

INFORMATION HANDOUT

For Contract No. 02-4G8204

At 02-Sis-5-R10.7/R19.5

Identified by

Project ID 0214000063

MATERIALS INFORMATION

Geotechnical Recommendation Memo

Dated April 1, 2015

Optional Disposal Site Informational Handout

Mining and Tunneling Underground Classification

Dated March 18, 2015

Lufft IRS Series Surface Sensor Installation Procedure

Dated September 25, 2014

MF-1331 Fold-Over Tower Installation Manual

Memorandum

*Flex your power!
Be energy efficient!*

To: STEVE TOPAL
BRANCH CHIEF
Design Branch R5

Date: April 1, 2015

File: 02-SIS-005 PM 18.85
EA: 02-4G8201
EFIS ID: 0214000063

Attn: Brett Ditzler, Project Engineer

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN NORTH-BRANCH B

Subject: Geotechnical Recommendations

INTRODUCTION

The purpose of the project is to replace a crushed culvert pipe at SIS 005 PM 18.85 (Figure 1) as part of the South Weed Pavement Rehab Project. Design Unit R5 requested recommendations for suitable trenchless excavation methods. The request was sent to the Office of Geotechnical Design North (OGDN) Branch B on January 12, 2015. This memo is based on field observations made on January 27, 2015, discussions with Redding staff from Design Unit R2 and OGDN, Microstation (dgn) files provided by Design Branch R5 in January and March, 2015, and as-built files from Contract 02-035804.

PROJECT DESCRIPTION

The proposal is to replace the existing collapsed 24" CMP with a new 36" smooth pipe using trenchless excavation beneath the freeway and cut and cover excavation along the northbound shoulder (Figure 2). The alignment of the proposed new smooth 36" pipe will extend from a DI located right of the freeway, across the northbound off ramp and northbound lanes, to a DI in the median of the freeway. The depth of the proposed pipe is approximately 11'-12' below the ground surface. The plans indicate that 246.1' of the proposed pipe will require trenchless excavation beneath the northbound off ramp, northbound lanes and a portion of the median. The existing pipe will be abandoned in the area of trenchless excavation and the vertical separation between the existing and proposed pipes will be as little as 1.6 vertical feet (Figure 3). The proposed jacking and receiving pits will be approximately 15 feet deep and 40 feet in length and width at the ends of the trenchless excavation, in the shoulder and the median.

Adjacent to the freeway, the southern portion of the proposed pipe will be placed in the shoulder using cut and cover excavation. The old pipe will be removed.

GEOTECHNICAL INVESTIGATION

Our field investigation and study of existing maps indicate that igneous volcanic rock is exposed along the railway on the hillside east of the freeway, approximately 80' from the site of the jacking pit and pipe. Based on visual inspection, the rock appears to be rhyolite, although andesite is more common in the Cascade Range. The rock is very fine grained, massive, light gray and pale red, fresh, hard, moderately fractured, and appears to contain approximately 1% mafic minerals.

Caltrans Design Information Bulletin (DIB) 83-04 recommends a minimum of two borings when considering trenchless excavation techniques to characterize subsurface conditions regarding the nature of the material and the location of groundwater. However, no subsurface investigation was performed due to the project schedule.

We found no boring records or LOTB's available within the project limits; however, we found LOTB's from both the Highway Avenue Undercrossing and the Siskiyou Way Undercrossing. The LOTB's may not be indicative of the subsurface conditions along the alignment proposed culvert alignment.

Examination of LOTB's from the Highway Avenue Undercrossing at approximately PM 18.9 indicated the presence of silt and sand with gravel and cobbles at a lower elevation than the proposed pipe, between 3520' and 3470' (Contract 02-035804). The proposed pipe (PM 18.85) will be between 3530' and 3540'. Groundwater was found approximately 15' below the ground surface, at an elevation of 3484'.

Study of LOTB's from the Siskiyou Way Undercrossing at approximately PM 18.7 indicated the presence of sand, gravel and boulders, saturated and wet fine silty sand with scattered gravel, red-brown saturated fine-medium moderately silty sand and gravel between 3530' and 3560' in elevation. Groundwater was found near the surface at an elevation of 3558'.

The elevation of groundwater is not known along the alignment of the proposed pipe, because we did not drill and monitor groundwater. Nearby, groundwater occurs at the surface and approximately 15' below the surface, at elevations of 3558' and 3484', according to the LOTB's.

In addition, discussions with Design Branch R5 on January 27, 2015 and examination of as built indicated that drainage from Boles Creek is carried beneath the freeway. Surface observations on January 27, 2015 indicated that Boles Creek carried a large volume of water at that time.

RECOMMENDATIONS

Excavation will likely encounter artificial fill beneath the northbound lanes and in the median. Bedrock may be encountered during excavation on the right side of the freeway, based on the proximity of the volcanic rock exposed adjacent to the railway.

Jacking/Receiving Pits

We recommend temporary shoring for the jacking and receiving pits.

Methods of Trenchless Excavation

Currently, we lack subsurface data along the proposed culvert alignment on which to base recommendations for trenchless excavation. However, we can provide general guidance regarding three techniques.

Because the existing and new pipes will be within 1.6 feet of each other, we recommend a relatively accurate method of trenchless excavation to avoid damaging the new pipe during its installation.

Auger Boring or Pipe Ramming, or a combination of these methods, could be successful in installing the proposed 36" pipe a distance of 246.1'. Below is a summary of the two techniques. The summary is based on the references provided below and do not necessarily reflect the actual limits of these techniques as currently practiced by all contractors. We have found that there is a great deal of variability between contractors with regard to trenchless technology. Microtunneling is a more accurate method of trenchless excavation, which is recommended in areas of high groundwater, should that be the case; however, we currently lack specifications.

Table 1. – Summary of two methods of trenchless excavation.

	Auger Boring	Pipe Ramming
OBSTRUCTION SIZE	≤33% pipe diameter	≤90% pipe diameter
LENGTH (approximate)	40-500 feet	40->300 feet
ACCURACY	Medium	Low
PIPE	8-60" diam.; steel	4-138" diam.; steel
HIGH GROUNDWATER	Unsuitable	Possible

Abandonment of the non-collapsed portion of the existing pipe, without backfilling the abandoned pipe, can create potential for deformation of the fill and provide a conduit for drainage. According to our discussions with Design Unit R5, the collapsed section of the existing pipe is directly under the northbound #2 lane; however, there probably are portions of the existing pipe that are not collapsed.

CONSTRUCTION CONSIDERATIONS

Bedrock may be encountered during excavation of the jacking/receiving pit located on the northbound shoulder and during cut and cover construction along the shoulder right of the freeway as the proposed pipe is 12" larger in diameter than the existing pipe.

Cobbles and boulders may be encountered in the fill.

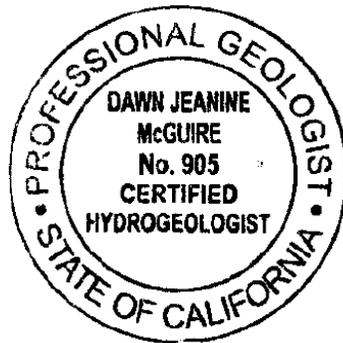
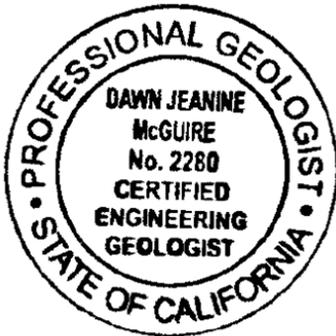
While we do not anticipate that groundwater will be encountered based on the level of groundwater shown in the LOTB's from the Highway Undercrossing, we have no data within the project site.

During trenchless excavation, the new pipe may be damaged if it encounters the existing, abandoned pipe.

We recommend that this office be contacted when the project plans and specifications are completed to allow for a final review. If you have any questions or comments, please contact Dawn McGuire at 707-441-3994 or Charlie Narwold at 707 445-6036.

Report by:

Reviewed by:



Dawn McGuire

DAWN MCGUIRE, C.E.G. #2280, CHG 905
Engineering Geologist
Office of Geotechnical Design - North
Branch B

CHARLIE NARWOLD, C.E.G. #2335
Senior Engineering Geologist
Office of Geotechnical Design - North
Branch B

REFERENCES

Design Information Bulletin No. 83-04, 2014, Caltrans Supplement to FHWA Culvert Repair Practices Manual: California Department of Transportation, 202 pages. Updated in August 2014; available online at <http://www.dot.ca.gov/hq/oppd/dib/dib83-04.pdf>

Federal Highway Administration Publication no. FHWA-RD-94-096, 1995, Culvert Repair Practices Manual, Volumes 1 and 2. See Volume 1, Chapter 7 – Culvert Replacement, p. 7-38 to 7-45.

Caltrans Division of Design, Highway Drainage Design,
<http://onramp.dot.ca.gov/hq/design/drainage/>

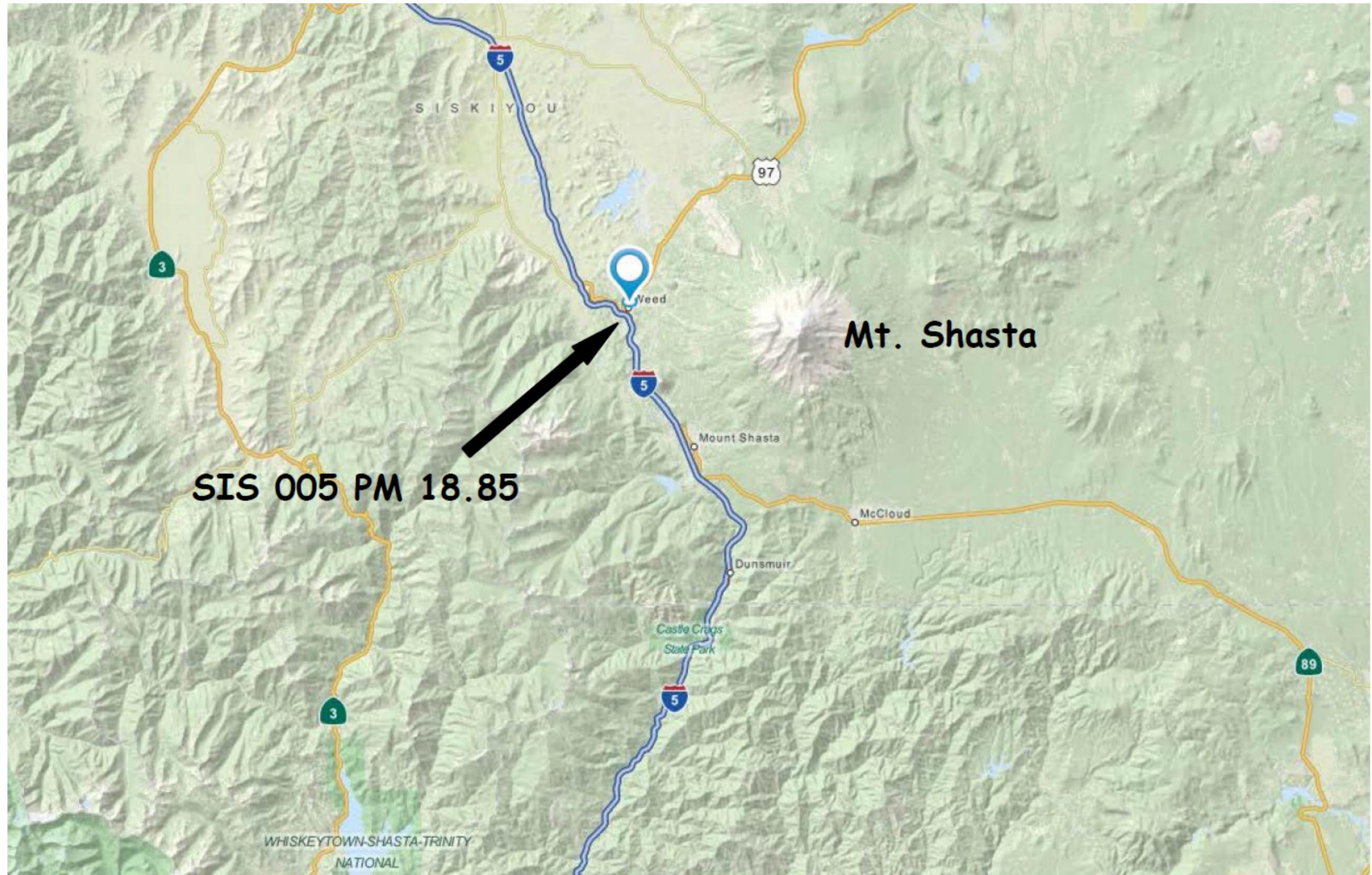
Attachments

Figure 1. – Vicinity map.

Figure 2. – Plan map.

Figure 3. – Drainage profile showing new culvert and existing culvert.

c: OGDN Project File



Department of Transportation
 Division of Engineering Services
 Geotechnical Services
 Office of Geotechnical Design - North

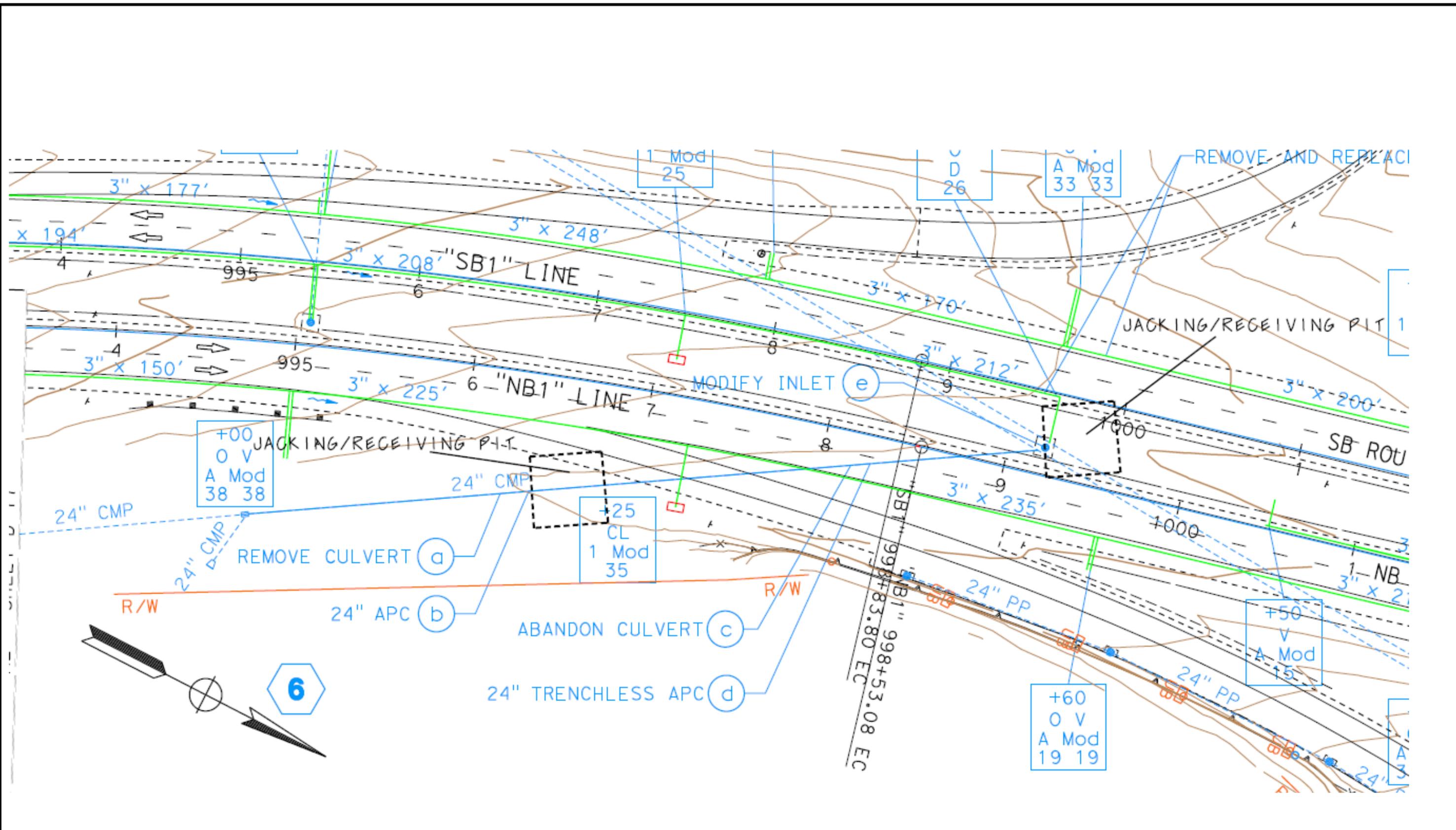
EFIS: 02 1400 0063

DATE: MARCH 2015

VICINITY MAP

02-SIS-005-PM-18.85
 SOUTH WEED PAVEMENT REHAB, REPLACE CRUSHED PIPE

Figure
 1



Department of Transportation
 Division of Engineering Services
 Geotechnical Services
 Office of Geotechnical Design - North

EFIS: 0214000063
 Date: MARCH 2015

PLAN MAP

02-SIS-005-PM-18.85
 SOUTH WEED PAVEMENT REHAB, REPLACE CRUSHED PIPE

Figure 2

**INFORMATIONAL HANDOUT
FOR A CONSTRUCTION CONTRACT
ON INTERSTATE 5 IN SISKIYOU COUNTY
(From Mt. Shasta to Weed)**

**SOUTH WEED REHAB PROJECT
SIS-5-PM R11.4/R19.1**

For

**Optional Locations for Permanent Disposal of:
Asphalt-concrete grindings, aggregate base,
concrete, and earthen material:**

- 1) City of Mt. Shasta, City Department of Public Works, site located at: 1990 S. Mt. Shasta Blvd. / Mt. Shasta, CA
- 2) Sousa Ready Mix, a privately owned commercial quarry located at: 110 Mt. Quarry Rd. / Mt. Shasta, CA
- 3) Caltrans Abrams Disposal, a Caltrans disposal site for earthen material located on Interstate 5
- 4) Caltrans Solus Hill Disposal, a Caltrans disposal site for earthen material located on State Route 97

Note: The records from this compilation may be inspected in the District Office at 1657 Riverside Drive Redding, CA 96001 or Contact the Disposal Site Coordinator, Russ Irvin, (530) 225-2084, email: Russell_Irvin@dot.ca.gov

Facts stated herein are as known to the State of California, Caltrans, and are to be verified by the Contractor prior to bid in accordance with Section 2 "Bidding" of the 2010 Standard Specifications.

