

PLOT SCALE - 200,000000:1,000000

PLOTTED FROM - TRRC11625

STATE OF SOUTH DAKOTA
DEPARTMENT OF TRANSPORTATION
PLANS FOR PROPOSED

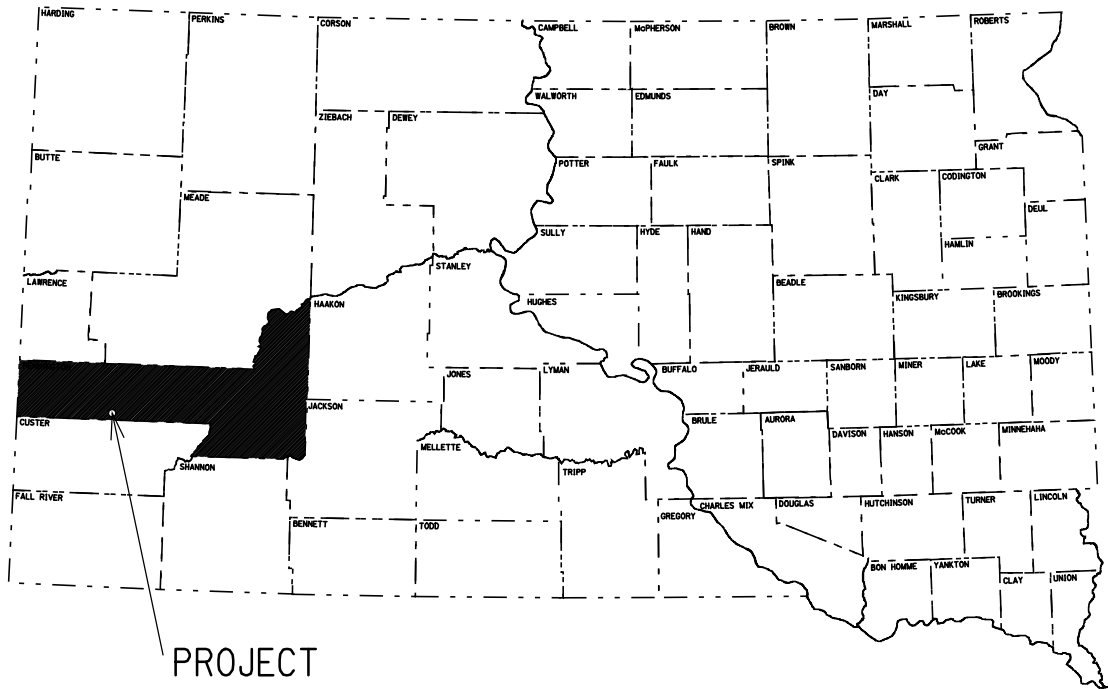
040-491
US16A & SD40
PENNINGTON COUNTY
TRAFFIC SIGNAL UPGRADE
PCN IHB

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491	1	11

Plotting Date: 16-JUL-2009

INDEX OF SHEETS

Sheet 1	General Layout with Index
Sheets 2-3	Estimate of Qts. and General Notes
Sheet 4	Original Signal Layout
Sheet 5	Original Signal Conduit Layout
Sheet 6	Original Wiring Diagram
Sheet 7	Signal Timing
Sheet 8	Cabinet Pad Dimensions
Sheet 9	Billboard Lighting Conduit Layout
Sheet 10	Typicals
Sheet 11	Standard Plates



KEYSTONE

DESIGN DESIGNATION US16A		DESIGN DESIGNATION SD40	
ADT (2008)	3315	ADT (2008)	605
ADT (2028)	3820	ADT (2028)	805
DHV	575	DHV	120
D	50%	D	50%
T DHV	7.0%	T DHV	1.4%
T ADT	15.3%	T ADT	3.0%
V	25	V	25



FILE - U:\REGIONRC\PR\2009RCREGMAINT\PLANS\PENNI1IHB\I1HB-TITLE.DGN PLOT NAME - 01

SECTION L ESTIMATE OF QUANTITIES

Bid Item Number	Item	Quantity	Unit
009E0010	Mobilization	Lump Sum	LS
634E0010	Flagging	8	Hour
634E0100	Traffic Control	476	Unit
634E0120	Traffic Control, Miscellaneous	Lump Sum	LS
635E5410	Controller Cabinet	1	Each
635E5430	Traffic Signal Controller	1	Each
635E5550	Detector Unit	2	Each
635E5800	Miscellaneous Signal Parts	Lump Sum	LS
635E5920	Pedestrian Signal Head	2	Each
635E6200	Miscellaneous, Electrical	Lump Sum	LS
635E8110	1" Rigid Conduit, Schedule 40	125	Ft
635E9014	1/C #4 AWG Copper Wire	530	Ft
635E9016	1/C #6 AWG Copper Wire	580	Ft
635E9020	1/C #10 AWG Copper Wire	125	Ft
635E9504	4/C #14 AWG Copper Tray Cable, K2	340	Ft
635E9512	12/C #14 AWG Copper Tray Cable, K2	410	Ft
635E9519	19/C #14 AWG Copper Tray Cable, K2	150	Ft
635E9600	#16 AWG Copper Twisted Shielded Pair	250	Ft
635E9710	2/C #10 AWG Copper Pole and Bracket Cable	110	Ft

