integral Flange

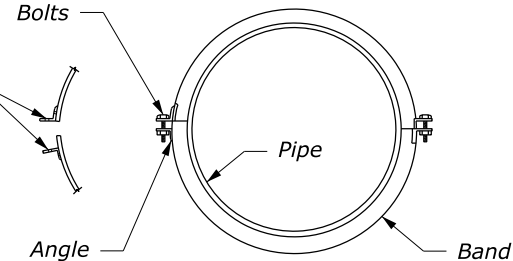


Oval Lug



Wedge and Strap

Rivet, spot weld, or
fillet weld at crest
of corrugation at
heel and toe of angle

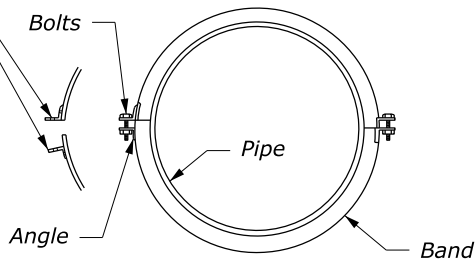


END VIEW

Second angle connection optional to 42" diameter, required above 42" diameter

ANNULAR BAND

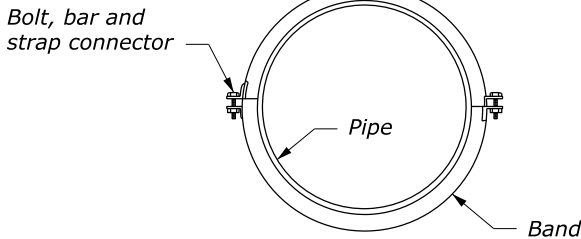
Rivet, spot weld, or fillet weld at crest
of corrugation at heel and toe of angle



END VIEW

Second angle connection optional to 42" diameter, required above 42" diameter

HELICAL BAND



END VIEW

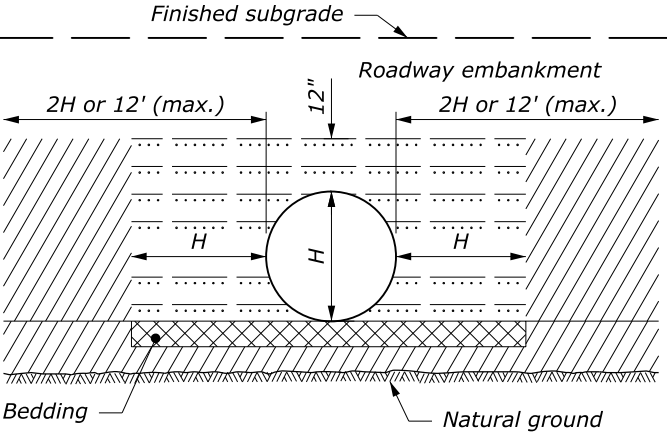
SEMI-CORRUGATED BAND

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
U.S. CUSTOMARY STANDARD	
METAL PIPE CULVERT COUPLING BAND	
STANDARD APPROVED FOR USE 12/1993 REVISED: 4/1994 6/2005	STANDARD 602-2

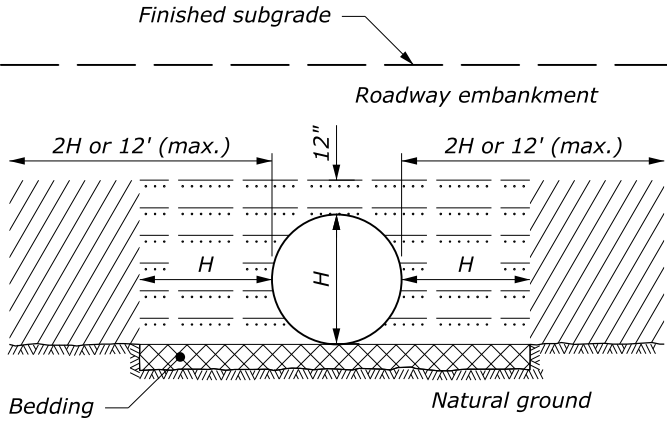
NOTE:

- Watertight pipe joints are not required unless specified in the Special Contract Requirements.
- Other types of coupling bands or fastening devices that comply with the joint performance criteria of AASHTO Standard specifications for Highway Bridges, Division II Section 26 may be used.