Table of Contents

General Information	2
Location Map: All Three Sites	3
Aerial: Site 1, City of Mt Shasta - SIS-5-8.7 (NB)	4
Aerial: Site 2, Sousa Ready Mix - SIS-5-13.2 (NB)	5
Aerial: Site 3, Caltrans Abrams Disposal - SIS-5-13.7 (Median)	6
Aerial: Site 4, Caltrans Solus Hill Disposal - SIS-97-4.9 (NB)	7

General Information

These sites are provided for use by Caltrans, at the option of the contractor, for the permanent disposal of material generated during the South Weed Rehab Project. It is anticipated the following amounts of excess material will be generated:

Asphalt-Concrete Grindings - 42,000 cubic yards

Aggregate Base - 6,250 cubic yards

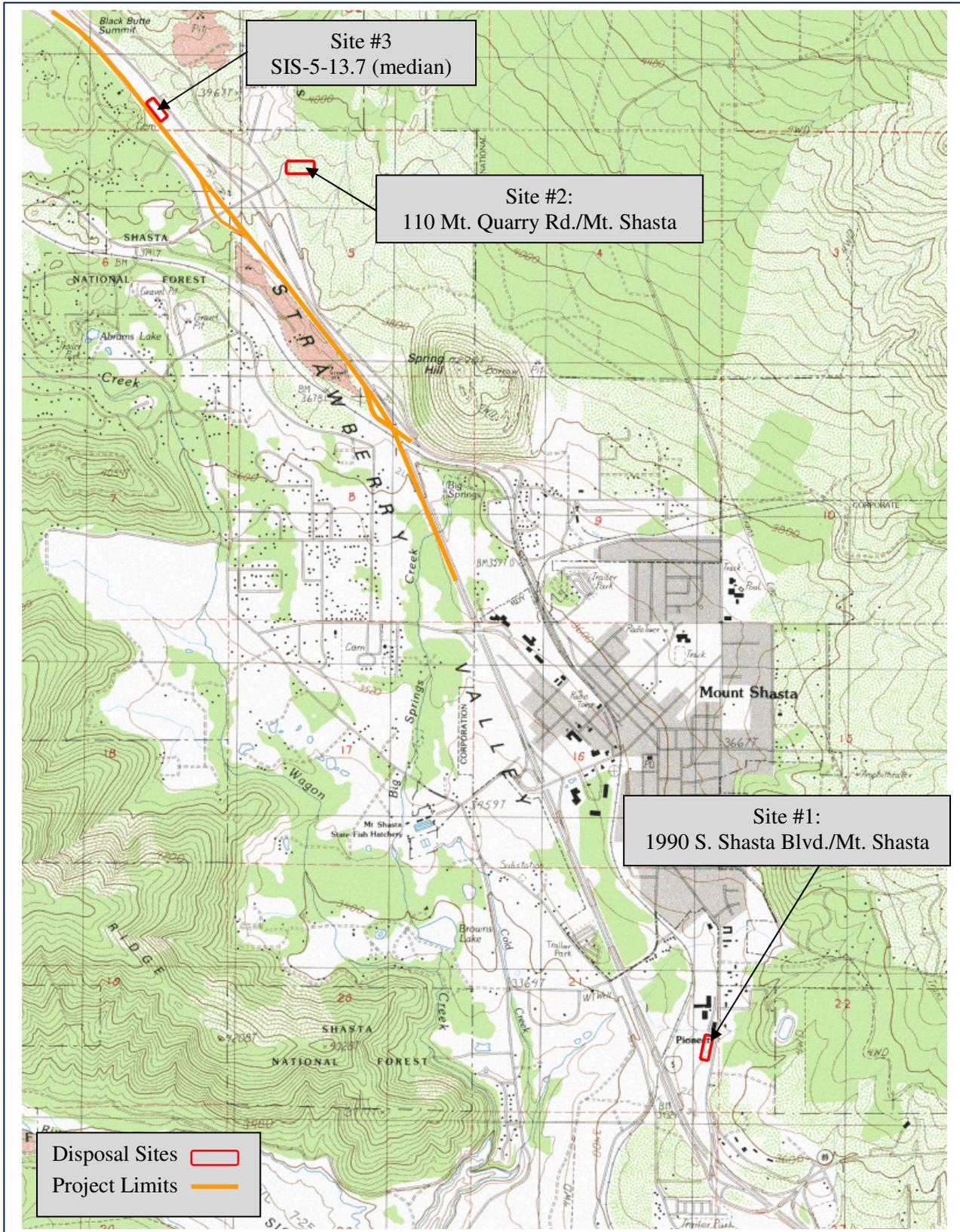
Concrete Chunks - 3,350 cubic yards

Earthen - 1,050 cubic yards

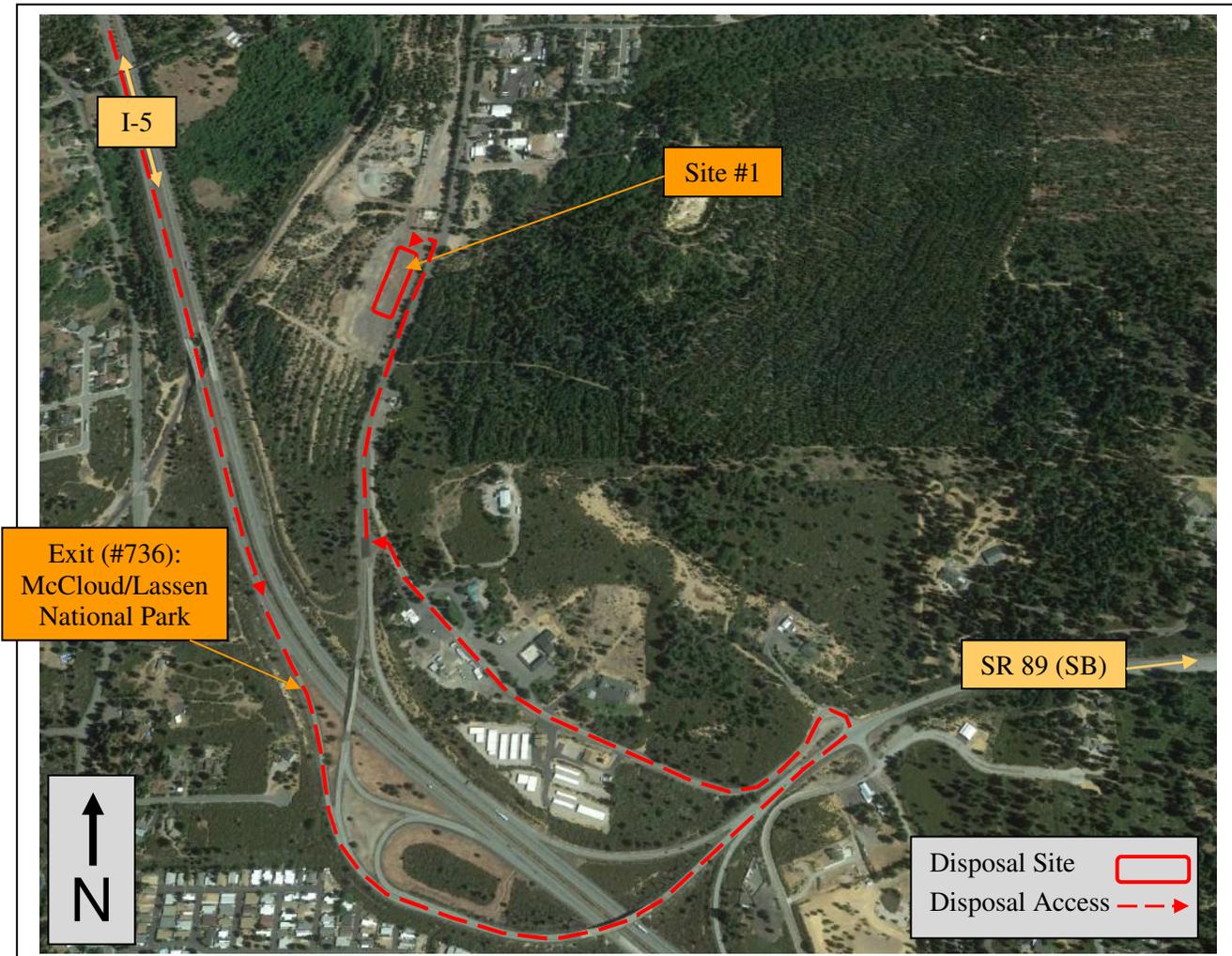
The following provisions apply to all sites:

- Delivery and placement of material will need to be coordinated with the contacts responsible for each site. See the individual aerials for contact information.
- Sites anticipated to be used must be included in the contractor's Storm Water Pollution Control Plan and all Construction Storm Water Best Management Practices shall apply to those sites. No additional compensation shall be made for placement of the erosion control measures at disposal sites.
- Existing facilities at these disposal sites shall be protected from damage by the contractor in accordance with Section 5-1.36 "Property and Facility Preservation" of the Standard Specifications.
- The contractor bears all liability for damage to haul vehicles and any facility or equipment damaged by the contractor's use of the site. The State assumes no liability for damage to contractor's equipment.
- Materials are to be placed within the site limits in an organized and safe manner with no risk of instability to embankments or drainage facilities.
- All asphalt grindings generated by this project not placed in a disposal site identified by Caltrans will remain property of the contractor.
- If the contractor uses a disposal location other than those shown in this Materials Information Handout attention is directed to Section 5-1.20B(4) of the Standard Specifications.
- Disposal or reuse of salvaged materials will be in accordance with Section 14 and Section 15 of the 2010 Standard Specifications.
- These sites have been environmentally approved for this project, however, they are not warranted to be completely satisfactory to the contractor's needs.

Location Map: Disposal Site Locations 1, 2 & 3



Optional Site 1: City of Mt. Shasta, SIS-5-8.7 (NB)



The site is provided by the City of Mt. Shasta and is located approximately 1 mile north of State Route 89 at the south end of Mt. Shasta Blvd. It is accessed off I-5 from the Mt. Shasta City Exit (#737) which is located 2.7 miles south of the southern project limits. Up to 5,000 cubic yards of asphalt concrete grindings, and only grindings, may be deposited here. Temporary stockpiling will not be allowed and any grindings deposited at this location will become property of the City of Mt. Shasta.

Contact information:

Facility location:

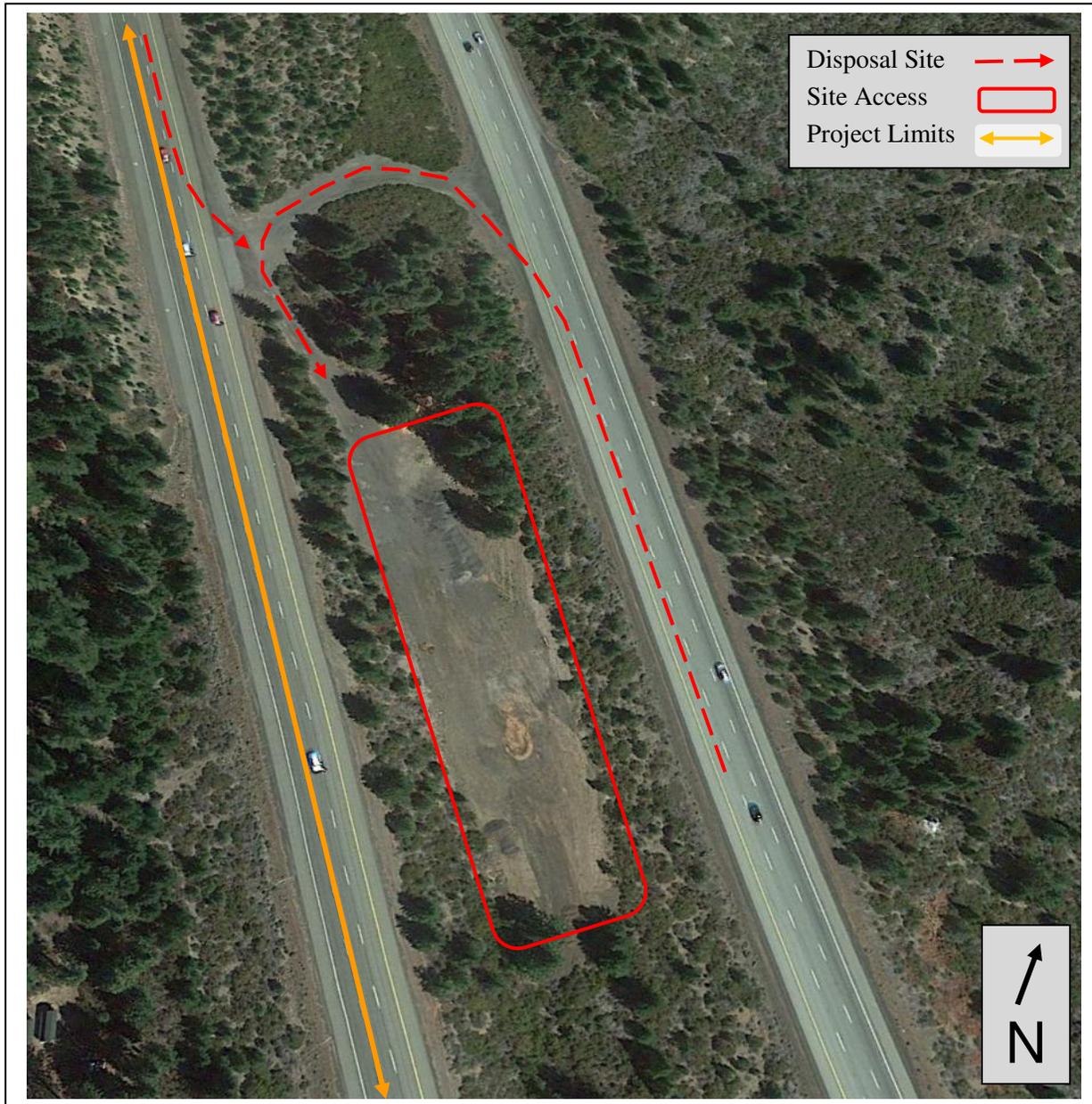
1990 S. Mt. Shasta Blvd., Mt. Shasta

Public Works Director - Rod Bryan, Phone: (530) 926-7526

Provisions that apply to this site:

- The contractor shall contact the Public Works Director Rod Bryan at least 1 week prior to disposal at this site.
- Only AC grindings will be accepted at this location, no more than 5,000 cubic yards.

Optional Site 3: Caltrans Abrams Disposal, SIS-5-13.7 (Median)



Contact information:

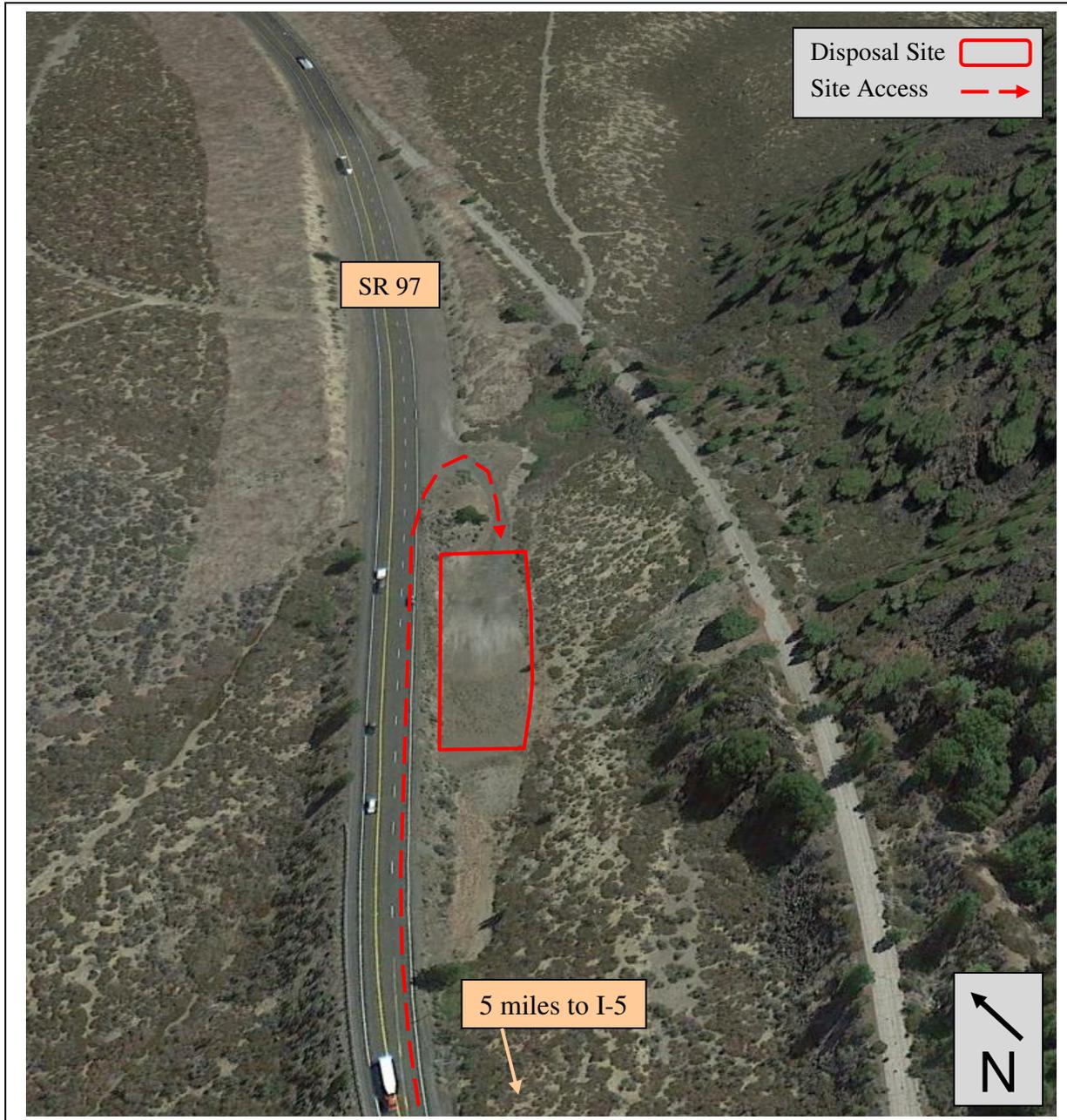
Facility location: SIS-5-13.7 (Median)

Caltrans Mt. Shasta Maintenance Supervisor - Jerry Brown: Phone: (530) 235-2839

Provisions that apply to this site:

- The contractor shall contact the Caltrans Maintenance Supervisor Jerry Brown at least 1 week prior to disposal at this site.
- Only earthen (rocks & soil) will be accepted at this location.