WORK DESCRIPTION AND SEQUENCE OF OPERATIONS

Work on this project will include, but is not limited to the following:

1. Set up traffic control.
2. Install new conduit for billboards.
3. Pour new concrete around existing cabinet pad.
4. Replace field wiring and incandescent bulbs with LED's.
5. Install stop signs and shut signal off.
6. Install new cabinet and controller.
7. Turn on signal.
8. Complete billboard lighting.

TRAFFIC SIGNAL CONTROL CABLE LABELS

Traffic signal cable shall be identified in hand holes, junction boxes, pedestal bases, electrical service cabinets, and controller cabinets as indicated on the Wiring Diagram. Labels shall be wrapped around traffic signal cable to indicate the signal pole and signal head that it is connected to. Labels shall be self-adhesive vinyl cloth with a preprinted legend. Traffic signal control cables to the poles shall be marked with a legend and shall be color coded as follows; northwest (blue), northeast (red), southeast (green), and southwest (orange).

SUPPLYING AS BUILT PLANS

If the traffic signal systems or roadway lighting systems are constructed different than what is stated in the plans, the Contractor shall supply as built plans to the Engineer and a copy shall be sent to the Traffic Design Engineer. The as built plans may include conduit layouts, wiring diagrams, or other drawings depicting the changes from the original plans.

INCIDENTAL WORK

Incidental work includes, but is not limited to, the restoration of all disturbed areas to the satisfaction of the Engineer.

SHOP DRAWING AND CATALOG CUTS SUBMITTALS

The Contractor shall submit shop drawings and catalog cuts in accordance with Section 985 of the Standard Specifications or in Adobe PDF format.

Adobe PDF submittals shall be sent to the following email address:

Pete.Longman@state.sd.us

ON-SITE INSPECTION

An on-site inspection of the traffic signals shall be conducted before acceptance of the project, once the traffic signals are completed and operational. The on-site inspection shall be conducted by the Contractor, Region Traffic Engineer, City Traffic Engineer, Project Engineer, and the Traffic Design Engineer.

TRAFFIC SIGNAL CONTROLLER

The controller shall be a solid state, digital, NEMA TS2 Type 1 from the approved product list and as approved by the South Dakota Department of Transportation Traffic Design Engineer in the Office of Road Design.

The controller shall be two through twelve phase controllers.

Vehicle detectors shall operate in the presence (non-locking) mode and shall have call delay timing capability. The call delay feature shall be inhibited by the controller. Set these detectors to 3 seconds delay.

Digital timing shall be provided with a battery backup.

The controller shall alternate the red and yellow indication when flashing.

The interface panels shall be capable of inserting up to twelve load switches.

The controllers shall be capable of programming by manual entry via the front panel keyboard, data downloading from a portable PC computer via null-modem cable, and data downloading from one controller to another using a serial port on each controller.

The controllers shall be capable of operating coordinated by time-based, hardwire, and telemetry.

The controller cabinets shall be capable of placing vehicle and pedestrian calls into the controller. Placed calls shall provide for eight vehicle phases and four pedestrian phases. The placed calls for vehicle phases shall be capable of extending the associated vehicle phase by continuous or intermittent contact.

The controllers shall have a copy function to copy all timing data from one phase to another. The controllers shall also permit copying all coordination pattern data from one pattern to another.

A Malfunction Management Unit shall be installed in each cabinet and shall conform to the requirements of NEMA Standard TS-2 Section 4.

A sufficient quantity of BUS Interface Units shall be installed in the cabinet to provide communication between detectors, load switches, controller unit, etc. Each BUS Interface Unit shall conform to NEMA Standard TS-2, Section 8.

The controller shall have internal signal dimming.

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491	2	11

TRAFFIC SIGNAL CONTROLLER (CONTINUED)

The controller Solid State Flasher shall have dimming capability.

The Contractor is responsible for programming controllers with the signal timings provided in these plans.

All costs for constructing the concrete pad and footing as per details in these plans, materials, labor, and furnishing and installing the controller cabinet shall be incidental to the contract unit price per each for "Traffic Signal Controller".