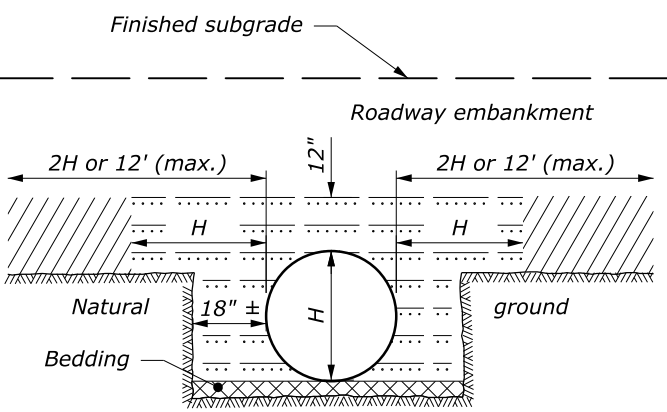
NO SCALE



ABOVE NATURAL GROUND



ON NATURAL GROUND



ABOVE AND BELOW
NATURAL GROUND

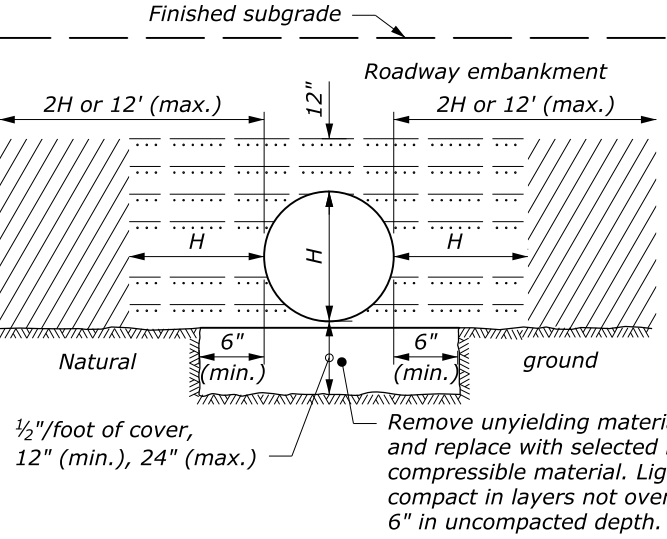
LEGEND:

Bedding material (uncompacted)

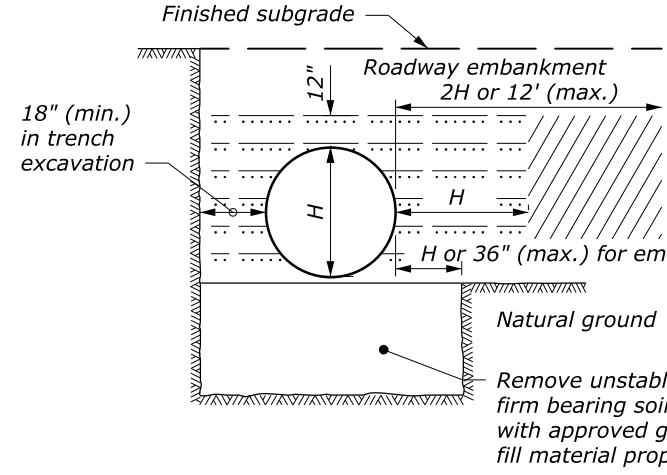
Embankment material placed in layers not exceeding 6" compacted depth.

Compacted backfill material placed in layers not exceeding 6" compacted depth. Or lean concrete backfill in accordance with Section 614.

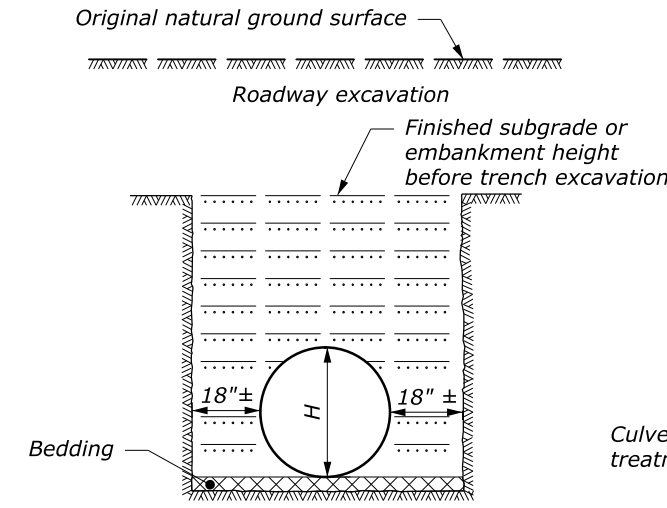
Impermeable backfill material.