Optional Site 4: Caltrans Solus Hill Disposal, SIS-97-4.9 (NB)



Contact information:

Facility location: SIS-97-4.5 (NB)

Caltrans Mt. Shasta Maintenance Supervisor - Jerry Brown: Phone: (530) 235-2839

Provisions that apply to this site:

- The contractor shall contact the Caltrans Maintenance Supervisor Jerry Brown at least 1 week prior to disposal at this site.
- Only earthen (rocks & soil) will be accepted at this location.

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

2424 Arden Way, Suite 125
Sacramento, California 95825
doshM&Tsac@dir.ca.gov



Telephone (916) 574-2540
FAX (916) 574-2542

March 18, 2015

California Dept. of Transportation
North Region Engineering
1031 Butte St
Redding, CA 96001

Attention: Toby Crawford, P.E.

Subject: Project: 15071 – South Weed Pavement Rehabilitation, Siskiyou County
Classification: Potentially Gassy With Special Conditions
Number Attached: 1 (A)

The information provided to this office relative to the above project has been reviewed. On the basis of this analysis, an Underground Classification of "Potentially Gassy With Special Conditions" has been assigned to the tunnel identified on your submittal. Please retain the original Classification for your records and deliver a true and correct copy of the Classification to the tunnel contractor for posting at the job site.

When the contractor who will be performing the work is selected, please advise them to notify this office to schedule the mandated Pre-Job Conference with the Division prior to commencing any activity associated with boring of the tunnel. A Pre-Job Request Form is enclosed.

Should you have another bore under construction that is not required to have an Underground Classification (i.e.: less than 30 inches in diameter), please contact the Mining and Tunneling Unit prior to any employee entry of such a space.

If you have any questions on this subject, please contact this office at your earliest convenience.

Sincerely,

A handwritten signature in black ink, appearing to read "D Patterson", written over a horizontal line.

Douglas Patterson
Senior Engineer

enc: Classification
Pre-Job Request Form

cc: toby.crawford@dot.ca.gov
ballard@dir.ca.gov



State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

15071A093CT

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

of CALTRANS DISTRICT 2, 1031 BUTTE STREET; REDDING, CA 96001

at SOUTH WEED PAVEMENT REHABILITATION

has been classified as *** POTENTIALLY GASSY WITH SPECIAL CONDITIONS ***

as required by the California Labor Code § 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

SPECIAL CONDITIONS

1. A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.
2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

The thirteen 60-inch-diameter 22-to-23-foot-deep vertically drilled shafts located along Interstate 5 between North Shasta City & Weed in Siskiyou County

This classification shall be conspicuously posted at the place of employment.



Douglas Patterson, Senior Engineer

March 18, 2015

REQUEST FOR PRE-JOB (TUNNEL)

ATTACH COPY OF CLASSIFICATION AND DIESEL PERMIT

Company Name: _____

Phone _____ FAX: _____

DATE FAXED: _____

PLEASE NOTE: THE BORING CONTRACTOR SHOULD SCHEDULE THE PREJOB AS FAR IN ADVANCE AS POSSIBLE - AT LEAST 3-4 DAYS IN ADVANCE. THE DIVISION REQUIRES THE JOB TO BE SET UP WHEN THE FIELD ENGINEER ARRIVES FOR THE PREJOB. THIS MEANS THAT THE BORE PIT HAS BEEN DUG AND PROPERLY GUARDED, THE CRANE IS IN PLACE AND READY TO LIFT, THE BORING MACHINE IS IN THE PIT AND READY TO GO, AND THE CREW IS READY TO BEGIN BORING THE TUNNEL. IF THERE IS A DELAY IN SETTING UP THE JOB, THE BORING CONTRACTOR SHOULD CONTACT THE DIVISION IMMEDIATELY.

PRE-JOB REQUEST DATE & TIME: _____

ON-SITE SUPERVISOR & CELL NO.: _____

CLASSIFICATION #: _____ DIESEL PERMIT #: _____

BORE DIAMETER AND LENGTH: _____ (Diameter) _____ (Length)

IS BORE ENTRY ANTICIPATED? YES NO
(Circle One)

You MUST contact the Division if entry is planned, REGARDLESS of the bore diameter.

MANNER OF EXCAVATION: _____

JOB-SITE LOCATION AND DIRECTIONS: _____

GENERAL CONTRACTOR: _____

SUBMITTED BY: _____

REVIEWED BY: _____ DATE: _____

Mining & Tunneling Unit, District 1
2424 Arden Way, Suite 125
Sacramento, California 95825-2400
(916) 574-2540; FAX: (916) 574-2542

Mining & Tunneling Unit, District 2
6150 Van Nuys Blvd., Suite 310
Van Nuys, California 91401-3333
(818) 901-5420; FAX: (818) 901-5579

Mining & Tunneling Unit, District 3
464 West Fourth Street, Suite 354
San Bernardino, California 92401-1442
(909) 383-6782; FAX: (909) 388-7132

CALTRANS

Lufft IRS Series Surface Sensor Installation Procedure

RWIS Surface Sensor Installation

Beyer, Michael R@DOT

9/25/2014

This document describes the installation procedure for Lufft IRS series of roadway surface sensors.



Document Title	Lufft IRS Series Surface Sensor Install Procedure (06-23-14)
Document No.	02-RWIS- 9001 (06-23-14)
Author	M. Beyer

Revision	Updates	Approved	Date
1.0	Initial Release	M. Beyer	23 June 014
1.1	Added Color Code & Testing for extension Cable, changed cable designator.	M. Beyer	7 July 2014
1.2	Added new extension cable splicing instructions.	M.Beyer	Sept. 23, 2014



Table Of Contents

- 1.0 Purpose and Scope5**
- 2.0 Materials and Tools6**
- 3.0 Warnings.....7**
- 4.0 Initial Preparation8**
 - 4.1 Roadway Surface Sensor Pre-Install Inspection8
 - 3.1.1 Insure Watertight Integrity of RSS8
 - 3.1.2 Check for Installation Leveling Aids and Protective Covering8
 - 3.1.3 Sub-Surface Sensor Checks9
 - 3.1.4 Check for Presence of 120 Ohm Termination Resistor9
 - 3.2 Pavement Pre-Install Inspection10
- 4.0 Layout for Holes and Saw Cuts10**
 - 4.1 RSS Hole and Saw Cut Layout10
 - 4.2 SSS Hole and Saw Cut to Accommodate Sub-Surface Sensor/Sensors11
 - 4.2.1 Sub-Surface Sensor-111
 - 4.2.2 Sub-Surface Sensor-212
 - 4.2.3 Sub-Surface Sensor Special Case Sensor-2 is Omitted12
 - 4.2.4 Sub-Surface Sensor Marked with a Red Flag12
- 5.0 Drilling, Cutting, and Cleaning13**
 - 5.1 RSS Hole Drilling13
 - 5.2 Saw Cuts for Communications Cabling13
 - 5.3 Saw Cuts for 2” Deep Sub-Surface Sensor 114
 - 5.4 Saw Cuts for 14” Deep Sub-Surface Sensor 214
 - 5.5 Cleaning the Holes and Saw Cuts15
 - 5.5.1 Initial Cleaning After Saw Cuts and Holes are Drilled15
 - 5.5.2 Hole for 14” Deep Sub-Surface Sensor15
 - 5.5.3 Cleaning the 14” Deep Sub-Surface Sensor-2 Hole16
 - 5.5.4 Masking the RSS Hole and Saw Cuts16
- 6.0 Installing the Backer Rod, Roadway Surface Sensors, and Cabling16**
 - 6.1 Placing the Lower Backer Rod16
 - 6.2 Placing the RSS16
 - 6.3 Placing SSS-117
 - 6.4 Placing SSS-217
 - 6.5 Placing Sensor Lead-In Cable18
 - 6.6 Placing Upper Backer Rod18
- 7.0 Application of Joint Sealants18**



7.1 Sealing the Roadway Surface Sensor in Place.....18

7.1.1 RSS Joint Sealer Properties and Application.....18

7.1.2 Applying the Sealant to the RSS and SSSs.....18

7.1.3 Approved Sealant for Use on the Sensor Lead-In Cable19

7.1.4 Applying the Sealant to the Sensor Lead-In Cable.....19

7.1.5 Removing the Plastic Film and Masking Tape.....19

7.2 Allowing Traffic Back in the Lanes.....19

8.0 Insuring Proper Torque on the RSS Insert.....20

9.0 Routing Sensor Lead-In Cable to the RWIS Cabinet.....20

9.1 Marking the Cables20

9.2 Pulling the Cables into the Pull Box Leaving Service Loops.....20

9.3 Splicing to Extension Cables if Necessary21

9.3.1 Identify and Test Each Pair.....21

9.3.2 Extension Cable Color Code.....22

9.3.3 Wire Splicing22

9.3.4 Splicing the RS-485 Communications Wires25

9.3.5 Shield Bonding at Splice.....26

9.3.6 Encapsulate the Splice Using the 3M Splice Encapsulation Kit.....26

10.0 Appendix.....27

10.1 Fabick MP-55 Joint Sealant Properties.....27

10.2 Standard Specifications 86-5.01A(3)(a), 86-5.01A(3)(d).....29

10.2.1 86-5.01A(3)(a) Elastomeric Sealant29

10.2.2 86-5.01A(3)(d) Epoxy Sealant for Inductive Loops.....30

10.3 3M Splice Encapsulation Kit30

10.4 Hubbell Bonding Kit.....34

10.5 Ideal Set-Screw Wire-Connector36

10.6 Scotchkote FD.....36

11.0 References.....39



Table of Figures

Figure 1 RSS Housing with Cable Glands Highlighted..... 8
Figure 2 Installation Aids and Green Protective Film 9
Figure 3 Radial Saw Cut Layout 11
Figure 4 Sub-Surface Sensor Designation 11
Figure 5 Hole and Slot for Sub-Surface Sensor 2 13
Figure 6 Sensor Lead-In Cable Saw Cut to RSS Hole..... 14
Figure 7 2" Deep Sub-Surface Sensor 1..... 14
Figure 8 SSS-2 In Place 15
Figure 9 Weights on RSS Installation Aids 17
Figure 10 RSS Torque Pattern 20
Figure 11 Separated Pairs 21
Figure 12 Wires in Screw-Terminal Prior to Soldering 23
Figure 13 Wires After Soldering 24
Figure 14 Completed Screw-Terminal Dipped in Scotchkote FD 24
Figure 15 RS 485 Communications Wire Splice 25
Figure 16 Splice Bonded..... 26

1.0 Purpose and Scope

This purpose of this procedure is to detail the Caltrans D02 accepted procedure for installation of the Lufft IRS series Roadway Surface Sensors (RSS) installation for both new construction and replacement where the replacement requires the installation of a new housing.

The procedure scope includes the minimum requirements and limitations regarding the pre-qualification of both the RSS devices and the pavement they are to be installed in, RSS sensor placement in the lane, RSS leveling with the pavement, RSS plastic insert torque requirements, cable installation and sealing in the pavement, cable extension & splicing, cable and RSS correlation identification, subsurface sensor installation, and minimum cable slack length in RWIS cabinet and pull boxes.



2.0 Materials and Tools

The following equipment and supplies are necessary to complete the install procedure:

- Torque wrench calibrated to 2 Nm with a 3 MM hex drive bit.
- Concrete saw with blades for cutting ½' wide by 3" deep slot in pavement.
- Hole saw for cutting 6" diameter hole 3" deep in pavement.
- Hammer Drill with ¾" by 18" masonry bit for drilling holes for sub-surface sensors.
- Water supply to wash the saw cuts and holes clean.
- Power Washer to wash the cuts and holes.
- Air compressor with blow pipe to clean and dry the saw cuts and holes.
- A wet/dry vacuum with a small nozzle to clean in and around sub-surface sensor hole.
- 5/8" backer rod.
- Joint sealant to fix the RSS in the pavement.
- Duct tape to keep joint sealant build up from occurring at interface of RSS hole, saw cuts and pavement.
- Sealant for sealing the cabling in the saw cuts.
- Method for layout of saw cuts and holes, chalk line, paint, etc.
- Straight Edge (Level)
- Weights to hold the RSS in place while pouring the joint sealant
- Tool for seating backer rod & cable in saw cuts.
- Common hand tools (screwdrivers, wrenches)



3.0 Warnings

- Warning: The cable connections at the body of the RSS must not be opened under any circumstances!
- The Cable can only be shortened at the end furthest from the sensor itself.
- The sensor cable must be protected by a sheath or backer rod.
- Warning: Damage to the sheathing of the communications cable or external sensors will lead to the ingress of water into the sensor! Sensors with damaged cables must not be installed and can only be repaired by Lufft.
- Under no circumstances must the road sensor protrude above the surface of the road (possible damage due to snow-plows).
- The RSS and Sensor Lead-In Cable must not be exposed to temperatures greater than 175° F
- The sealants must be applied to clean DRY surfaces in dry weather conditions.
- The retention screws holding the plastic insert in the sensor must be torqued to 2 Nm
- Do not allow traffic on the lanes until the sealants have cured properly.



4.0 Initial Preparation

4.1 Roadway Surface Sensor Pre-Install Inspection

3.1.1 Insure Watertight Integrity of RSS

Pre-inspection of the Roadway Surface Sensors, (RSS), shall be performed to insure the RSSs and cabling are acceptable for installation. Any damage to the seal in the cable connection to RSS housing or cuts or abrasion in the cable jacket which could allow water intrusion will void the warranty and exclude that RSS from being installable. See Figure 1 RSS Housing with Cable Glands Highlighted.

The Sensor body shall have no visible defects or damage, this device is rated IP68 which is rated for continuous immersion in water and is hermetically sealed. Any damage to the shape of the body, the screw fasteners that hold the plastic electronics body in the housing, or the plastic electronics body itself will void the unit from being installable and must be returned to the manufacturer for repair or replacement.



Figure 1 RSS Housing with Cable Glands Highlighted

3.1.2 Check for Installation Leveling Aids and Protective Covering

In addition the surface sensor shall have the installation aids, metal L brackets, and green protective film installed. See Figure 2 Installation Aids and Green Protective Film.



Figure 2 Installation Aids and Green Protective Film

3.1.3 Sub-Surface Sensor Checks

If any of the RSSs have Sub-Surface Sensors, (SSS), the lengths will need to be measured these measurements will be needed a later step, they should be approximately 20”.

If one or more of the temperature sensors is marked with a red cable flag on which a depth is marked that sensor depth will have to be confirmed with the Design Engineer of the accompanying Roadway Information Weather System (RWIS).

3.1.4 Check for Presence of 120 Ohm Termination Resistor

Check for the presence of a RS 485 termination resistor by measuring the resistance on the communications wiring. All sensor lead-in cables have four wires and a braided shield, some are color coded with Green and Yellow designating the RS-485 communications wires, some have all black wires numbered 1 through 4 with the numbers printed in white and numbers 3 and 4 indicating the RS-485 communication wires. Use an Ohmmeter to measure the resistance between the two RS-485 communications wires it should read near 120 Ohms give or take 20 Ohms. If the resistance is significantly different please contact the Design Engineer to have the RSSs checked and resistors installed if necessary. See Table 1 Below

Table 1 Extension Cable Color Code

Sensor Lead-In Cable Color	Sensor Lead-In Cable #	Extension Cable Color	Wire Designation
White	1	Gray Pair	Negative Power Supply
Brown	2	Brown Pair	Positive Power Supply
Green	3	Green Pair	RS-485A
Yellow	4	Orange Pair	RS-485 B



3.2 Pavement Pre-Install Inspection

The pavement where the RSS is to be installed must be free of cracking or rutting that could cause inaccurate measurements or premature failure of the RSS. i.e. the pavement must be flat with the surrounding pavement, not ruts or humps, that could cause water to stand on the RSS or it to be unduly exposed to damage or wear being hit by snow plows, sweepers or other equipment. Cracking of the pavement should not be to the extent that breakouts are occurring, or the act of saw cutting and hole drilling will cause those conditions to occur. Should any of the aforementioned conditions exist the Design Engineer of the RWIS system must be consulted for possible relocation. The edges of the saw cuts and holes must be square and not spalled or rounded as the sealants will not make the proper bond and cause premature failure of the system.

4.0 Layout for Holes and Saw Cuts

4.1 RSS Hole and Saw Cut Layout

Place markings on the pavement for the placement of the RSSs in the center of each lane, not in the wheel tracks, designated to receive a RSS at the designated Mile Post (MP) in the plans. Minor adjustment of the placement of each RSS will be necessary so that a straight saw cut from the pull box entry conduit to each RSS can be accomplished without the need to have more than one sensor lead-in cable in any one saw cut. Care also needs to be taken to insure that the saw cuts do not come closer than 6" apart while still in the traffic lane. See Figure 3 Radial Saw Cut Layout.

The communication cable employed for the RSSs is not like Detector Loop Cable, (DLC), or DLC lead in wire and is not suitable for angled cuts with sharp corners, straight cuts are preferred.

The layout in Figure 3 is an example only; this layout will need to be augmented as the lane conditions dictate. i.e. a divided highway will have to have a pull box in the median, or on each shoulder, other lane configurations will require alternative layouts to accommodate the individual conditions at the site. The point being there should be no need for multiple Sensor Lead-In Cables in one slot nor for angled cuts to make turns in the run from the pull box entry conduit to the RSS.

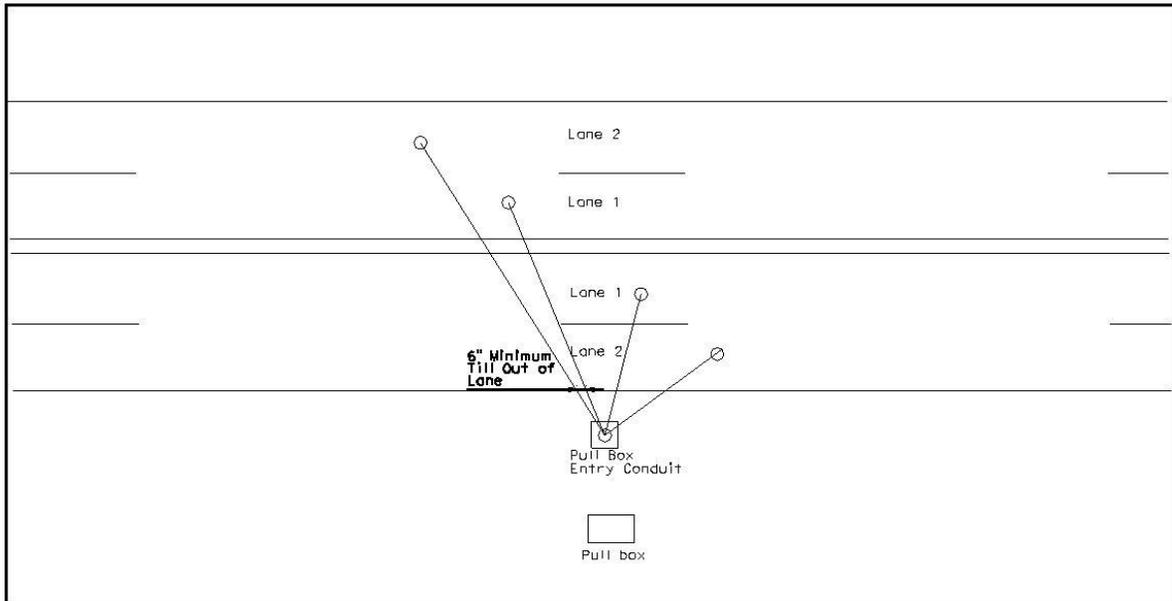


Figure 3 Radial Saw Cut Layout

4.2 SSS Hole and Saw Cut to Accommodate Sub-Surface Sensor/Sensors

Some RSSs will include one or two sub-surface temperature sensors and the associated hole will need to be modified for the installation of the SSS. The sub surface sensors are designed to be installed at specific depths, see Figure 4 Sub-Surface Sensor Designation.