CONTROLLER CABINET

The Contractor shall install the new traffic signal controller into the new controller cabinet.

The new controller cabinet shall include a push button for manual operation of the traffic signal.

The controller cabinet doors shall be hinged on the right side.

The new controller cabinet shall be mounted on the newly modified existing concrete pad.

All costs for materials, labor, and furnishing and installing the controller cabinet shall be incidental to the contract unit price per each for "Controller Cabinet".

CONTROLLER PROGRAMMING

The Contractor shall furnish the Road Design Office with a copy of the data programmed into the Controller prior to the full operation of the Controller for approval. The address is as follows:

Pete Longman
Traffic Design Engineer
Office of Road Design
700 East Broadway
Pierre, SD 57501

SIGNAL AIMING

Signals shall be aimed and trees shall be trimmed such that all the signals for each approach shall be continuously visible for the minimum distance listed in the table in Section 4D.15 of the MUTCD.

SIGNAL BACKPLATES

Signal backplates shall extend not less than 5 inches at the top, bottom, and sides. The bottom of the backplate on vehicle signal faces mounted directly above pedestrian signal indications shall be sized to permit the separate adjustment of the vehicle and pedestrian signal indication and may be less than 4 inches. All backplates shall have a dull black finish.

Signal backplates for 3-section heads shall be polycarbonate.

SIGNAL BACKPLATES (CONTINUED)

All costs for labor and material to replace the backplates shall be incidental to the contract lump sum price for “Miscellaneous Signal Parts”.

MISCELLANEOUS SIGNAL PARTS

The Contractor shall replace all existing 3 section vehicle signal head back plates with new backplates. The estimated quantity of backplates is 11.

The Contractor shall replace all existing circular red, yellow, and green incandescent indications with light emitting diode (LED) modules. The estimated quantities of LED modules are 11 red, 11 yellow and 11 green.

All costs for labor and material to replace the existing incandescent indications with LED modules shall be incidental to the contract lump sum price for “Miscellaneous Signal Parts”.

MISCELLANEOUS ELECTRICAL

Miscellaneous work will also include removing the service line, socket and meter for the ground mounted flood lights in front of the Keystone businesses sign.

This will include running new 1” schedule 40 conduit and #10 AWG copper wire from the signal cabinet to the location of the existing service line and meter where the existing wire for the lights are located. In addition, a 20 amp disconnect switch shall be added in place of the existing meter socket to replace the existing fuse disconnect.

All costs for labor and material to replace the existing wire with new wire, removing the service line, socket, meter, and replacing with new conduit and wire shall be incidental to the contract lump sum price “Miscellaneous Electrical.”

CONDUIT INSTALLATION

The Contractor shall not use a machine requiring flowing water for installation of conduit under streets or roadways unless specifically permitted by the Engineer.

TRAFFIC CONTROL

The contract unit price per unit for Traffic Control shall include all labor, equipment and materials necessary to furnish, erect and maintain the traffic control devices for the duration of the entire project. Payment will be made only once for each traffic control device even if the device is used more than once on the project.

The intent of the plan sequence of operations is to have the least amount of impact on the traveling public and adjacent businesses. Requests to deviate from the sequence of operations shall be submitted in writing to the Engineer for review. Approval of an alternate sequence of operations will only be allowed when the proposed changes meet with the Department’s intent for traffic control and sequencing of the work. An alternate sequence shall be submitted for review a minimum of two weeks prior to potential implementation.

TRAFFIC CONTROL (CONTINUED)

Vehicles working in traffic or along side traffic shall be equipped with a flashing amber light.

No work will be allowed during hours of darkness. Hours of darkness are defined, as ½ hour after sunset until ½ hour before sunrise.

Traffic control shall be in accordance with MUTCD Standards, and the Standard Specifications and the layouts contained in the plans.

All construction operations shall be conducted in the general direction of traffic movement.

Non-applicable signing shall be covered or removed during periods of inactivity. The cost of removing or covering non-applicable signs shall be incidental to the contract lump sum price for, Traffic Control, Miscellaneous. This includes permanent signing that conflicts with work detailed in these plans.

The contractor or designated traffic control subcontractor shall make night inspections at the initial set up of traffic control and every week thereafter to ensure the adequacy, legibility and reflectivity of each sign and device. A written summary of each inspection shall be given to the Engineer within 24 hours after completion of the inspection. The cost for the nighttime inspection work shall be incidental to the related contract items.

Storage of vehicles and equipment and materials shall not be closer than 30’ from the edge of the driving lane. Contractor’s employees should mobilize at a location off of the right-of-way and arrive at the work site in a minimum number of vehicles necessary to perform the work.