ON UNYIELDING MATERIAL

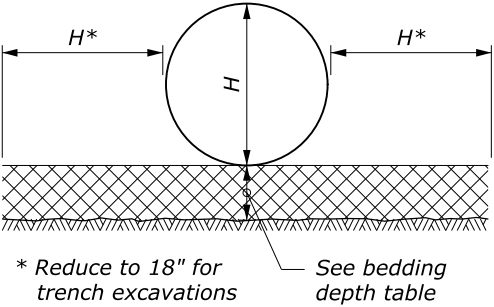


ON UNSTABLE MATERIAL



BELOW NATURAL GROUND OR
TRENCH EXCAVATION IN EMBANKMENT

BEDDING DEPTH	
PIPE SIZE (H)	DEPTH
12" to 54"	4"
> 54"	6"

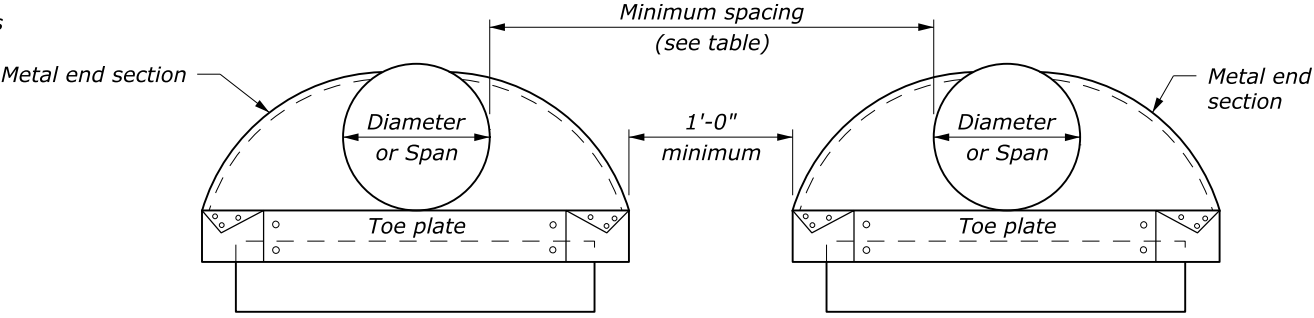


PIPE BEDDING

NOTE:

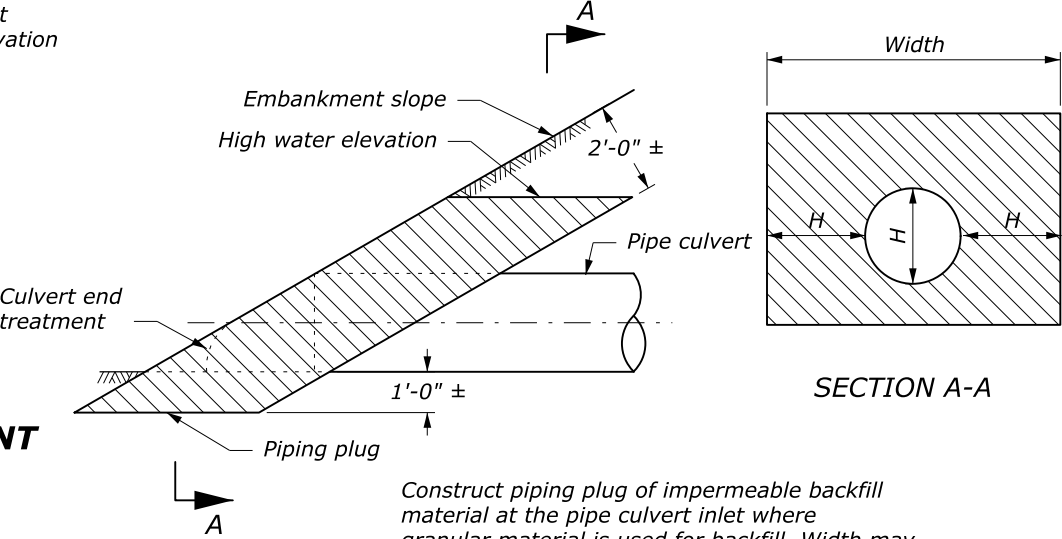
- When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
- H equals the diameter of all round pipe culverts or the rise dimension of all pipe arch culverts.
- See Section 704 for bedding and backfill requirements.