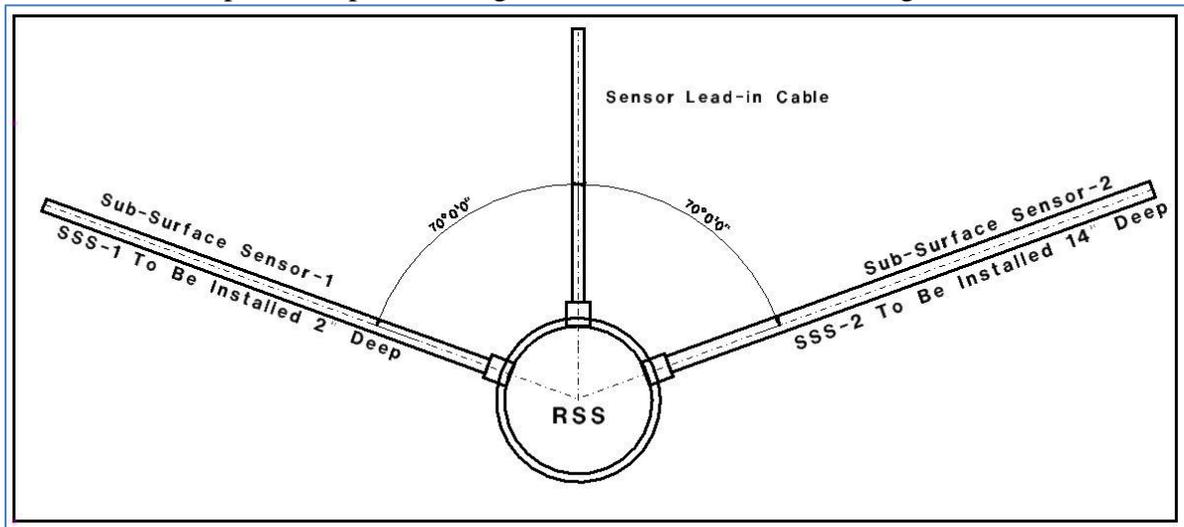


Figure 4 Sub-Surface Sensor Designation

4.2.1 Sub-Surface Sensor-1

For SSS-1 a saw cut is required at 70° CCW in relation to the Sensor Lead-In Cable the cut shall be ½' wide and 3" deep and the length will depend on the measurement taken in step 3.0



Initial Preparation. The depth of the sensor which is located at the very tip of the cable will need to be at the specified depth so the saw cut will have to run till the arbor, or center axis of the saw blade, passes over the point where the tip of the cable will extend to ensuring the sensor is not raised up in the trailing end of the saw cut. See Figure 7, 2" Deep Sub-Surface Sensor 1.

4.2.2 Sub-Surface Sensor-2

For SSS-2 a 3" deep cut will also be necessary to extend out 7.75" at 70° CW in relation to the Sensor Lead-In Cable. Again the saw arbor will have to extend over the 7.75" mark to ensure the cut is 3" deep all the way to the 7.75" mark. At the 7.75" mark a hole will need to be drilled 3/4" in diameter and 11" in depth as measured from the bottom of the saw cut, or 14" from the pavement surface there should be no sharp corner where the SSS cable bends down into the hole, use a hammer and chisel or screwdriver if necessary. See Figure 5 Hole and slot for Sub-Surface Sensor.

4.2.3 Sub-Surface Sensor Special Case Sensor-2 is Omitted

If temperature sensor 2 is omitted and temperature sensor 1 is included it will be installed as per the instructions for temperature sensor 2. i.e. as per Figure 5.

4.2.4 Sub-Surface Sensor Marked with a Red Flag

If one of the temperature sensors is marked with a red cable flag on which a depth is marked that sensors installation depth will have to be confirmed with the Design Engineer of the accompanying RWIS.

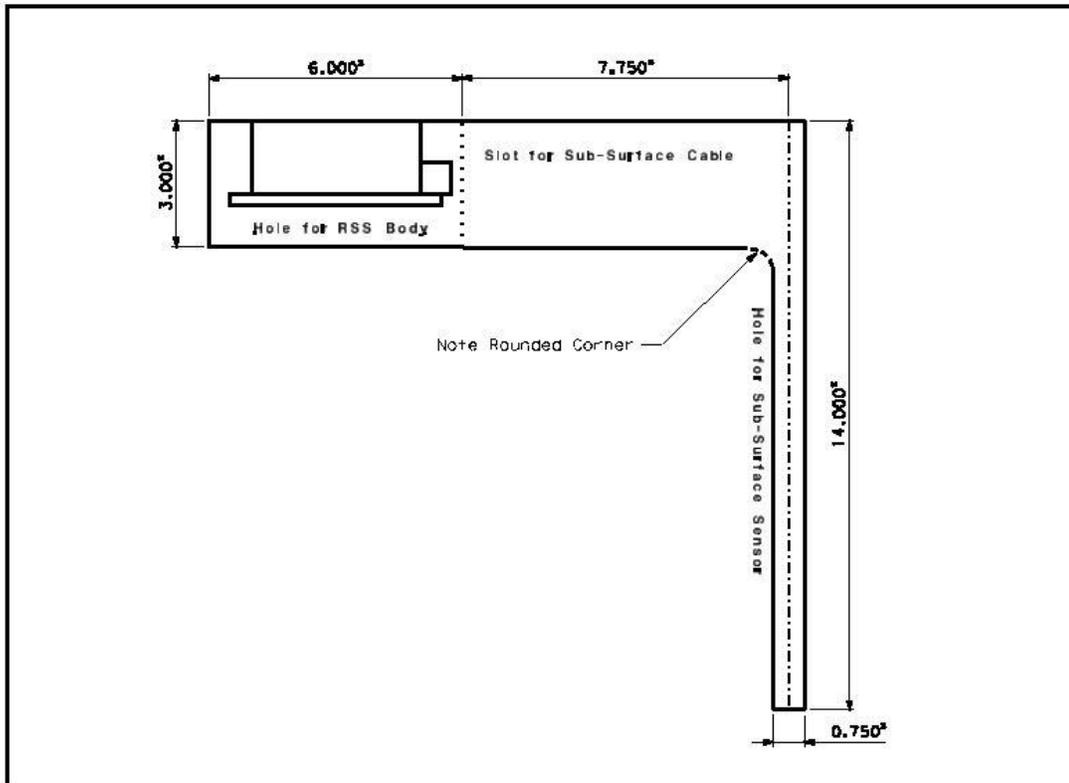


Figure 5 Hole and Slot for Sub-Surface Sensor 2

5.0 Drilling, Cutting, and Cleaning

5.1 RSS Hole Drilling

The hole drilled for the sensor must be 6" in diameter and 3" deep. This will accommodate the body of the sensor and the cable glands. Saw cuts where any SSS cables extend will accommodate the enlarged SSS cabling with waterproofing heat shrink. The RSS hole must be drilled first and the bottom of the hole cleared to a level surface at 3" depth.

5.2 Saw Cuts for Communications Cabling

The saw cuts for the communication cables shall be straight runs from the pull box entry conduit to the RSS hole. The saw cut will extend through the hole to the extent that the arbor, or centerline of the saw blade passes the edge of the hole where the Sensor Lead-In Cable passes into the RSS hole thus making the bottom of the cut level at 3" deep all the way into the RSS hole. See Figure 6 Sensor Lead-In Cable Saw Cut to RSS Hole.

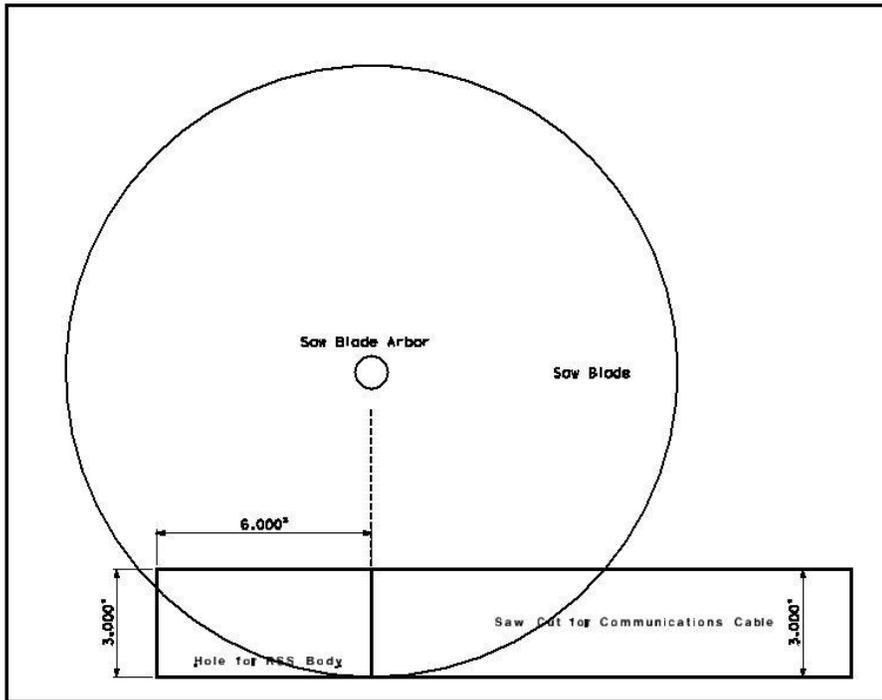


Figure 6 Sensor Lead-In Cable Saw Cut to RSS Hole

5.3 Saw Cuts for 2" Deep Sub-Surface Sensor 1

The saw cut for SSS-1, if any, will be 3" deep the entire length of the sensor cable and sensor itself, it will extend from the edge of the RSS hole to the tip of the sensor, will not have any sharp edges and will not cause the sensor to rise up at the end of the saw cut. See Figure 7 2" Deep Sub-Surface Sensor.

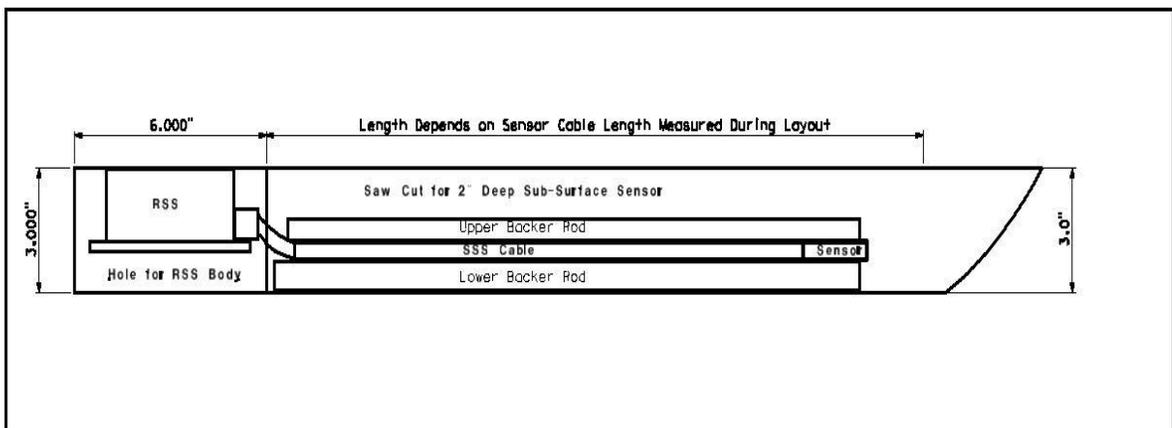


Figure 7 2" Deep Sub-Surface Sensor 1

5.4 Saw Cuts for 14" Deep Sub-Surface Sensor 2

The saw cut for SSS-2 will be 3" deep between the RSS hole and the SSS-2 hole with no sharp edges the hole depth may need to be modified so there is room for the sensor to fit all the way in without cable sticking up in the saw cut. See Figure 8 SSS-2 In Place.

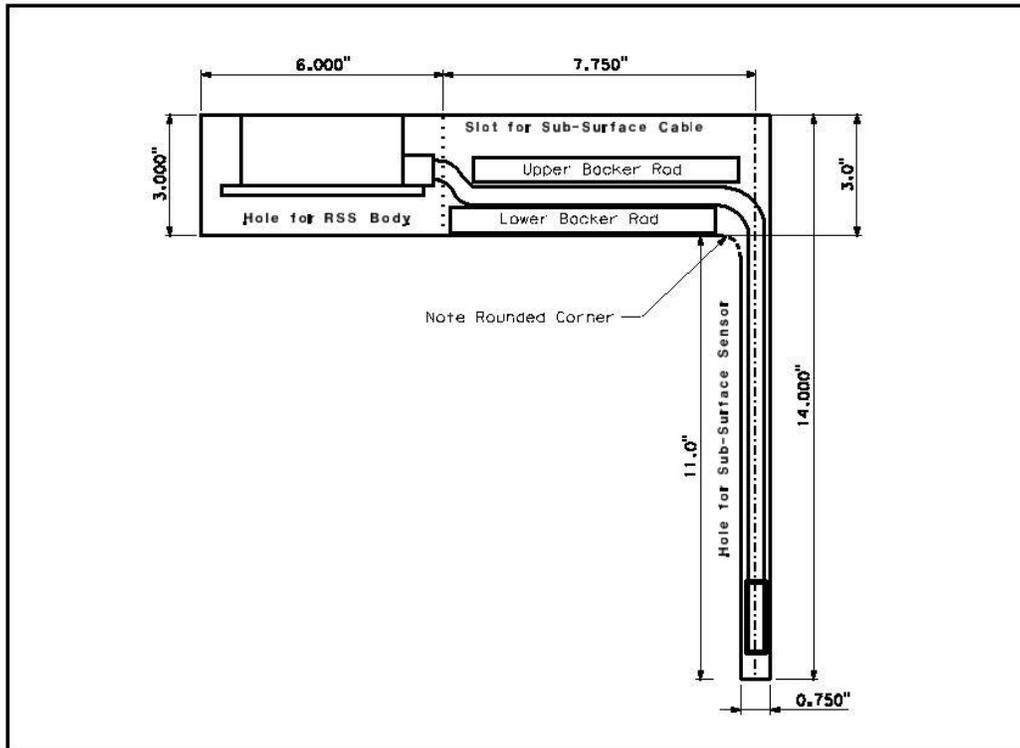


Figure 8 SSS-2 In Place

5.5 Cleaning the Holes and Saw Cuts

5.5.1 Initial Cleaning After Saw Cuts and Holes are Drilled

After the saw cutting and hole drilling is complete power wash the slots and 6" hole with water as a solvent to loosen and displace the slurry left from the cutting processes, then blow out thoroughly with compressed air till dry. Inspect the RSS hole and saw cuts for even bottom surfaces with no jagged or rough protrusions into the areas where cabling will be laid. Inspect the saw cuts and holes for slurry, sand or mud on the edges or bottoms that will prohibit the integrity of the adhesion of the sealants to the surrounding pavement. Scrape, wash and use compressed air to blow dry any remaining dirt and debris. Again the holes and saw cuts must be clean and dry prior to continuing the install water will damage the joint sealant and dirt will prevent a permanent bond between the sealant and slot edges which can cause failure of the sealant.

5.5.2 Hole for 14" Deep Sub-Surface Sensor



The hole for SSS-2 should not be drilled until after the flushing and cleaning with water has been completed and has dried. The hole shall be $\frac{3}{4}$ " diameter and a minimum of 14" deep as measured from the pavement surface, and the center will be $7\text{-}\frac{3}{4}$ " from the edge of the RSS hole. See figure 8 SSS-2 In Place.

5.5.3 Cleaning the 14" Deep Sub-Surface Sensor-2 Hole

The 14" deep hole for SSS-2 will need to be cleaned running the drill in and out of the hole and cleaning the debris, this will be an iterative process until the hole is clean to a depth that will accommodate the sensor fitting all the way in place with no cable left sticking up in the slot and the slot being clean of debris, a vacuum with a narrow nozzle will be necessary no water is to be allowed in this hole. It is important that the hole not be wet which will cause the sealant to change state and not perform as intended and not form a watertight seal around the sensor head at the bottom of the hole.

5.5.4 Masking the RSS Hole and Saw Cuts

Use duct tape to mask off the edges of the 6" hole and saw cuts to avoid spillage from the sealing process becoming permanent. See Figure 9.

6.0 Installing the Backer Rod, Roadway Surface Sensors, and Cabling

6.1 Placing the Lower Backer Rod

All saw cuts that will receive Sensor Lead-In Cable will have $\frac{5}{8}$ " backer rod installed fully seated in the bottom of the saw cut below the cable. The backer rod shall start at the interface between the saw cut and the RSS hole and continue to either the hole in the pavement for the pull box entry conduit, to the end of the sensor cable in the 3" deep cut for SSS-1, or to the beginning of the slope into the vertical hole for SSS-2. Use of a roller designed for the purpose, a stick handle with a 8" diameter $\frac{3}{8}$ " thick plywood wheel attached, or other tool may be used as long as the rod is fully seated in the bottom of the saw cut and not damaged.

6.2 Placing the RSS

The first step will be placing the RSS so it is centered in the hole taking care to align the Sensor Lead-In Cable and SSS cables with their respective slots. Measure the distance from at least three points around the sensor to the edge of the hole to make certain the RSS is centered in the 6" hole. The installation aids will then need to be held in place with weights, one on each side, heavy pieces of steel, 5 to 10 Lb. each, are ideal because they are less intrusive to the work area but cinder blocks will work as long as the RSS is held firmly in place and there is enough access to make the necessary measurements and adjustments in placement, as well as allow access for applying the sealant.