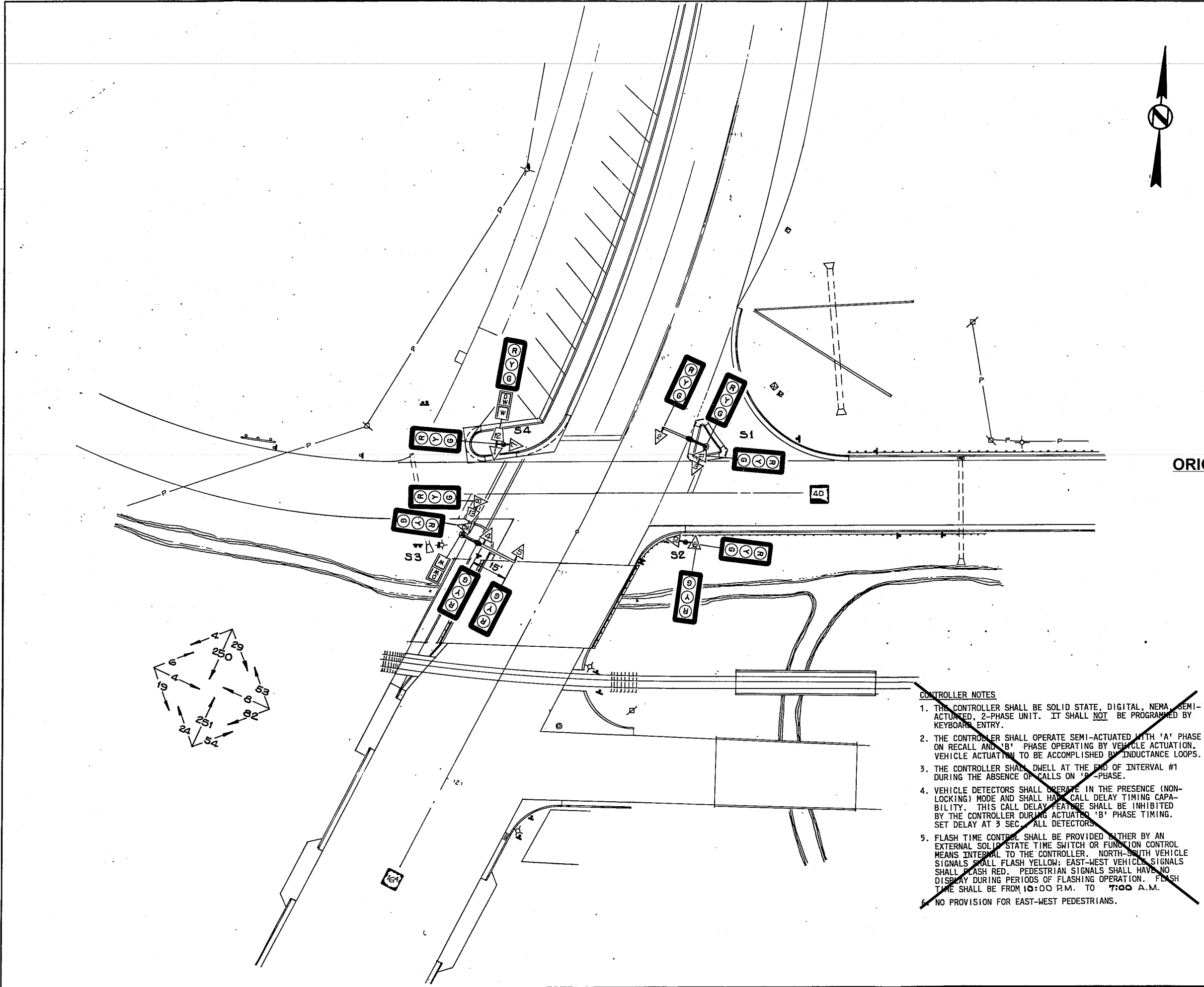
Indiscriminate driving and parking of vehicles within the right-of-way will not be permitted. Any damage to the vegetation, surfacing, embankment, delineators and existing signs resulting from such indiscriminate use shall be repaired and/or restored by the Contractor, at no expense to the State, and to the satisfaction of the Engineer.

The bottom of signs on portable or temporary supports shall not be less than seven feet above the pavement in urban areas and one foot above the pavement in rural areas. Portable sign supports may be used as long as the duration is less than 3 days. If the duration is more than 3 days the signs shall be on fixed supports, except portable sign supports will be allowed where surfacing in the median consists of bituminous material.