MINIMUM SPACING	
DIAMETER or SPAN	SPACING
UP to 48"	24"
48" and UP	Half diameter or span or 36", whichever is less



ELEVATION

MULTIPLE PIPE INSTALLATION



PIPING PLUG

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
FEDERAL LANDS HIGHWAY

U.S. CUSTOMARY STANDARD

METAL AND PLASTIC
PIPE CULVERT BEDDING

STANDARD APPROVED FOR USE 12/1993
REVISED: 4/1994 6/2005
DRAFT: 10/2014

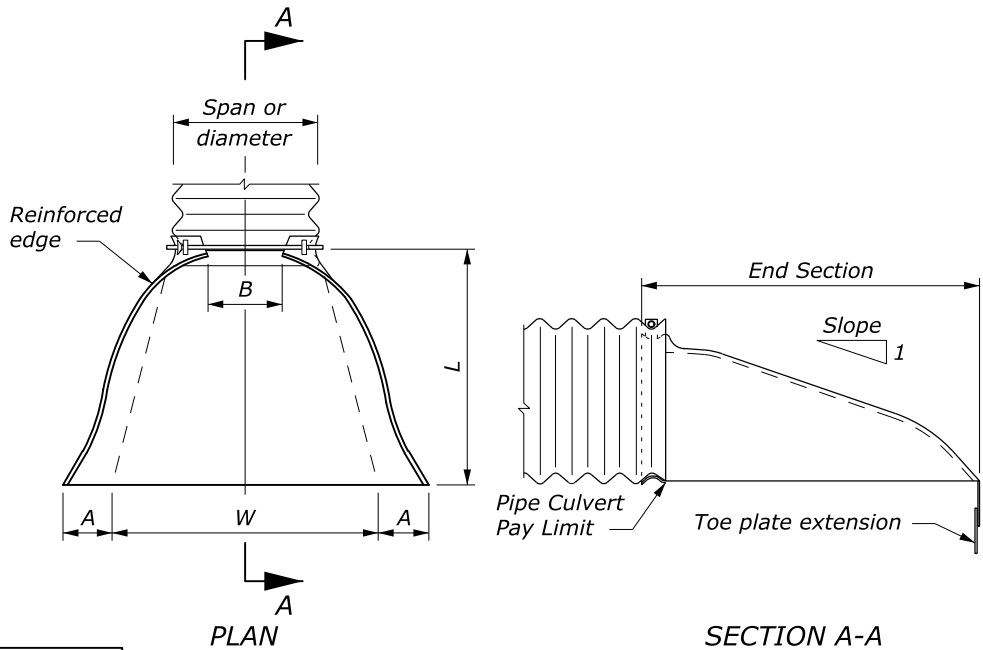
STANDARD
602-3

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3 September 2015 11:06 AM

STATE	PROJECT	SHEET NUMBER

END SECTIONS FOR ROUND PIPE CULVERT

PIPE SIZE DIAMETER INCHES	METAL THICKNESS				DIMENSIONS INCHES					SLOPE Approx.
	STEEL		ALUMINUM							
	INCHES	GAGE	INCHES	GAGE	A (min)	B (max)	H (min)	L (±2")	W (max)	
12	0.064	16	0.060	16	5	7	6	21	44	2¼
15	0.064	16	0.060	16	6	8	6	26	52	2¼
18	0.064	16	0.060	16	7	10	6	31	58	2⅛
21	0.064	16	0.060	16	8	12	6	36	66	2⅛
24	0.064	16	0.060	16	9	13	6	41	72	2⅛
30	0.079	14	0.075	14	11	16	8	51	88	2⅛
36	0.079	14	0.075	14	13	19	9	60	105	2
42	0.109	12	0.105	12	15	25	10	69	122	2⅛
48	0.109	12	0.105	12	17	29	12	78	131	2
54	0.109	12	0.105	12	17	33	12	84	143	2
60	0.109	12	0.105	12	17	36	12	87	157	1⅞
66	0.109	12	0.105	12	17	39	12	87	162	1⅞
72	0.109	12	0.105	12	17	44	12	87	169	1½
78	0.109	12	0.105	12	17	48	12	87	178	1⅜
84	0.109	12	0.105	12	17	52	12	87	184	1⅓
90	0.109	12	0.105	12	17	58	12	87	188	1¼