With the RSS centered in the hole and the Sensor Lead-In Cable aligned level the RSS with the surrounding pavement by using a straight edge to pass over the RSS and onto the



pavement on both sides from multiple angles to insure the RSS does not protrude above nor drop below the surrounding pavement, slight bends to the installation aids may be necessary to accomplish the best fit. Adjust the weights on the installation aids to hold the RSS in place level with the pavement surface taking care to keep the RSS centered in the hole. See Figure 9, Weights on RSS Installation Aids.



Figure 9 Weights on RSS Installation Aids

6.3 Placing SSS-1

If both SSS-1 and SSS-2 are present, SSS-1 will be installed in a 3” deep saw cut like that in Figure 7. In this case the sensor will have been placed in the saw cut while the RSS was being placed and it will only be necessary to insure the sensor and cable are in the bottom of the saw cut with the sensor tip laying flat approximately 2” from the surface of the pavement. Note the backer rod will keep the sensor up a bit from the bottom of the saw cut be sure the backer rod does not extend beyond the end of the sensor, the end or tip of the sensor should be sticking out just beyond the end of the backer rod, this is to keep the temperature sensor from being insulated from the surrounding pavement/joint sealant temperature. See Figure 7

6.4 Placing SSS-2

SSS-2 will have to be feed into the 14” deep hole being careful not to move the RSS from it’s placement, ensure that the sensor fits loose enough in the hole so that when the joint sealant is poured it will have room to run around the tip of the sensor and fill the bottom of the hole.



Make certain the cable between the RSS body and the curve down into the 14” deep hole is laying in the bottom of the saw cut firmly on the backer rod and not bowed up. See Figure 8 SSS-2 In Place.

6.5 Placing Sensor Lead-In Cable

The communication cable can be laid into the saw cut over the lower backer rod and rolled or pressed down so that it is firmly in contact with the backer rod. In all cases the cabling must have room for **at least** 1.25” of sealant over the upper backer rod.

It may be that with live traffic on one or more lanes it will be necessary to stop at a certain point and set the remaining sensor lead-in cable to the side and place a temporary dam for the sealant at that point then fill the saw cut with sealant up to that point and after traffic has been switched to another lane remove the temporary dam and continue laying the backer rod and cable in place before continuing the sealing process. Where this is necessary be sure to clean the backer rod used as a dam completely out of the saw cut prior to continuing the sealing process so there is no potential for a fissure between the sealant applications which may allow water intrusion to the cable.

6.6 Placing Upper Backer Rod

After the sensor lead-in and SSS cables are in place the upper backer rod will need to be installed, again using 5/8” backer rod firmly pressed down into the saw cut, using a wheeled tool or other tool as long as the backer rod is pressed down enough to hold the cabling in place with no space between the upper and lower backer rod.

7.0 Application of Joint Sealants

7.1 Sealing the Roadway Surface Sensor in Place

7.1.1 RSS Joint Sealer Properties and Application

The joint sealant used to fix the RSS and SSSs in place shall be Fabick MP-55, or equivalent, see 10.1 Fabick Joint Sealant Properties. This is a fast setting; self leveling sealant that can be applied under a wide temperature range 20°F to 180°F. However it is not to be applied in wet conditions the product will change state in the presence of water and will not perform as intended. The surfaces therefore shall be dry and the process not attempted in rainy conditions. The application of the sealant to fix the RSS in place must be done using the manufacturer supplied, or approved, mixing apparatus.

7.1.2 Applying the Sealant to the RSS and SSSs

Once the RSS and any associated SSSs are in place begin the application of the sealant at the 14” deep SSS, if one exists, inject enough sealant to fill the hole, move and wiggle the cable of the SSS where it goes down the hole to bring any trapped air to the top and make sure the sealant penetrates to the bottom of the hole and completely encases the sensor cable and



sensor end. Then fill the hole the rest of the way and work back through the saw cut to the RSS hole.

Fill the RSS hole slowly at first and observe that the sealant runs under the entire RSS and no air gaps are trapped under the RSS. Only fill the hole till the sealant reaches midway up the body of the sensor, let the sealant cure till the sensor is fixed solidly in place then remove the installation aids, replace the screws that held the installation aids in place firmly but not so tight as to move the sensor then tape over the screws so no epoxy gets into the screw caps. This is to keep the installation aids from being sealed in place by the sealant. Note do not torque the screws at this time wait till all the sealant has been placed to be level with the pavement and has cured

Then fill the RSS hole to the level of the pavement taking care to not over or under fill the hole. It may be that on a slanted surface it will be necessary to tape over the lower portion of the hole even with the pavement and fill from the high side.

7.1.3 Approved Sealant for Use on the Sensor Lead-In Cable

The Sealant used on the Sensor Lead-In Cable can be the same as used for the RSS and SSS or can be one of those specified in the Caltrans 2010 Standard Specifications sections:

- 86-5.01A(3)(a) **Elastomeric Sealant**
- 86-5.01A(3)(d) **Epoxy Sealant for Inductive Loops**

Section 86-5 of the Caltrans 2010 Standard Specifications is intended for Detectors in general and may include the use of Hot-Melt Rubberized Asphalt Sealant but the sensor lead-in cable connected to the RSSs is not rated for use in temperatures above 175°F even short term exposure to temperatures consistent with hot melt are not acceptable and will damage the cable so Hot-Melt is not an option only the above listed sealants.

In addition note the use of asphaltic emulsion has been eliminated from the standard list of sealants acceptable for use on detector loops due to, shrinkage and curing time.

7.1.4 Applying the Sealant to the Sensor Lead-In Cable

Completely remove any backer rod dams used to hold other sealants back at stopping points or as delineators between sealant types. With the saw cuts clean and masked off apply the sealant as per the manufactures instruction taking care to fill the saw cuts to the level of the surrounding pavement.

7.1.5 Removing the Plastic Film and Masking Tape

After the sealants have cured remove the green plastic film and masking tape and examine the results for any imperfections in the leveling of the sealants and fill or cut as necessary to achieve a smooth level surface between the pavement and the sealants.

7.2 Allowing Traffic Back in the Lanes



Do not allow traffic over the freshly installed RSSs until the sealants have properly cured for both the RSS and Sensor Lead-In Cables. Follow the sealant manufactures timing instructions and confirm the hardness of the material prior to switching traffic from lane to lane.

8.0 Insuring Proper Torque on the RSS Insert

After the sealant has cured torque all six of the hex head screws to the specified 2 Nm using the sequence in Figure 10 RSS Torque Pattern. Make a 2nd pass with the torque wrench to confirm all screws are at the specified torque.

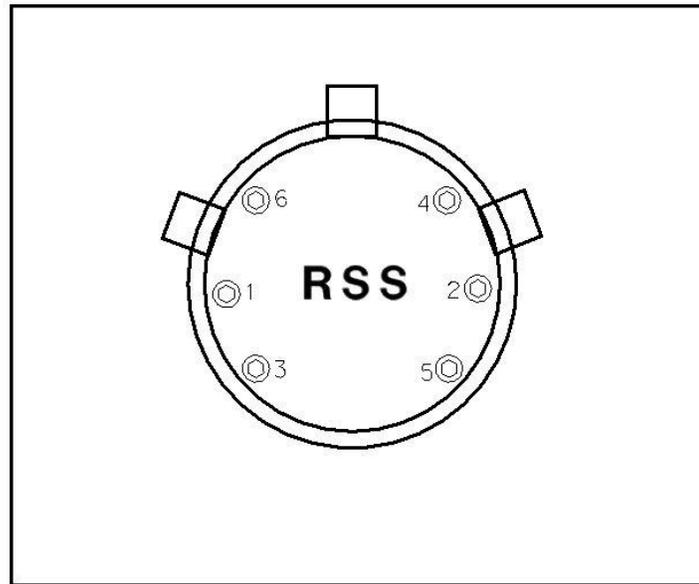


Figure 10 RSS Torque Pattern

9.0 Routing Sensor Lead-In Cable to the RWIS Cabinet

9.1 Marking the Cables

Each cable must be permanently marked to correspond with the lane the surface sensor is located in and indicate if it has a SSS by adding SSS. The numbering will start from the innermost lane and include the lane number and direction, i.e. NB 1, NB 2, SB 1, & SB 2 SSS for instance. The Identification will be plastic cable markers designed for the purpose and attached using wire ties. Markings will be in the pull box nearest the sensors themselves AND in the RWIS cabinet. The markings will be located 6" from the entry to the pull box or RWIS cabinet. It may be necessary to temporarily mark the cables during pulling then after they are in place come back and mark them permanently.

9.2 Pulling the Cables into the Pull Box Leaving Service Loops



The cables will need to be identified prior to pulling into the pull box and again identified once they are in the pull box nearest the sensors. Intermediate pull boxes will not require labeling or the service loops. Once the cables have been identified they can be pulled on to the next pull box leaving three loops, the size of the pull box, in the pull box nearest the sensors and nearest the RWIS cabinet this means 3 loops for each cable and then on into the RWIS cabinet leaving 6' minimum in the RWIS cabinet and again labeled at 6" from entry into the cabinet.

9.3 Splicing to Extension Cables if Necessary

If the cables need to be extended there shall be only one splice and it will be located in the pull box nearest the sensors themselves. The splices will be encapsulated in 3M 8980 Series Splice Encapsulation Kits with the High Gel Encapsulating Compound. (See Appendix)

9.3.1 Identify and Test Each Pair

Care shall be taken to identify each pair in the extension cable and that pairs not be split. i.e. each pair is identified by one wire having a color and one white wire wrapped together with that colored wire. Test each pair by shorting the colored wire to its white mate at the splice location and then going to the RWIS cabinet end and testing that pair for a short at that end thus assuring the two wires of the pair that are positively identified at each end of the run. See Figure 12 Separated Pairs

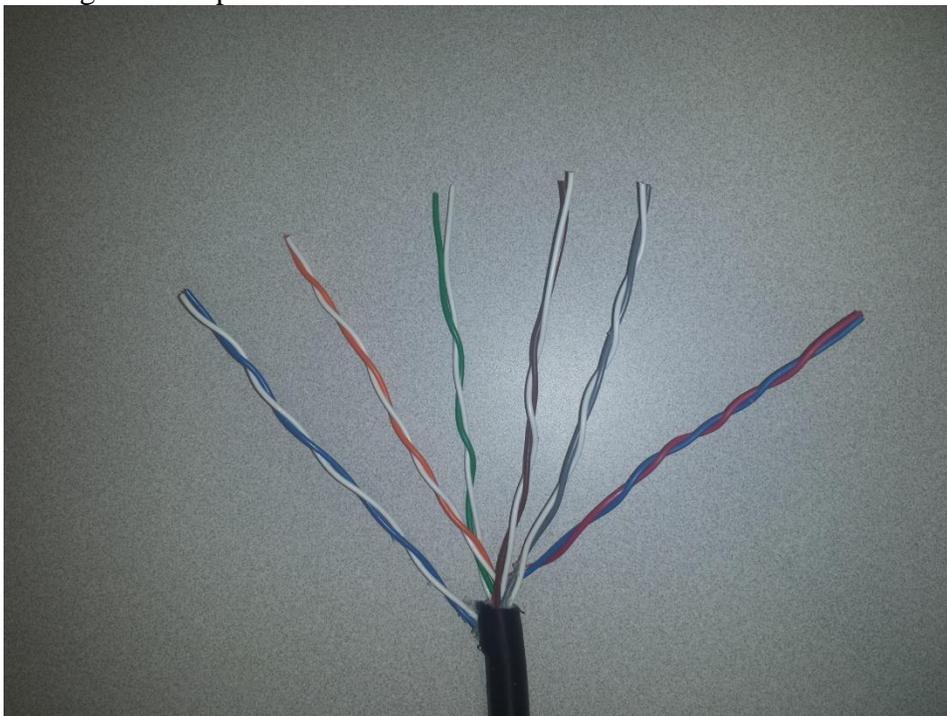


Figure 11 Separated Pairs



9.3.2 Extension Cable Color Code

The wires in the sensor lead-in cable will be identified by either color or having a number, 1 through 4, printed in white on black insulation. Each pair in the extension cable is identified by color. Once all wires and pairs have been identified they shall be spliced according to Table-1 Extension Cable Color Code.

Table-1 Extension Cable Color Code

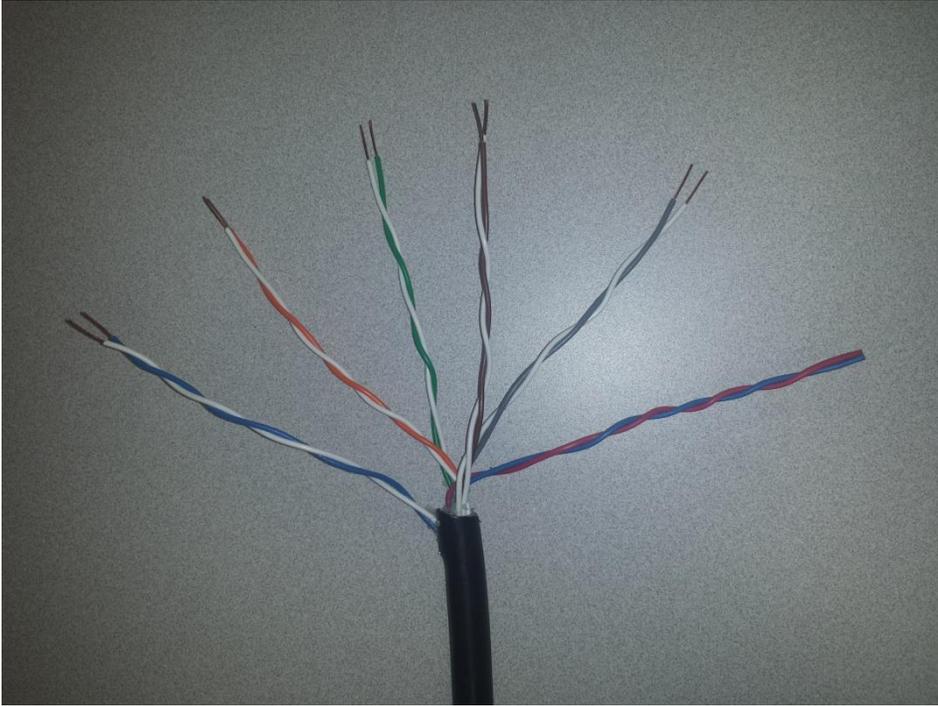
Sensor Lead-In Cable Color	Sensor Lead-In Cable #	Extension Cable Color	Wire Designation
White	1	Blue and Gray Pairs	Negative Power Supply
Brown	2	Brown and Orange Pairs	Positive Power Supply
Green	3	Green of Green Pair	RS-485A
Yellow	4	White of Green Pair	RS-485 B

9.3.3 Wire Splicing

For the power wiring the overall loop resistance of the wire must be less than 10 Ohms. To that end each of the power supply wires in the sensor cable will need to be spliced to 2 pairs of wires in the 6 pair sensor lead in cable specified in RUS Bulletin 1753F-205 (PE-30) 19Ga. used for the extending RSS cabling. The wire splicing will be accomplished using Ideal Set-Screw Wire-Connector part #30-210, see Section 11.5, soldering the wires together after the mechanical connection has been made with the screw connector, then being sealed using ScotchKote FD. and finally encapsulated in a Scotch Splice Encapsulating Kit.

The splicing process will consist of the following steps:

1. Strip the wires that will be spliced back 1/2"
2. Tin the stranded wires from the SS cable.
3. Strip the five wires for each the negative and positive power supply lines, see Table-1 Extension Cable Color Code, into the brass screw-terminals and tighten the screws making sure the wires seat properly and all five wires in each brass set-screw connector are mechanically secured.
4. Solder the bare ends of the wires that will be sticking out approximately 1/4" to make a sound electrical connection.
5. Trim the soldered ends back so the caps will screw onto the brass set-screw connector.
6. Dip the terminal with the soldered wires in the Scotchkote FD and screw on the terminal cap.