SIGN TABULATION

SIGN CODE	SIGN SIZE	DESCRIPTION	NUMBER REQUIRED	UNITS PER SIGN	UNITS
G20-2	36" x 18"	END ROAD WORK	4	17	68
R1-1	48" x 48"	STOP	4	34	136
W3-1	48" x 48"	STOP AHEAD (SYMBOL)	4	34	136
W20-1	48" x 48"	ROAD WORK ##### FT. OR AHEAD	4	34	136
W20-7a	48" x 48"	FLAGGER	4	34	136
TOTAL UNITS					612

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491	3	11



STATE OF		PROJECT	SHEET NO.	TOTAL SHEETS
S.D.		040-491	4	11
SIGNAL PLAN				
LIST OF MATERIAL				
BID ITEM NUMBER	KEY	ITEM	EST. QUAN.	
635.0227	☒	DETECTOR UNIT - DIGITAL TYPE W/CALL DELAY TIMING	2	EA.
635.0234		ACTUATED CONTROLLER (see controller notes, this sheet)	1	EA.
635.0360	S1	SIGNAL POLE W/20' SIG. MAST ARM & LUM. EXTN. TO 40' W/6' LUM. MAST ARM	1	EA
635.0361	S3	SIGNAL POLE W/25' SIG. MAST ARM & LUM. EXTN. TO 40' W/6' LUM. MAST ARM	1	EA
635.0370	S2 & S4	PEDESTAL SIGNAL POLE	2	EA
635.0380	☐	PEDESTRIAN SIGNAL HEAD 1-WAY, 2-SECTION W/12" SQ. LENSES & VISORS	2	EA
635.0381	▽	VEHICLE SIGNAL HEAD 1-WAY, 3-SECTION W/12" DIA. LENSES ALUMINUM BACK PLATE & TUNNEL VISORS	11	EA
635.0529	⑤	2/C #10 AWG COPPER POLE & BRACKET CABLE	110	LF
635.0539	⑥	4/C #14 AWG COPPER	340	LF
635.0710	●	ROADWAY LUMINAIRE - 400 WATT W/ MERC. VAPOR LAMP, PE. CELL & 120V BALLAST, MED. NON-CO. TYPE IV	2	EA

ORIGINAL PLANS - FOR REFERENCE ONLY

CONTROLLER NOTES

1. THE CONTROLLER SHALL BE SOLID STATE, DIGITAL, NEMA, SEMI-ACTUATED, 2-PHASE UNIT. IT SHALL NOT BE PROGRAMMED BY KEYBOARD ENTRY.
2. THE CONTROLLER SHALL OPERATE SEMI-ACTUATED WITH 'A' PHASE ON RECALL AND 'B' PHASE OPERATING BY VEHICLE ACTUATION. VEHICLE ACTUATION TO BE ACCOMPLISHED BY INDUCTANCE LOOPS.
3. THE CONTROLLER SHALL DWELL AT THE END OF INTERVAL #1 DURING THE ABSENCE OF CALLS ON 'B' PHASE.
4. VEHICLE DETECTORS SHALL OPERATE IN THE PRESENCE (NON-LOCKING) MODE AND SHALL HAVE CALL DELAY TIMING CAPABILITY. THIS CALL DELAY FEATURE SHALL BE INHIBITED BY THE CONTROLLER DURING ACTUATED 'B' PHASE TIMING. SET DELAY AT 3 SEC. ALL DETECTORS.
5. FLASH TIME CONTROL SHALL BE PROVIDED EITHER BY AN EXTERNAL SOLID STATE TIME SWITCH OR FUNCTION CONTROL MEANS INTERNAL TO THE CONTROLLER. NORTH-SOUTH VEHICLE SIGNALS SHALL FLASH YELLOW; EAST-WEST VEHICLE SIGNALS SHALL FLASH RED. PEDESTRIAN SIGNALS SHALL HAVE NO DISPLAY DURING PERIODS OF FLASHING OPERATION. FLASH TIME SHALL BE FROM 10:00 P.M. TO 7:00 A.M.
6. NO PROVISION FOR EAST-WEST PEDESTRIANS.

SIGNAL SEQUENCING, TIMING, & PHASING								
SIGNAL INTERVAL	1 2 3 4 5 6 7							45 sec. MAX. CYCLE SIGNAL TIMING (seconds)
	SIGNAL	1	2	3	4	5	6	
SIGNAL DISPLAYS	↓	G	G	Y	R	R	R	R
	12	W	F	DW	DW	DW	DW	DW
	↑	R	R	R	R	G	Y	R
45 sec. MAX. CYCLE SIGNAL TIMING (seconds)	MIN. GREEN	18.0				1.0		
	PASSAGE					5.0		
	MAX. GREEN	18.0				17.0		
	PED. TIME	16.0	2.0					
	CLEARANCES			4.1	0.9		3.2	1.8
PHASES		Aφ				Bφ		
		↑				↓		
		RECALL				ACTUATED		