96	0.109	12	0.105	12	17	58	12	87	197	1⅛

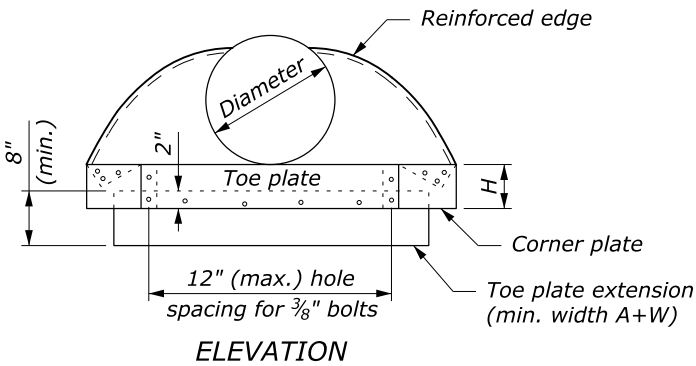


ROUND OR PIPE ARCH CULVERT

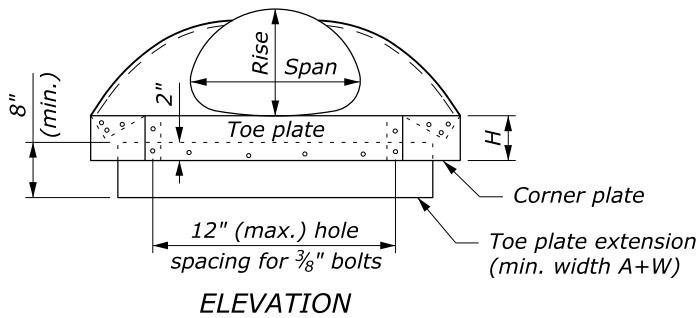
NOTE:

1. Variations in design and dimensions are permitted to allow for manufacturer's standards.
2. Fabricate the diameter of the end section of Design B to match the inside diameter of the concrete pipe culvert.
3. Design C may be used in lieu of design A for all metal pipe culvert sizes. Coupling bands may be any acceptable type for the pipe culvert specified.
4. Fabricate multiple piece bodies with lap seams tightly joined by ⅜" rivets or bolts. Fabricate end section center panels for 60" and larger diameter pipe and equivalent pipe arch from 0.138 inch steel or 0.135 inch aluminum.
5. On end section center panels for 66" and larger equivalent pipe arch provide 2½" × 2½" × ¼" angle reinforcement bolted or riveted under the center panel seam.
6. Supplement the reinforced edges of end sections for 60" and larger diameter pipe and 66" and larger equivalent pipe arch with 2½" × 2½" × ¼" stiffener angles attached with bolts or rivets.
7. Fabricate connector section, corner plate and toe plate extensions from the same metal thickness as the panel body. Use toe plate extension where shown on the plans.
8. Warp embankment slopes to match the slope of the flared end sections.