See Figure 11 Striped Wires

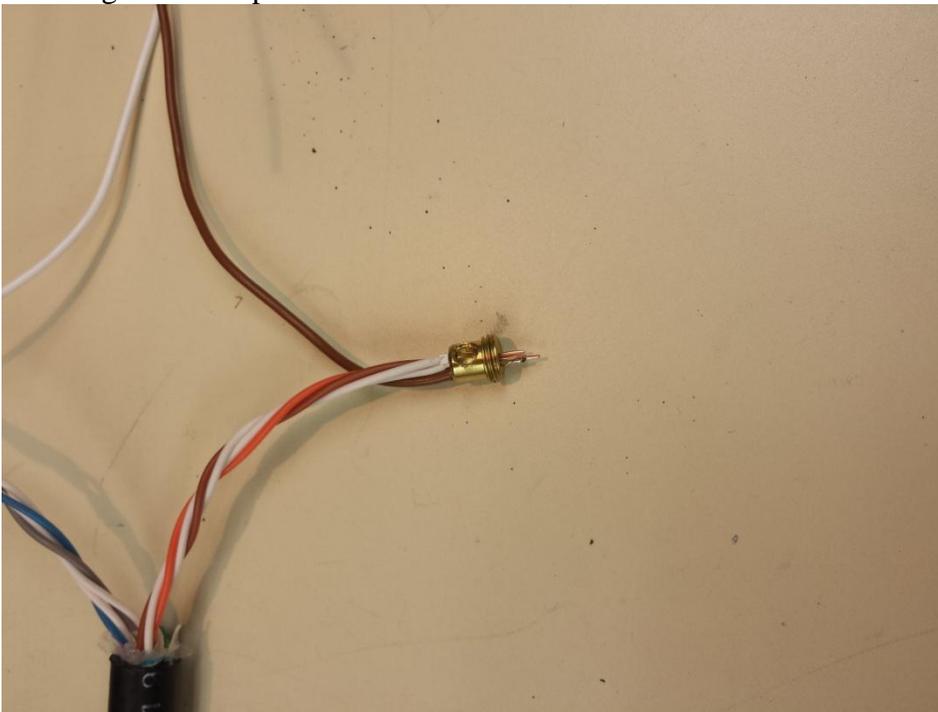


Figure 12 Wires in Screw-Terminal Prior to Soldering

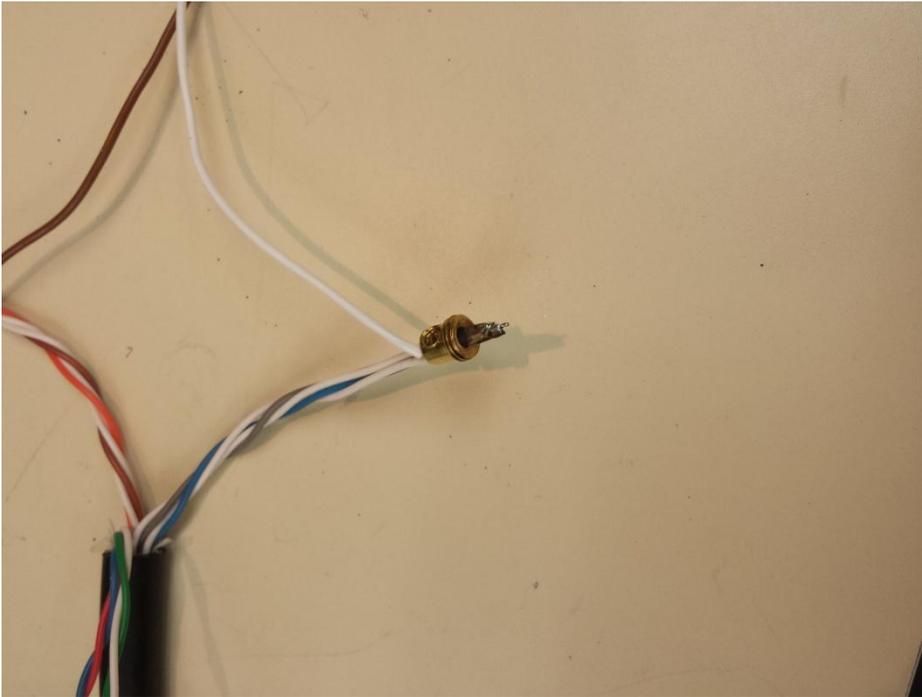


Figure 13 Wires After Soldering

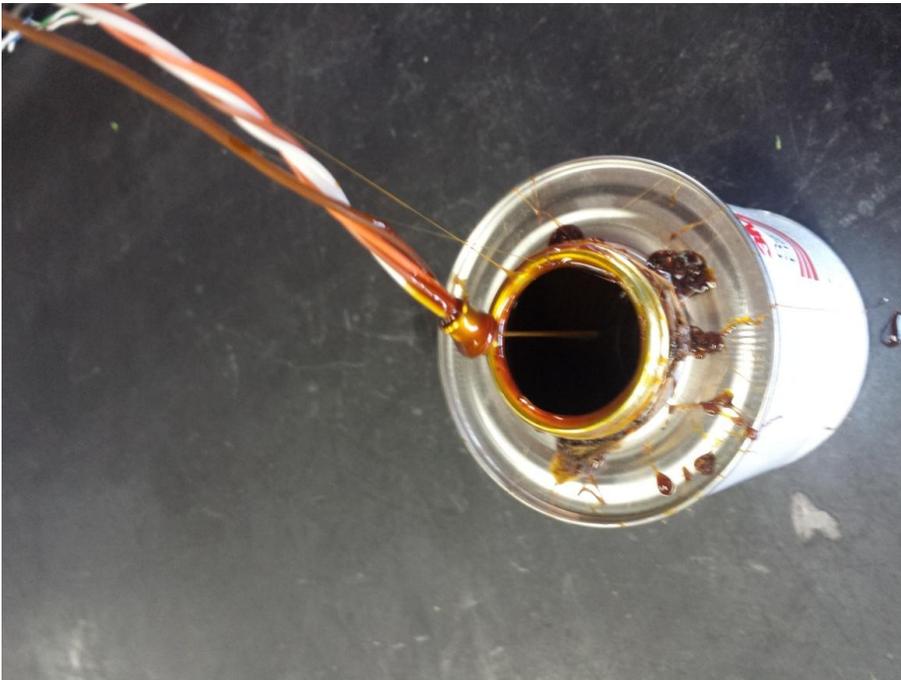


Figure 14 Completed Screw-Terminal Dipped in Scotchkote FD



9.3.4 Splicing the RS-485 Communications Wires

The remaining two wires from the SS are the RS-485 communications wires and require the communications cabling to be balanced 120 Ohm cabling and this requires the pair of wires that are twisted together the entire run from the RSS to the Remote Processing Unit (RPU) at the RWIS. The green balanced pair has been selected to be spliced to the communications wires from the RSS. This splice can be made with the 3M gel filled Scotchlok UR connectors. See Figure 15 RS 485 Communications Wire Splice.



Figure 15 RS 485 Communications Wire Splice

9.3.5 Shield Bonding at Splice

The shield of both cables will be bonded using a Hubbell BC285SB100 rivet type bonding fixture on the extension cable, see Hubbell Bonding Kit in appendix, and a crimp on connector to the braided shield of the RSS cable, the two shields then bonded using the metal strip supplied in the 3M Splice Kit. See Figure 15 Splice Bonded.



Figure 16 Splice Bonded

9.3.6 Encapsulate the Splice Using the 3M Splice Encapsulation Kit

The entire splice must be encapsulated in the 3M splice encapsulating kit per the instructions with that kit such that the splice connectors and the jackets of both cables are sealed against water intrusion.



10.0 Appendix

10.1 Fabick MP-55 Joint Sealant Properties

Product Description:

Fabick MP-55 material is a two component 100% solid hybrid polyurethane/polyurea based joint sealant. **MP-55** is a self-leveling joint sealant designed to protect horizontal concrete expansion and control joints from spalling, chipping, and breakdown. This elastomer displays fast cure times and excellent adhesion to concrete. **MP-55** can be applied at temperatures ranging 20°F to 180°F. This hybrid polyurethane/polyurea elastomer displays excellent chemical resistance, water insensitivity, and thermal stability at high and low temperatures. **MP-55** may also be used under traditional floor coatings (such as epoxies, polyureas and polyurethanes) or tiles to smooth the joints and provide protection from cracking and sinking caused by non-elastomeric joints sealants.

Typical Physical Properties: 2:1

Tensile Strength (PSI)	ASTM D412	2950	
Elongation (%)	ASTM D412	350	
100% Modulus	ASTM D412	1620	
Tear Strength (PLI)	ASTM D412	500	
Hardness (Shore A)	ASTM D2240	95A	
Flexibility (1/8 "Mandrel)	ASTM D1737	Pass	
Flashpoint (°F)	ASTM	>200	
Pensky-Martin			
Taber Abrasion (mg loss) CS18 Wheel 1 kg per 1000 cycles	ASTM D4060	25	
Viscosity	B Side	CPS	1200
Viscosity	A Side	CPS	400

Typical Processing Properties:

Gel Time	Minutes	2
Tack Free Time	Minutes	5
Open to Industrial Traffic	Minutes	15

Application Equipment:

This material may be applied using a plural component pump (2:1 or by volume), or by plural component cartridges. This proportioning unit must be capable of supplying the correct pressure and heat for the required hose length on a consistent basis. This characteristic is mandatory to apply this elastomer in a consistent, efficient manner. The applicators for the plural component cartridges can be manual, pneumatic, or battery operated.

Available Colors:

- Black
- Custom tinting on request

Installation Recommendations:

MP-55 adheres well to sound concrete substrates. All surfaces should be free of moisture, loose particles and debris. Any moisture present in the joint should be eliminated prior to installation. Using a diamond blade saw,



saw the joint vertically to 90° angles to a minimum depth of 1 inch. The joint should be widened slightly to ensure adhesion to freshly opened concrete. Care should be taken not to adversely affect adhesion by “burnishing” the sides of the joint with a grinder. After sawing or grinding, care should be taken that minimal amounts of dust and debris are left over in the joint. The joint should be vacuumed using a common “shop-vac” to remove as much dust and debris as possible or high-pressure air depending on the site location. **MP-55** should be placed in the joint full depth, overfilled, and allowed to cure for a minimum of ten minutes before shaving level with the concrete.

Clean-Up Disposal:

Cured product may be disposed of without restriction. The uncured isocyanate and resin portions should be mixed together and disposed of in a normal manner. “Drip-free” containers should be disposed of in accordance with local, state and federal laws.

Shelf Life and Storage:

Six months in factory delivered unopened drums or plural component cartridges. Keep away from extreme heat, cold, direct sunlight, and moisture. It is recommended to keep the material at a stable storage temperature between 60°F and 80°F as much as possible. The components used in the MP-55 have been specially formulated to withstand a certain amount of low temperature applications. However, it is recommended to warm the material to a minimum of 60°F before application if the material is cold. This is to help with flow and proper mixing.

Limitations:

MP-55 is an aromatic polyurethane. While the physical properties may not be affected, the elastomer could yellow and chalk with exposure to UV or Hg vapor light. It is highly recommended to use a dark color for any applications requiring color stability. If color stability is mandatory, contact the manufacturer for recommendations. The chemical resistance chart should be consulted prior to any application. **MP-55** was designed to protect the edges of concrete control and expansion joints. **MP-55** will pull away from the joint edges if too much slab movement is encountered. This characteristic allows for early replacement and to alert the property owners that movement is present.

Adhesion Results:

ASTM D-4541 Elastomeric

Concrete (No Primer) >400 psi Concrete

Chemical Resistance: Chemical	Result (25 °C)	Chemical	Result (25 °C)
Acetic Acid (100%)	RC	NaCl/ h2o (10%)	R
Brake Fluid (DOT3)	RC	Potassium Hydroxide (10%)	R
Clorox® (10%) H2O	C,Dis	Sodium Hydroxide (10%)	R
Diesel Fuel	R	Sodium Bicarbonate	R
Gasoline	R	Sugar/H2o (10%)	R
Hydrochloric Acid (10%)	R	Sulfuric Acid (10%)	R, Dis
Hydraulic Fluid (Oil)	R, Dis	Sulfuric Acid (>22%)	NR
Mineral Spirits	R	Vinegar/H2o (5%)	R
Motor Oil	R, Dis	Water	R
Muriatic Acid (10%)	R	Xylene	C

Coverage Calculations:

Coverage Rate=ft./gal: Does not include overfilling.

Joint Width (Inches)	Inches	1/8 inch	¼ inch	½ inch	¾ inch	1 inch
-----------------------------	--------	----------	--------	--------	--------	--------



1/8	1230	615	308	205	154
1/4	615	308	154	102	77
1/2	308	154	77	51	38
3/4	205	103	51	34	25
1	154	77	38	25	19
1 1/2	103	51	25	17	12
2	77	38	19	12	9
3	52	25	12	8	6

10.2 Standard Specifications 86-5.01A(3)(a), 86-5.01A(3)(d)

10.2.1 86-5.01A(3)(a) Elastomeric Sealant

Polyurethane material that will within stated shelf life cure only in the presence of moisture. Sealant must be suitable for use in both HMA and concrete pavement.

The cured sealant must have the performance characteristics shown in the following table:

Performance Characteristics of Cured Sealant Characteristic	ASTM	Requirement
Hardness (indentation) at 25 °C and 50% relative humidity. (Type A, Model 1700 only)	D 2240 Rex.	65-85
Tensile strength: Pulled at 508 mm per minute	D 412 Die C	3.45 MPa, min
Elongation: Pulled at 508 mm per minute	D 412 Die C	400%, min
Flex at -40 °C: 0.6-mm free film bend (180°) over 13-mm mandrel	--	No cracks
Weathering resistance: Weatherometer 350 h, cured 7 days at 25 °C @ 50% relative humidity	D 822	Slight chalking
Salt spray resistance: 28 days at 38 °C with 5% NaCl, Die C & pulled at 508 mm per minute	B 117	3.45 MPa, minimum tensile 400%, minimum elongation
Dielectric constant over a temperature range of -30 °C to 50 °C	D 150	Less than 25% change



10.2.2 86-5.01A(3)(d) Epoxy Sealant for Inductive Loops

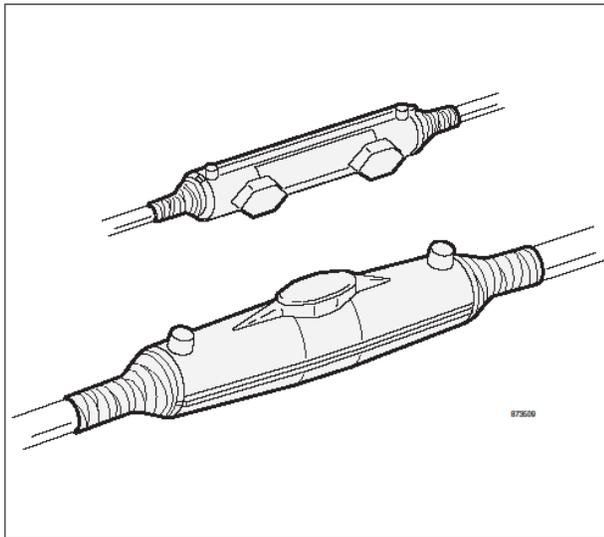
Use for repair work on existing spalls, cracks, and other deformations in and around saw cuts housing inductor loops and leads. The maximum gel time of the combined components must be 30 minutes when tested under California Test 434. The rapid cure allows minimum traffic delay when tested under California Test 434.

10.3 3M Splice Encapsulation Kit

3M

Scotchcast™ Splice Encapsulation Kits 8980 Series

(with 3M™ High Gel Encapsulating Compound or
3M™ Scotchcast™ Encapsulating Compound 4407)

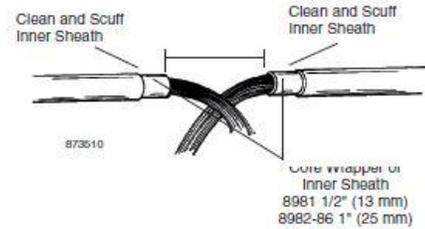


January 2006
78-8097-8956-9-E

3.0 Cable Preparations

3.1 Prepare the cables. Cut shield flush with the outer sheath and scuff the inner sheath (on double sheath cables).

3M™ Scotchcast™ Kit Number	Splice Opening
8991	1.5" (38 mm)
8982	5.25" (133 mm)
8983	9.75" (248 mm)
8984	9" (228 mm)
8985	17" (431 mm)
8986	17" (431 mm)



3.2 Filled Cables
 For best results, clean filled cables thoroughly before encapsulating.

Note: Carefully follow health, safety and environmental information given on cable cleaner label or Material Safety Data Sheet.

3.3 For 8982-8986 kits, insert the shield connector between the shield and the inner sheath (or core wrapper on single sheath cables). On 8982-8983 kits, make certain the shield connector studs are aligned with "bubbles" on the side of the mold body. (Note: Cables show 4462-FN shield connector).

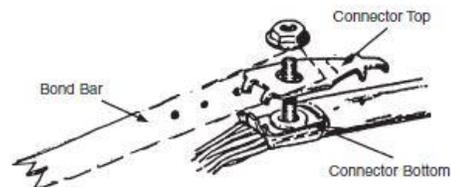


3.4 For cables less than 3/4" (19 mm) in diameter, cut a 1" (25 mm) slit in the sheath opposite the connector location. Then complete the procedure.

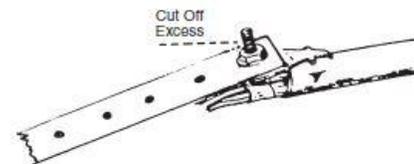


3.5 Install shield bond connector and bond bar. Then install one nut securely onto shield bond connector stud.

Note: Torque 4460 series shield connector nuts to 30-35 in-lbs (3.4-4.0 kg•m)
 Torque 4462 series shield connector nuts to 45 ± 5 in-lbs (5.2 ± 0.6 kg•m).



3.6 Cut off excess stud.



3.7 For double sheath cables, build sealing collars on the inner sheath. Each sealing collar consists of one wrap of 3/4" (19 mm) wide B sealing tape cut in half 3/8" (9 mm) and completely overwrapped with at least two turns of 3/4" (19 mm) highly stretched DR tape, white side out.

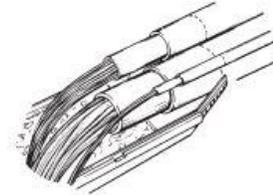
3.8 For 3M™ Scotchcast™ Kits 8981-8986, continue shield by installing the bonding strap or strain bar(s) across the splice opening.



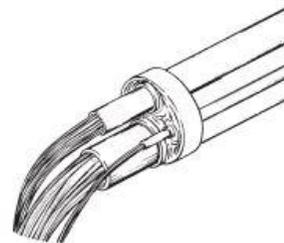
3.9 Build outer sheath sealing collars just beyond the nose of the shield bond connector—each sealing collar consists of one 3/4" (19 mm) wrap of B sealing tape cut in half 3/8" (9 mm) and completely overwrapped with at least two turns of highly stretched DR tape, white side out. (Collars must be covered by closure).

3.10 For multiple cables:

(a) Center a closure-half over the splice and mark the closure end location on the cables.



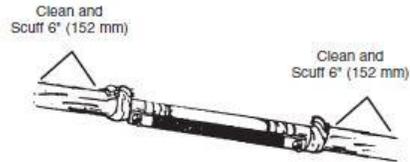
(b) Seal cables together with B sealing tape filling all voids between the cables. Trim closure ends to fit build up.



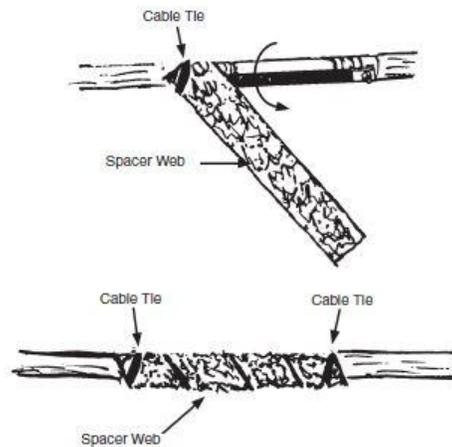
**4.0 Splice Conductors
 (per company practice)**

5.0 Closure Assembly

5.1 3M™ Scotchcast™ Kits 8981-8986
 Clean and scuff completely around the cables sheath for distances indicated using sheath scuff.



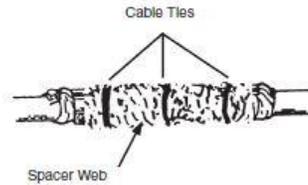
5.2 8981 Closure
 Secure one end of spacer web to the cable with a cable tie. Spiral wrap spacer web tightly around splice bundle. Secure end to cable with cable tie.



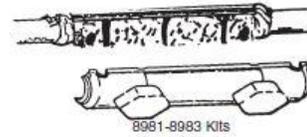
5.3 8982-8986 Closures
 Install spacer web and secure in place with cable ties.

Note: Do not overlap spacer web.

5.4 Center the closure over the splice opening.
 For 8981 and 8983 kits, position the bubbles over the shield connectors.



- 5.5 Trim closure ends so that they loosely fit on the cable outer sheath.