		STATE OF	PROJECT	SHEET NO.	TOTAL SHEETS
		S.D.	040-491	5	11
CONDUIT LAYOUT					
LIST OF MATERIAL					
BID ITEM NUMBER	KEY	ITEM			EST. QUAN.
635.0037	S2	2.0 FT. DIA. FOOTING (see sheet #8)			7 LF
635.0038	S3	2.5 FT. DIA. FOOTING (see sheet #8)			12 LF
635.0043	Δ	ELECTRIC SERVICE CABINET			1 EA
635.0155	JB3 & JB4	12" DIA. JUNCTION BOX (see sheet #8)			2 EA
635.0157	JB1 & JB2	24" DIA. JUNCTION BOX (see sheet #8)			2 EA
635.0159	⊕	METER SOCKET			1 EA
635.0228	◇	DETECTOR LOOP (see sheet #11)			4 EA
635.0405	—	2" RIGID CONDUIT			240 LF
635.0407	- - -	3" RIGID CONDUIT			130 LF
635.0516	④	1/2" #4 AWG COPPER			530 LF
635.0520	⑥	1/2" #6 AWG COPPER			580 LF
635.0541	⑭	1/2" #14 AWG COPPER			410 LF
635.0542	⑰	1/2" #16 AWG COPPER			150 LF
635.0548	⑳	2/c #16 AWG COPPER TWISTED SHIELDED PAIR			250 LF
635.0039	S4	3.0 FT. DIA. FOOTING (See Sheet 8)			3 L.F.

ORIGINAL PLANS - FOR REFERENCE ONLY

120/240 VAC, 60 Hz, 1 ϕ , 3-W
B.H.P.L. SERVICE

50 amp BREAKERS

METER

SERVICE CABINET

JB2

JB1

JB3

CONTROLLER

* FUSE SIZE:
10 amp NON-TIME DELAY
OR
5 amp DUAL ELEMENT

ORIGINAL PLANS - FOR REFERENCE ONLY

ALL FIXTURES SHALL BE BONDED IN ACCORDANCE WITH THE N.E.C.

PLOT SCALE - 40' 000000:1.000000



PLOTTED FROM - TRRC11625

SIGNAL TIMINGS

SD 16A & SD40/OLD HILL CITY RD

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491		

Plotting Date: 16-JUL-2009

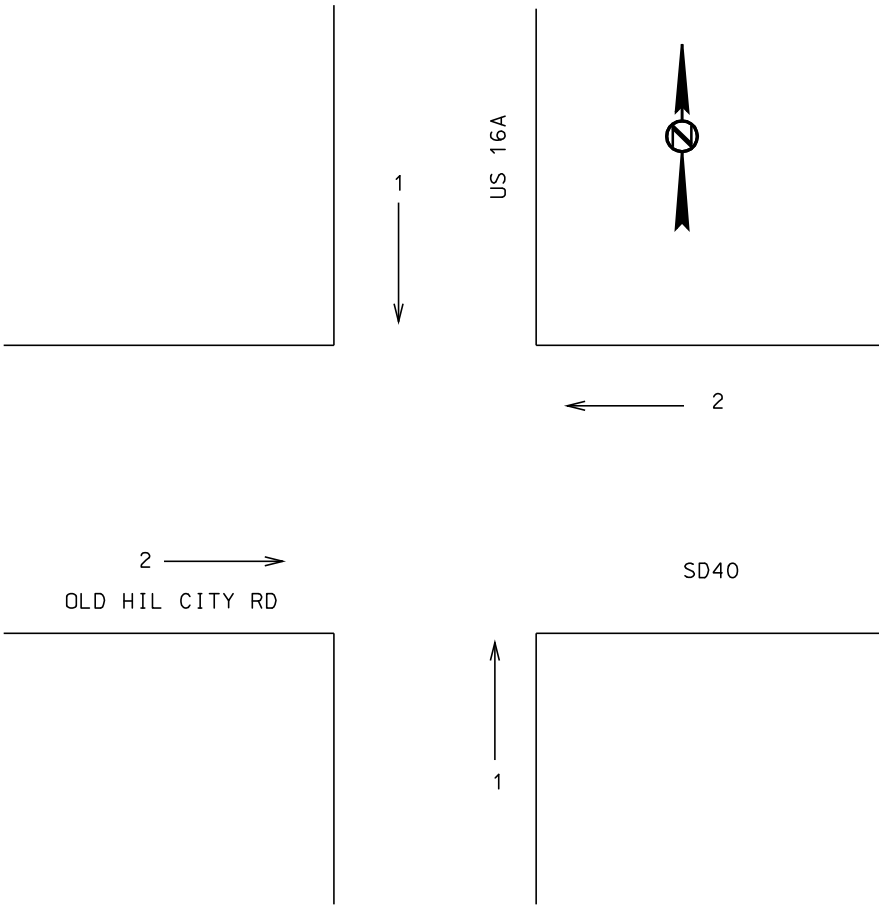
PHASING AND SEQUENCING								
INTERVAL SIGNAL HEAD	1	2	3	4	5	6	7	FLASH DISPLAY
EASTBOUND	G	Y						R
WESTBOUND	G	Y						R
NORTHBOUND (16A)				G	G	Y		Y
SOUTHBOUND (16A)				G	G	Y		Y
NB & SB	DW	DW	DW	W	F DW	DW	DW	NO DISPLAY
MOVEMENTS	2			1 W/PED				
PHASES								