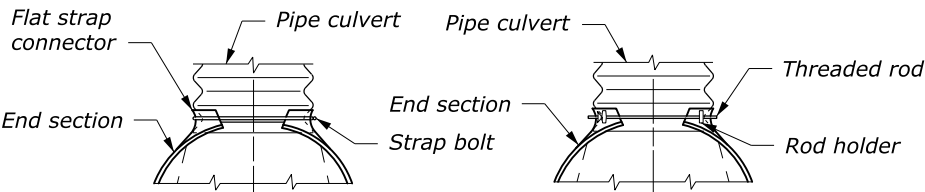
END SECTIONS FOR PIPE ARCH CULVERT											
PIPE SIZE SPAN × RISE INCHES	EQUI- VALENT DIAM. (INCHES)	METAL THICKNESS				DIMENSIONS INCHES					SLOPE Approx.
		STEEL		ALUMINUM							
		INCHES	GAGE	INCHES	GAGE	A (min)	B (max)	H (min)	L (±2")	W (max)	
17 × 13	15	0.064	16	0.060	16	7	9	6	19	30	2½
21 × 15	18	0.064	16	0.060	16	7	10	6	23	36	2½
24 × 18	21	0.064	16	0.060	16	8	12	6	28	42	2½
28 × 20	24	0.064	16	0.060	16	9	14	6	32	48	2½
35 × 24	30	0.079	14	0.075	14	10	16	8	39	60	2½
42 × 29	36	0.079	14	0.075	14	12	18	9	46	75	2½
49 × 33	42	0.109	12	0.105	12	13	21	12	53	85	2½
57 × 38	48	0.109	12	0.105	12	18	26	12	63	90	2½
60 × 46	54	0.109	12	0.105	12	18	34	12	70	102	2
64 × 43	54	0.109	12	0.105	12	18	30	12	70	102	2
66 × 51	60	0.109	12	0.105	12	18	33	12	77	116	1½
71 × 47	60	0.109	12	0.105	12	18	33	12	77	114	1½
73 × 55	66	0.109	12	0.105	12	18	36	12	77	126	1½
77 × 52	66	0.109	12	0.105	12	18	36	12	77	126	1½
81 × 59	72	0.109	12	0.105	12	18	39	12	77	138	1½
83 × 57	72	0.109	12	0.105	12	18	39	12	77	138	1½
87 × 63	78	0.109	12	0.105	12	20	38	12	77	148	1½
95 × 67	84	0.109	12	0.105	12	20	34	12	87	162	1½
103 × 71	90	0.109	12	0.105	12	20	38	12	87	174	1½
112 × 75	96	0.109	12	0.105	12	20	40	12	87	174	1½



ROUND PIPE CULVERT

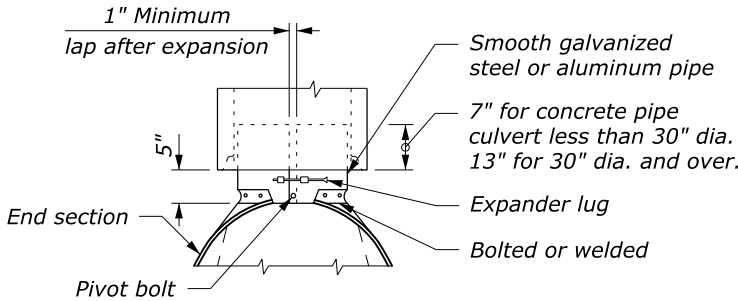


PIPE ARCH CULVERT

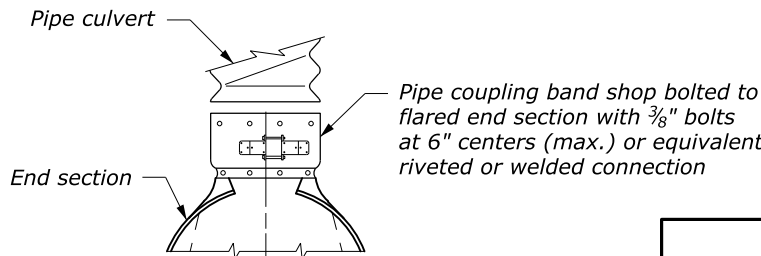


For 12" thru 24" round pipe and 17" × 13" thru 28" × 20" pipe arch For 30" thru 60" round pipe and 35" × 24" thru 66" × 51" pipe arch