- 5.6 Install closures.
 Align the tongue and groove and snap the closure halves together. HINT: Pliers may be used to snap the closure halves together, but be sure that the tongue and groove are properly engaged before crimping the flanges.



- 5.7 Wrap the closure ends with DR or 23 rubber tape provided in the kit.

- 5.8 Install funnels on 3M™ Scotchcast™ Kits 8981-8983.

6.0 Closure Filling

- 6.1 Position closure:

8981-8983 kits: Slightly incline closure 1/2" (13 mm).

8984-8986 kits: Keep closure level.

- 6.2 Mix compound per instructions on Uni-pack container guard bag.

Note: For health, safety and disposal information refer to compound label or Material Safety Data Sheet for encapsulating compound being used.

- 6.3 Pour compound:

8981-8983 kits: Pour compound into closure through funnel on low end only. Pour until compound fills closure and reaches top of funnel on lower end.

8984-8986 kits: Pour compound to top of air vents. Replace cover onto pour opening. Closure can be buried immediately.

8

10.4 Hubbell Bonding Kit



Bonding Connector



Order Information

Use to field install a screw terminal/connection point in braided strap, service wire, or cable shield.

Delivery: 100 SHIELDBOND® connectors
1 Field installation tool kit

Catalog No. **BC285SB100**



Hubbell Premise Wiring

HUBBELL INCORPORATED (Delaware)
14 Lord's Hill Road • Stonington, CT 06378-0901 • (860) 535-8326 • 800-626-0005
Fax: (860) 535-8328 • Internet site: <http://www.hubbell-premise.com>

Worldwide Locations

DS-M27 10/05

Hubbell Premise Wiring, Asia Pacific	852-2836-7131	Fax: 852-2836-7132	Hubbell Premise Wiring, Latin America	305-408-4501	Fax: 305-408-8201
Hubbell Canada Inc.	905-839-1138	Fax: 905-839-9108	Hubbell de Mexico, S.A. de C.V.	(5255) 9151-9999	Fax: (5255) 9151-9989
Hubbell Premise Wiring, Central America	506-309-4158	Fax: 506-260-1616	Hubbell Premise Wiring, Middle East	971-4-393-4192	Fax: 971-4-393-4194
Hubbell Premise Wiring, China	8621-6309-0119	Fax: 8621-6309-0122	Hubbell-Taian Co., Ltd., Taiwan	886-2-2522-1862	Fax: 886-2-2522-1872
Hubbell Premise Wiring, Colombia	571-245-8940	Fax: 571-340-0925	Hubbell Premise Wiring, Turkey	90-216-313-5016	Fax: 90-216-414-8148
Hubbell Premise Wiring, Europe	44-01283 500500	Fax: 44-01283 500400	Hubbell Premise Wiring, Venezuela	58-416-680-7453	Fax: 58-281-274-7900
Hubbell Int'l. Inc., Korea Branch	82-2-(0)2607-1363	Fax: 82-2-(0)2603-7386			



10.5 Ideal Set-Screw Wire-Connector

CONNECTOR ACCESSORIES

WWW.IDEALINDUSTRIES.COM

1-800-485-0705 CUSTOMER ASSISTANCE

IDEAL® WIRE TERMINATION

Set Screw Wire Connectors

- Eliminates need for restripping wire each time connection is disturbed
- Solid brass sleeves in three sizes handle 22 through 10 AWG wires
- Set-screw easily and securely applies maximum compression to conductors to ensure a vibration-resistant splice
- Permits fast visual inspection of splice
- Tough, flame-retardant shell rated at 150°C (302°F)
- UL Listed to 486C and CSA Certified to C222 #188 ; comply with Federal Specification W-S-610E

Model	Wire Combination Range	Quantity	Cat. No.
10	300V 22 thru 10 AWG Min. 1 #20 w/1 #22 Max. 2 #14 w/1 #16	Box of 100	30-210
		Carton of 1,000	30-310
11	600V 22 thru 10 AWG Min. 1 #14 w/1 #20 Max. 3 #14 w/2 #18	Box of 100	30-211
		Carton of 1,000	30-311
22	600V 20 thru 10 AWG Min. 1 #16 w/3 #18 Max. 2 #10 w/1 #12	Box of 100	30-222
		Carton of 1,000	30-322



Set Screw Holder



- Convenient tool for holding and tightening set-screw connectors
- Accepts IDEAL Models 11 and 22 set-screw connectors

For Connector Models	Cat. No.
11 & 22	K-2422

A-16

Noalox® Anti-Oxidant

- Anti-oxidant compound improves efficiency and service life of aluminum electrical applications
- Suspended zinc particles penetrate and cut aluminum oxide
- Provides additional inner-strand and inner-conductor current paths for improved conductivity and cooler connections
- Carrier material excludes air to minimize further oxidation
- For use with pressure-type wire connectors including lugs, taps, service entrances and split bolts
- Reduces galling and seizing when applied to aluminum conduit joints – promotes good ground continuity



Description	Cat. No.
1/2-oz. Tube	30-024
4-oz. Squeeze bottle	30-026
8-oz. Squeeze bottle	30-030
8-oz. Brush cap	30-031
1-gal. Bucket	30-032
5-gal. Bucket	30-040



Spin-Twist® Wire Connector Socket



- Speeds installation of IDEAL and BUCHANAN Wire Connectors
- For use with electric corded or cordless drill drivers
- 1/4 in. chuck fits most drills or drive sockets

For Connector Models	Cat. No.
Wire-Nut®, Wing-Nut®, Twister®, B-CAP® & WingTwist™ Wire Connectors.	30-902

10.6 Scotchkote FD



3M™ Scotchkote™ Electrical Coating FD

Data Sheet

May 2012

Product Description 3M™ Scotchkote™ Electrical Coating FD is designed as a fast-drying sealant and bonding agent intended for use on joints wrapped with plastic electrical tape.

- Product Features**
- Compatible with Scotch® Vinyl Electrical Tapes
 - Fast drying
 - Flexible when dry
 - Self-contained applicator
 - Virtually no waste if container resealed after use

Applications 3M™ Scotchkote™ Electrical Coating FD is intended for use as an outer seal on vinyl tape applications which are subjected to excessive amounts of oil. It is designed to improve the weather resistance of the taped joint of splice. It is suitable for direct burial, direct water immersion or above ground applications. Contact with potable water is not recommended.

Precautionary and first aid information for this product may be found in its Material Safety Data Sheet and on the product container

Application Techniques After taping splices with Scotch Vinyl Electrical Tape, apply 3M™ Scotchkote™ Electrical Coating FD evenly over splice, extending a short distance onto the cable insulation. Be sure the surface is clean, dry and free from oil or grease before electrical coating is applied



3M™ Scotchkote™ Electrical Coating FD

Typical Physical Properties

Technical information provided consists of typical product data and should not be used for specification purposes. Unless otherwise noted, all tests are performed at room temperature.

Physical Properties	Typical Value
Tack Free Time @ 72°F/22°C	12 minutes
Adhesion to: Wood Metal Rubber Plastic	Good Good Good Good
Electrical Properties	Typical Value
Dielectric Strength: Dry 24 hrs. in H ₂ O	450 volts/mil 200 volts/mil
Chemical Properties	Typical Value
Solvent	Acctone
Solids (25%)	Synthetic rubber & resin
Flash Point	-4°F/-20°C (closed cup)

Availability

Please contact your local distributor; available from 3M.com/electrical [Where to Buy] or call 1.800.245.3573.

Important Notice

All statements, technical information, and recommendations related to 3M's products are based on information believed to be reliable, but the accuracy or completeness is not guaranteed. Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use. Any statements related to the product, which are not contained in 3M's current publications, or any contrary statements contained on your purchase order, shall have no force or effect unless expressly agreed upon, in writing, by an authorized officer of 3M.

Warranty; Limited Remedy; Limited Liability

This product will be free from defects in material and manufacture at the time of purchase. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** If this product is defective within the warranty period stated above, your exclusive remedy shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. **Except where prohibited by law, 3M will not be liable for any indirect, special, incidental or consequential loss or damage arising from this 3M product, regardless of the legal theory asserted.**

3M, Scotchkote and Scotch are trademarks of 3M Company.



Electrical Markets Division
8801 River Place Blvd.
Austin, TX 78726-9000
800.245.3573
FAX: 800.245.0329
www.3M.com/electrical

Please recycle
© 3M 2012 All rights reserved
78-8141-5245-6 A



11.0 References

- Campbell Scientific “IRS21 Lufft Intelligent Road Surface Sensor”
<http://s.campbellsci.com/documents/cr/manuals/irs21.pdf>
- Lufft Operating Manual “Intelligent Road Sensor IRS31Pro_UMB” Version 3 (02-2014)
http://www.lufft.com/dateianzeige.php?Dateiname=download/manual%5CIRS31Pro-UMB_V3_e.pdf
- Fabick Technical Data Sheet Fabick MP-55 Date:1/11/2010
<http://www.fabick.com/tech-sheet.html>
- Helukabel PAAR-TRINIC-Li-2YCYv data sheet
http://www.hitechcontrols.com/cables/data_computer_cables/flexible/paar_tronic_li2y_cy.html
- Caltrans Standard Specifications 2010
http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_Std_Specs/2010_StdSpecs.pdf
- Caltrans Standard Plans 2010
http://www.dot.ca.gov/hq/esc/oe/project_plans/highway_plans/stdplans_US-customary-units_10/viewable_pdf/2010-Std-Plns-for-Web.pdf
- Backer Rod Mfg. Inc. 2010 Product Catalog
<http://www.bayindustries.com/media/35076/backer-rod-catalog.pdf>
- Ideal Set-Screw Terminal-Connector
http://www.idealindustries.com/prodDetail.do?prodId=set-screw_wire_connectors

MF-1331

Fold-Over Tower

CONTENTS	PAGE #
Assembly Notes	2
Footing Assembly	3
Tower Assembly	4
Parts Lists	5
Fold-over Kit Assembly	5
Fold-Over Parts Diagram	7
Lightning Rod Kit	8
Tower Operating Instructions	9
Safety Rules	11
GME Warranty	11
Accessories	12



Rev. 4/17/00

Congratulations!

We would like to thank you for choosing a GlenMartin, Inc. **Fold-Over Meteorological Tower**. This fold-over tower is manufactured in the USA of quality 6061-T6 anodized aluminum, stainless steel and galvanized steel for durability and long life. Please take the time to inspect the winch cable and winch at least once a month for rust or other problems. Lightly grease the stainless steel winch cable as needed. With proper care, your fold-over meteorological tower should give you a lifetime of use.

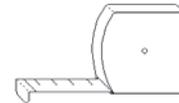
TOOLS YOU'LL NEED FOR ASSEMBLY AND INSTALLATION



SOCKET SET



**ADJUSTABLE
END WRENCH**



TAPE MEASURE

READ CAREFULLY - THEN PLAN YOUR INSTALLATION PROCEDURE CAREFULLY

Locate your tower site. Maintain a safe distance from all power lines. At least one and one-half to twice the height of the tower and antenna is a safe distance. Remember that any contact with power lines can be fatal to you! All towers should be properly guyed. All tower installations should be grounded per local or national codes. All towers should be installed by trained and experienced personnel and should be inspected by qualified personnel at least twice a year.

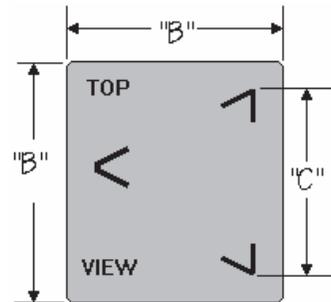
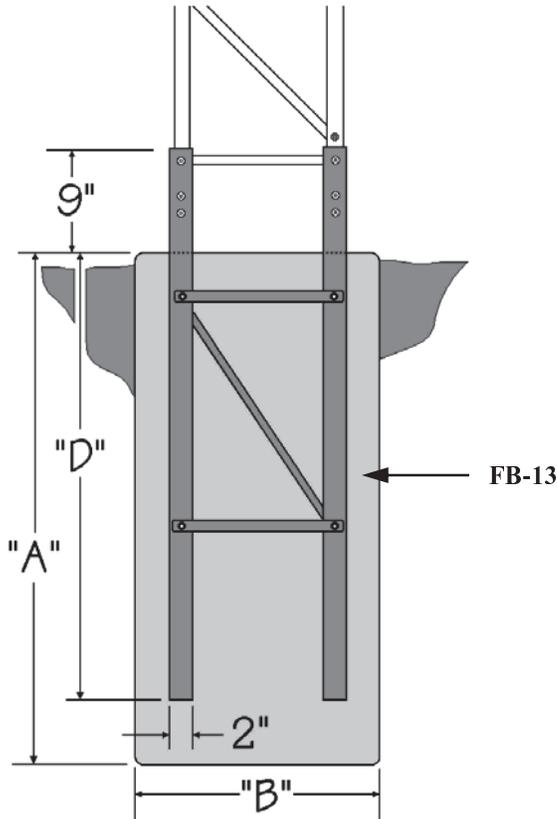
Tower Installation:

CONCRETE FOOTING SECTION - FB-13: Dig appropriate size hole. Bolt three legs of footing section together and slip the bottom tower section into the base. Line up fixed base and tower leg holes, then ream 5/16" holes in 18 places (from square holes to round holes) in the tower legs. Bolt fixed base to first section of tower prior to setting fixed base in the hole. The steel portion of the base legs should extend about nine inches from the top of the concrete so that aluminum tower sections never come in contact with the concrete directly. The base assembly and first tower section should be leveled, plumbed, and temporarily guyed or braced while pouring the concrete. Crown the top of the concrete slightly to prevent water accumulation.

TOWER CONSTRUCTION - M-13: Lay out tower sections so that dark painted ends are at the bottom (pointing downward). Bolt complete sections together using short angle joint clips with a 7/16" nut driver. Make certain bolt heads are seated and torqued to nine foot-pounds. Take care that joining tower surfaces are flush.

FOLD-OVER ASSEMBLY KIT: See assembly instructions beginning on page 5.

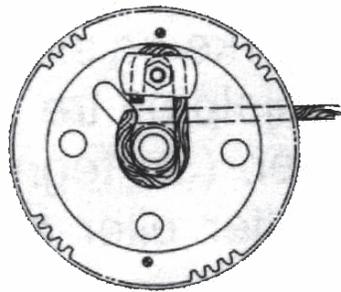
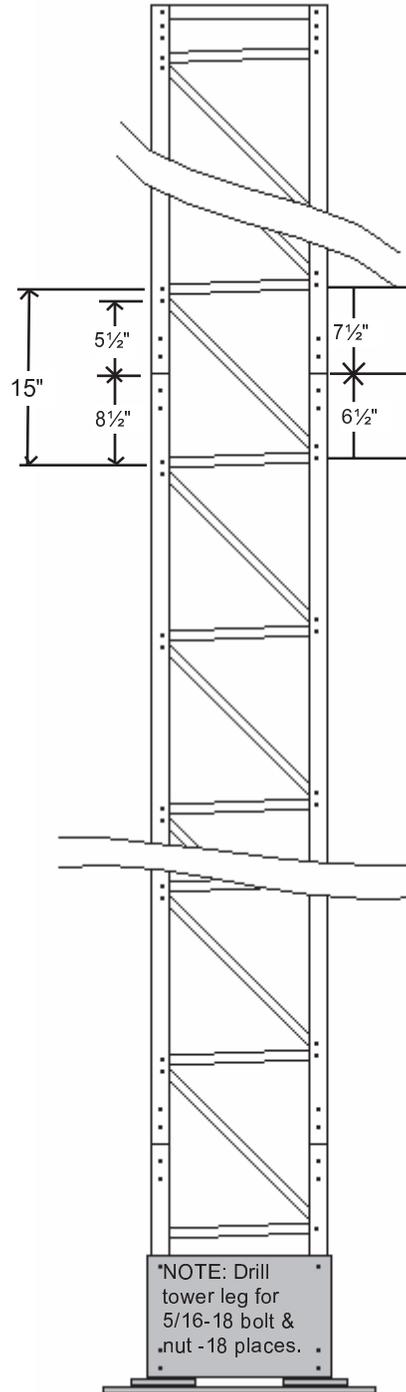
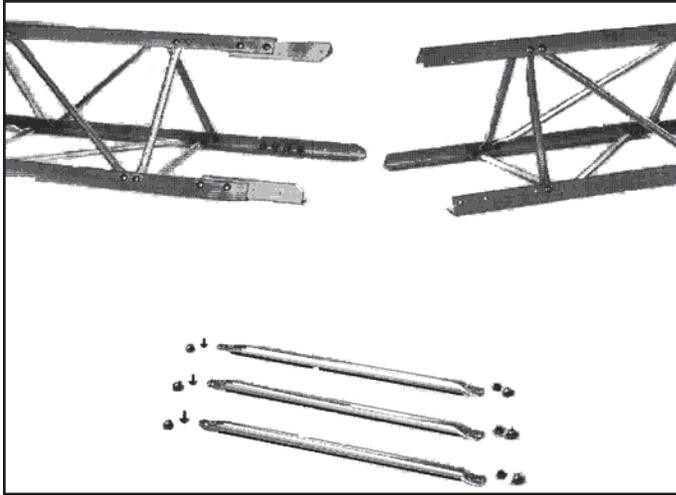
TOWER ERECTION: Towers less than 50' may be hinged into vertical position with the help of several good men. Be cautioned to exert equal stress to tower legs to prevent undue stress, twist, or damage to tower. After tower is erected, replumb the tower with main leveling studs. In some cases, it may be preferable to hire a professional tower erector.