CONTROLLER TIMINGS (FREE OPERATION)								
MOVEMENT	1	2	3	4	5	6	7	8
PHASE	↓↑	⇔						
MIN GREEN	7	12						
ADDED INITIAL								
MAX INITIAL								
PASSAGE TIME		4						
MAXIMUM 1	27	23						
MAXIMUM 2								
TIME BEFORE								
TIME TO REDUCE								
MINIMUM GAP								
YELLOW CHANGE	4	3.5						
RED CLEARANCE	1.5	1.5						
WALK	19							
PED CLEARANCE	9							

TIMING PLAN 1	
TIME OF DAY (TOD)	PATTERN (C/S/O)
6:00 - 23:00	FREE
23:00 - 6:00	FLASH

WEEKLY PROGRAM							
	SUN	MON	TUE	WED	THU	FRI	SAT
TIMING PLAN	1	1	1	1	1	1	1

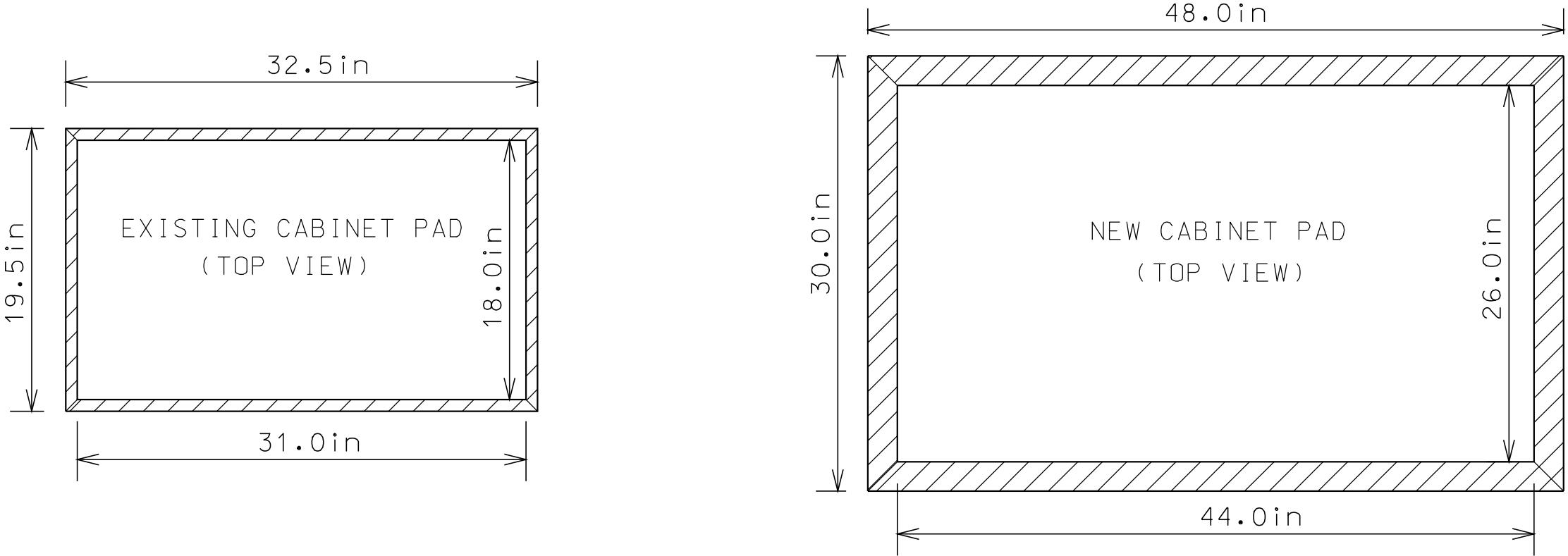
DETECTOR SETTINGS								
DETECTOR LABEL	AMPLIFIED CHANNEL DETECTOR	DETECTOR TYPE	DETECTOR OPERATION			LOCKING CALL	MOVEMENT CALLED	MOVEMENT EXTENDED
			CALLS & EXTENDS	CALLS ONLY	EXTENDS ONLY			
E1,E2	EXISTING	EXISTING	X				2	2
W1,W2	EXISTING	EXISTING	X				2	2