**DESIGN A
CONNECTION TO ANNULAR
CORRUGATED METAL PIPE**



**DESIGN B
CONNECTION TO CONCRETE
PIPE INLET END**



**DESIGN C
CONNECTION TO METAL PIPE
OR OUTLET END OF CONCRETE PIPE**

NO SCALE

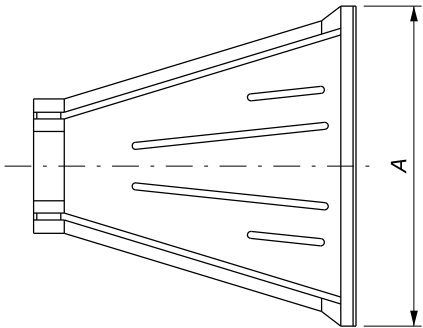
U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
U.S. CUSTOMARY STANDARD	
METAL END SECTIONS	
STANDARD APPROVED FOR USE 12/1993 REVISED: 4/1994 6/2005 DRAFT: 10/2007	STANDARD 602-4

POLYETHYLENE (PE) PLASTIC ROUND PIPE CULVERT															
FILL HEIGHT TABLE AND MINIMUM CELL CLASSIFICATION NUMBER PER ASTM D 3350															
SMOOTH WALL (SOLID WALL)								CORRUGATED			RIBBED				
PIPE SIZE	MINIMUM COVER	CELL CLASSIFICATION NUMBER 335434C						PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 435400C	PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 334433C	CELL CLASS. NO. 335434C	
DIAMETER INCHES	INCHES	MINIMUM WALL THICKNESS (INCHES)						DIAMETER INCHES	INCHES	MAXIMUM FILL HEIGHT (FEET)	DIAMETER INCHES	INCHES	MAXIMUM FILL HEIGHT (FEET)		
		0.607	0.857	0.923	1.154	1.385	1.292						1.477		
		MAXIMUM FILL HEIGHT (FEET)													
12	12	57							12	12	10	18	12	18	24
18	12		52						15	12	10	24	12	22	28
24	12			38					18	12	10	30	12	22	28
30	12				38				24	12	10	36	12	25	31
36	12					38			30	12	10	42	12	21	27
42	12						27		36	12	10	48	12	21	26
48	12						27								

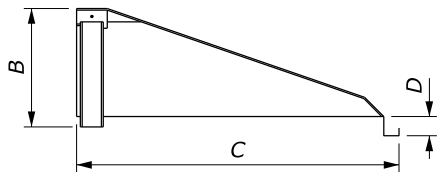
NOTE:

1. When directed, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to 1% of the pipe length. Develop camber on a parabolic curve. If the midpoint elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.
2. Measure minimum cover from the top of the pipe culvert to the subgrade for flexible pavements, and to the top of the pavement for rigid pavements. Measure maximum fill height from the top of the pipe to the top of the pavement for both flexible and rigid pavement.

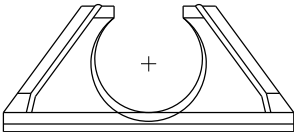
POLYVINYL CHLORIDE (PVC) PLASTIC ROUND PIPE CULVERT									
FILL HEIGHT TABLE AND MINIMUM CELL CLASSIFICATION NUMBER PER ASTM D 1784									
SMOOTH WALL (SOLID WALL)						RIBBED			
PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 12454		CELL CLASS. NO. 12364		PIPE SIZE	MINIMUM COVER	CELL CLASS. NO. 12454C	CELL CLASS. NO. 12364C
		MINIMUM WALL THICKNESS (INCHES)							
	DIAMETER INCHES	INCHES	0.358	0.438	0.358		0.438	DIAMETER INCHES	INCHES
12	12	65		69		12	12	37	26
15	12		62		66	15	12	32	22
						18	12	33	23
						24	12	29	21
						30	12	28	20
						36	12	27	19
						42	12	26	18
						48	12	24	17



TOP



SIDE



FRONT

PLASTIC PIPE END SECTION

END SECTION DIMENSIONS				
PIPE SIZE DIAMETER INCHES	DIMENSIONS INCHES			
	A	B	C	D
12	42	14.5	33	6
15	46	24.5	45.5	6
18	54	29	55	6
24	64	37	65	6
30	88	36	63.5	6
36	88	43	66.5	6

NO SCALE

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION FEDERAL LANDS HIGHWAY	
U.S. CUSTOMARY STANDARD	
PLASTIC PIPE CULVERT	
STANDARD APPROVED FOR USE 12/1993 REVISED: 4/1994 6/2005 DRAFT: 2/2009	STANDARD 602-5