FOOTING TYPE	"A"	"B"	"C"	"D"	CU. YDS. CON- CRETE REQ'D.
FB-13	45"	33"	13"	39"	1.05
CB-13	45"	33"	15.43"	45"	1.05

FB-13 Parts List

- 3 Angle legs
- 6 Horizontal braces
- 3 Diagonal braces
- 18 5/16-18 Stainless bolts
- 18 5/16-18 Stainless nuts
- 12 1/4-20x3/4 Hex bolts
- 12 1/4-20 nuts



WINCH CABLE ANCHORING METHOD

Fold-Over Assembly Kit Installation Instructions

- 1. Before assembling please take an inventory of parts received.**
- 2. Bolt the winch to the winch plate using two 3/8" bolts and two 5/16" bolts. Locate the lower edge of the plate 3 feet from the start of the tower. Remove the six 1/4" carriage bolts from under the winch plate. Bolt the plate to the tower leg using six 1/4" hex head bolts. Drill two 1/4" holes in the tower leg and fasten the plate with two additional 1/4" hex head bolts.**
- 3. Locate the U-bolt bracket at the 6'10" level. Remove four 1/4" carriage bolts under the clamp. Position the bracket and fasten with four 1/4" hex head bolts. Drill two additional 1/4" holes in the tower leg and fasten the bracket with two 1/4" hex head bolts.**
- 4. The hinge assembly is bolted between the first two tower sections. If there are inside tower clips at the top of the first section, remove them at this time. Locate the hinge assembly on the tower sections and clamp in place so the mounting holes align. Drill through the mounting holes with a 5/16" bit so as to ream out the square holes in the tower leg. Secure the hinge assembly to the two lower sections with twenty-four 5/16" hex head bolts.**

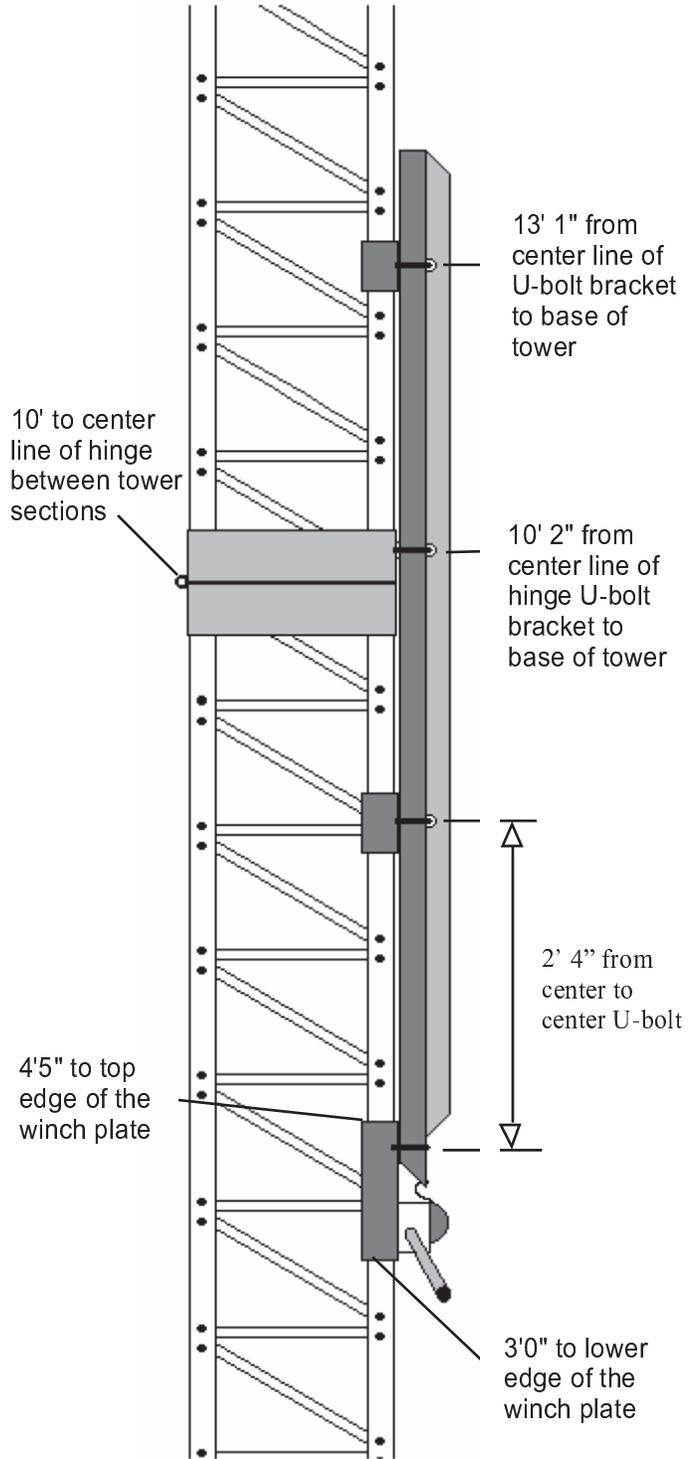
5. Repeat step 2 for the U-bolt bracket at the 13' 1" level.

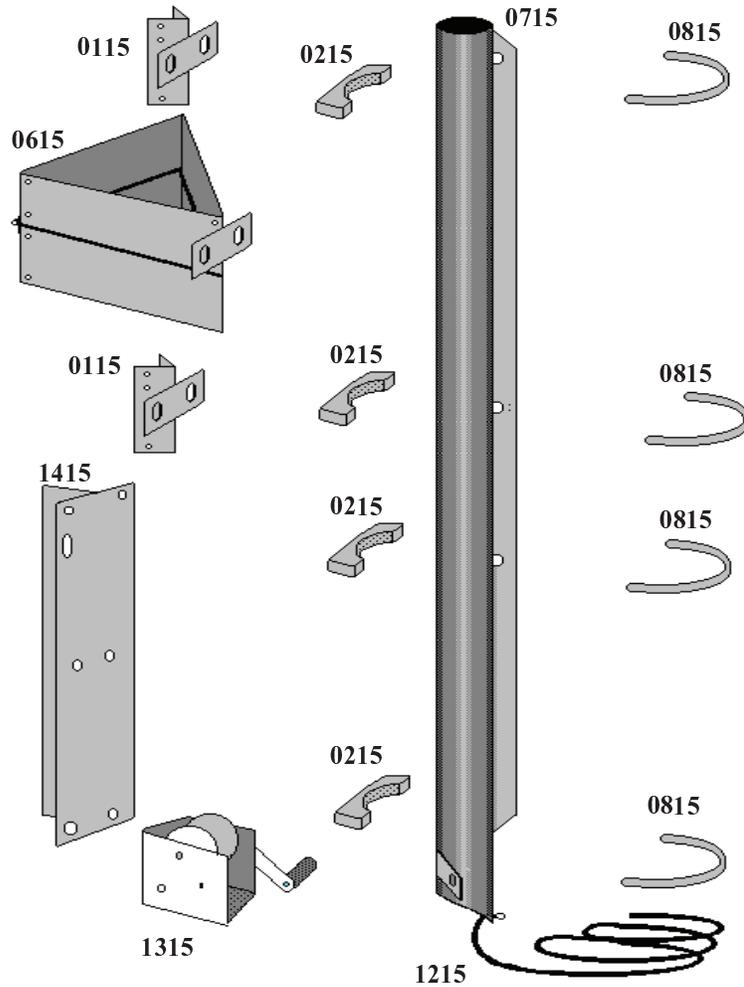
6. Using a U-bolt and saddle placed between the mast pipe and the top mount, attach the mast to the tower. Check the location of the bottom of the mast to make sure the lock tab aligns with the lock hole in the winch plate. Tighten the U-bolt nuts.

7. Install the three other U-bolts in a similar manner.

8. Run the wire rope through the 1/4" hole in the end of the mast and attach the loose end to the winch with the clamps provided (see page 4 for winch cable attachment).

Note: Use existing punched holes in all assemblies and drill through with 5/16 bit to change the 1/4" square hole in tower leg to a 5/16 hole for the bolt.

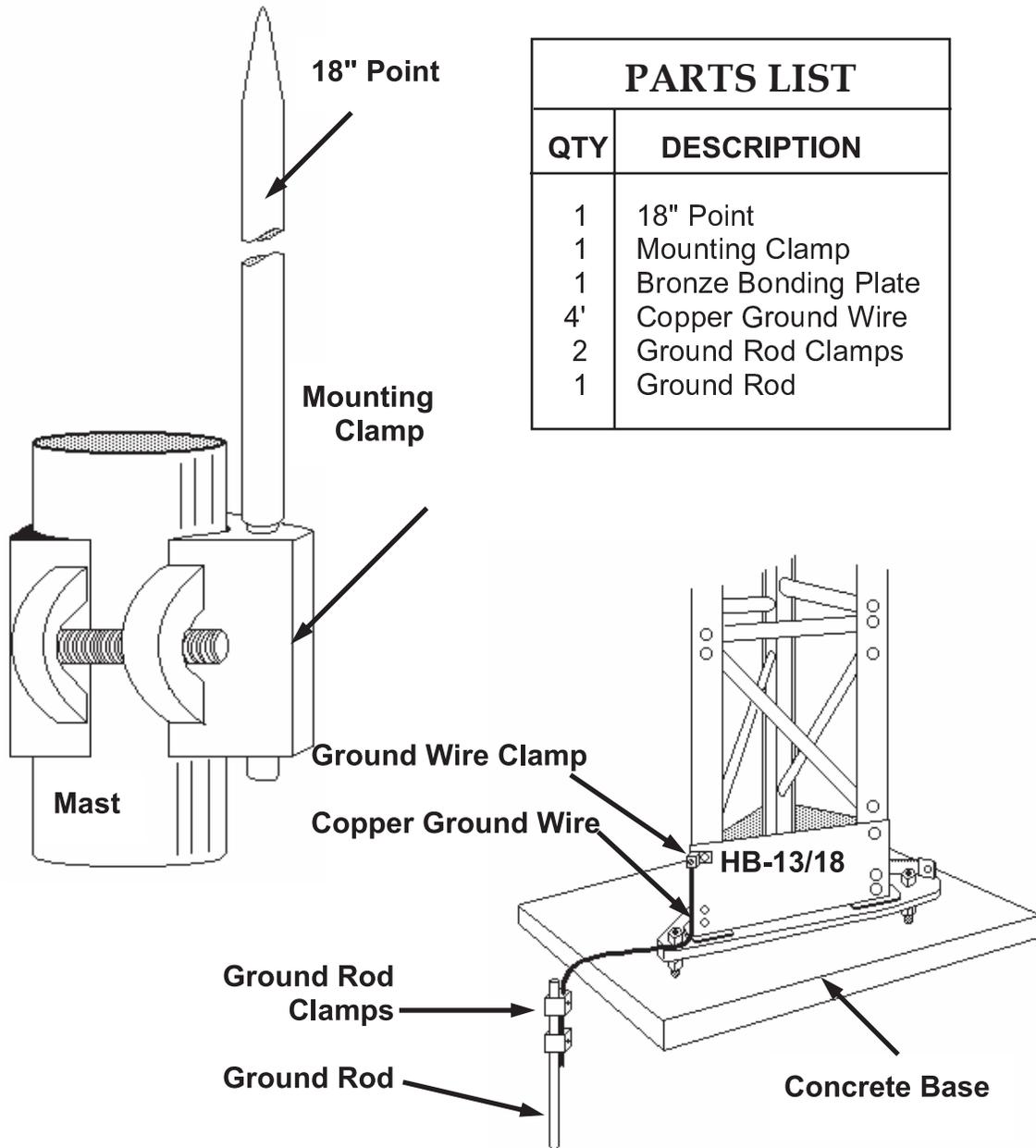




KM-1000 Fold - Over Part List

Line	Item	Qty	Description	Line	Item	Qty	Description
1	0115	2	Top Tower Mount	5	0715	1	Mast Pipe
2	0215	4	Saddle	6	0815	4	U-Bolt and two locknuts, SS
3	0615	1	Hinge Assembly	7	1215	1	SS Winch Cable & stop
4	1515	1	Hardware Kit 14 -1/4-20 bolts & nuts 2 -3/8 bolt, for winch 2 -5/16 bolts for winch 24 -5/16 bolts & nuts, hinge	8	1315	1	Winch and handle
				9	1415	1	Winch Plate Assembly

OPTIONAL LIGHTNING ROD KIT INSTALLATION



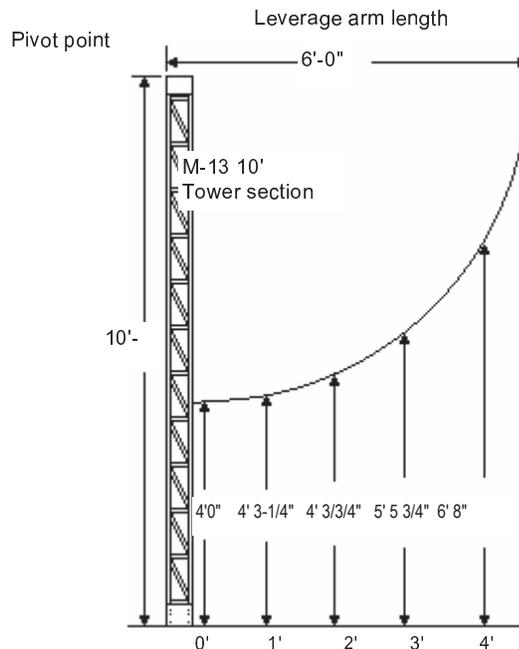
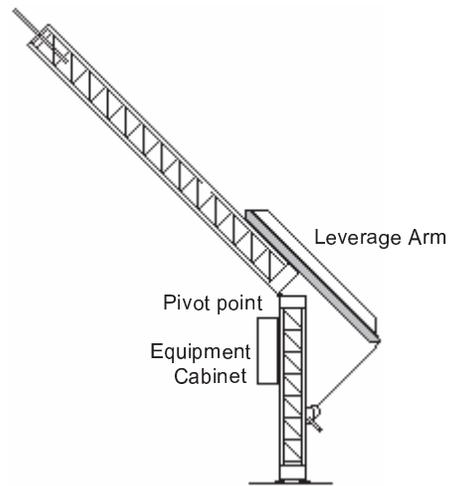
Fold-Over Kit General Information

The fold-over assembly permits the installed tower to hinge at the 10' level. This allows the atmospheric components mounted on the tower to be serviced by lowering the tower rather than having to reach them from a bucket truck. A hand operated winch lowers the upper section(s) of the tower to ground level for easy access to any components mounted at the top.

The assembly bolts to the tower using existing bolt holes and can be retrofitted to existing installed towers.

Note: The tower folds OVER the equipment cabinet.

Two legs of the tower are hinged and the third leg separates. A 2" pipe is bolted to this third leg serving as a leverage arm. All parts are made of 6061-T6 anodized aluminum, stainless steel or hot-dipped galvanized steel.



**Clearance Required at various
distances from the base**

TOWER OPERATING INSTRUCTIONS

To lower hinged section of your folding tower, remove the nuts from the bottom 2 U-Bolt clamps (being careful not to lose the 4 nuts). Next, unlock the leverage arm (if a padlock is being used) and manually pull the bottom of the leverage arm outward from the tower. Crank the winch cable to continue lowering the top sections of the tower.

To return the tower to the normal position, crank the tower vertical with the hand winch, and replace four nuts on the bottom two U-Bolts holding the leverage arm to the bottom section of the tower. If locking the top section is desired, a padlock can be applied through the lock tab at the base of the leverage arm and the face plate on the tower.

Periodic inspection of your tower and fold-over assembly will assure long satisfactory service. A very light coat of oil on the stainless steel winch cable will help.

The winch has been fully lubricated at the factory; but for continued smooth performance and increased life, occasional greasing of gears, reel shaft and an occasional drop of oil on drive shaft bearings are recommended. The winch finish can be protected and will provide longer life if it is periodically washed with water and wiped with a light oil or wax.

Keep winch in good working order. Damaged or severely-worn parts create unnecessary dangers and could result in personal injury or property damage.

Never install this fold-over tower in a position which, when folded over or erect, could come within one and one half times its height with mast of overhead power lines or other obstacles. The chart on Page 9 gives leverage-arm tolerances when tower is folded over.

SAFETY RULES

1. Never mount any tower system close to wires or power lines. Stay at least 1½ times the overall height away from any power lines or wires.
2. Never attempt to touch someone who is in contact with power lines or wires.
3. Never climb the tower. Serious injury could result from a fall. This is even more dangerous when you are on a roof top.
4. If you drop something while working on a roof, NEVER try to catch or stop it. Let it fall and keep your own balance secure.
5. Use the buddy system. Always have someone helping nearby.
6. Always keep children away.
7. NEVER attempt to install or attempt to repair equipment while under the influence of drugs, alcohol or any medication.

Please keep these instructions in a safe place after installation.

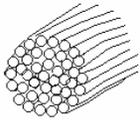
GlenMartin WARRANTY

GlenMartin, Inc. warrants this Fold-over tower for one full year. If this product fails to give the original purchaser complete satisfaction within one year from the original date of purchase, return it to the nearest authorized distributor and GlenMartin, Inc. will repair it, free of charge. GlenMartin, Inc. will not be liable for loss or damage to property or any incidental or consequential loss or expense from property damage due directly or indirectly from the use of this product.

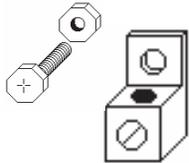


ACCESSORIES

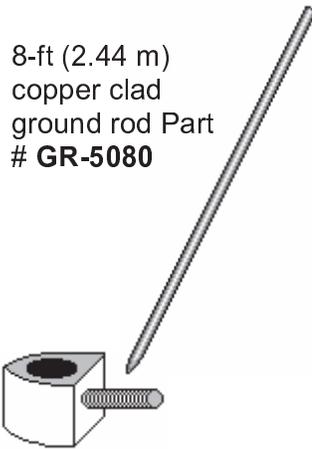
GROUND ACCESSORIES



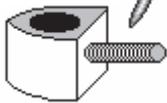
#4
Braided ground wire
Part # **CW-0040**



Grounding Lug
Part # **TL-0470**



8-ft (2.44 m)
copper clad
ground rod Part
GR-5080

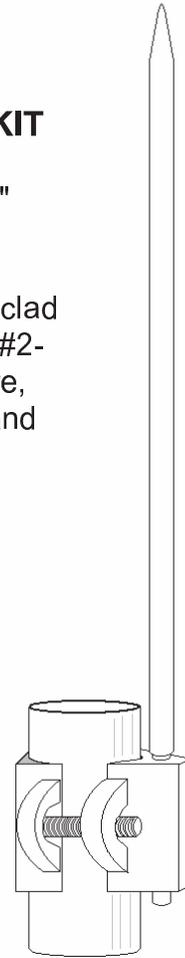


Ground Rod Clamp
Part # **GR-4400**

LIGHTNING ROD KIT

Complete kit with 18" tapered aluminum lightning rod, mast clamp, 8 foot copper clad ground rod, 4 feet of #2-Ø braided ground wire, one Grounding Lug and two Ground Rod Clamps.

Part # **LR-8400**



HOW TO ORDER - Order from your authorized GlenMartin, Inc. distributor or call us at the number listed below. Check/money order/MasterCard/ Visa/ C.O.D. accepted. Our foreign sales department specializes in overseas shipments!

Notice: Dimensions, shipping weights and performance specifications are subject to variation within reasonable tolerances. Since changes and improvements are being made continually, specifications shown are subject to change without notice.

GlenMartin, Inc.

13620 Old Hwy 40, Boonville, MO 65233

Call our Customer Service Department Mon. - Fri. 9 am - 4:30 pm Central Time

800-486-1223 <http://www.glenmartin.com>