CABINET PAD DETAILS

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491	8	11

Plotting Date: 16-JUL-2009



PLOT SCALE - 9.36000011.000000

PLOTTED FROM - TRC11625

FILE - U:\REGION\RC\PR\2009\RC\MAINT\PLANS\PENN\11HB\11HB_CABINET\PAD\DIMENS.DWG - 08

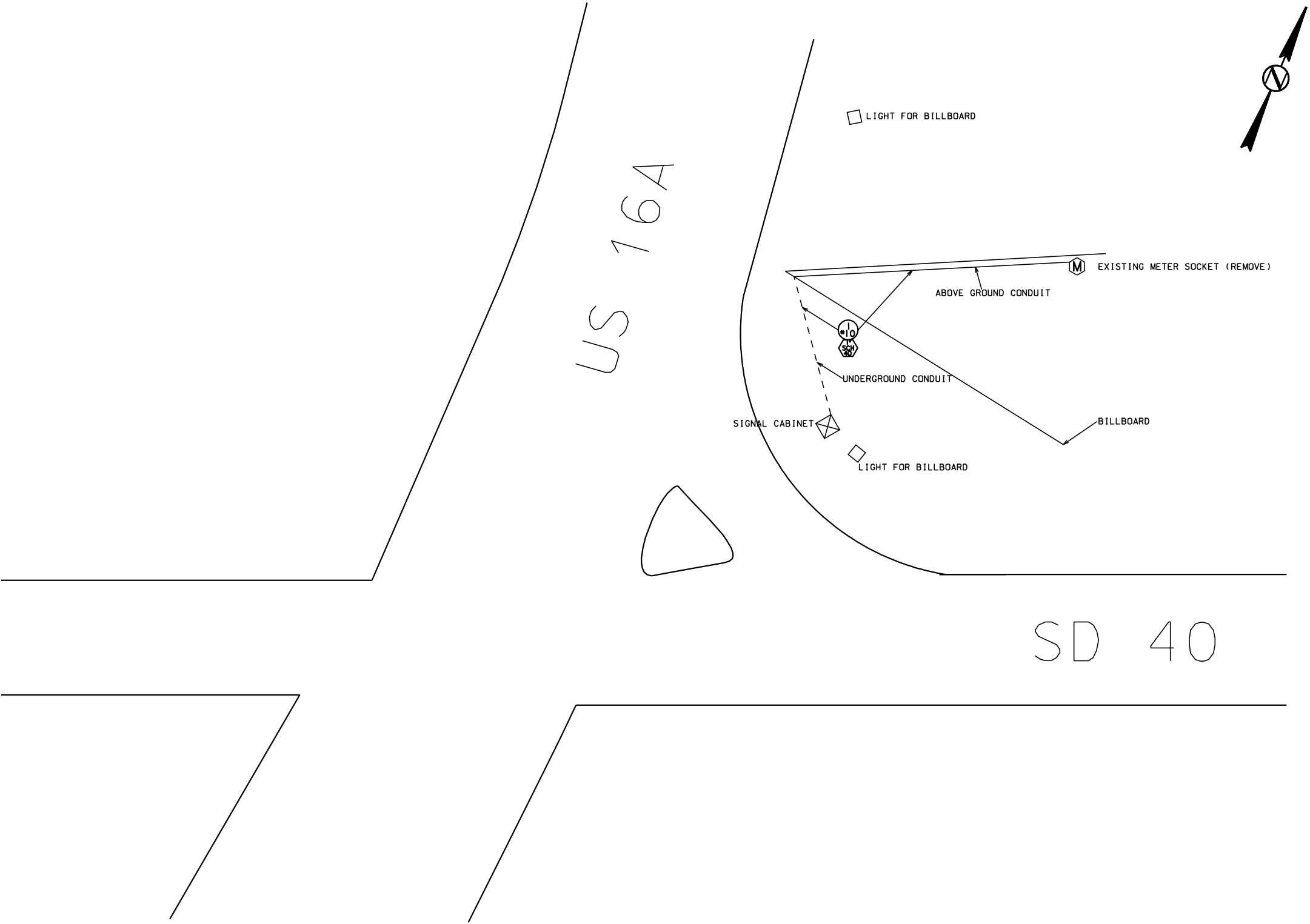
PLOT SCALE - 90000.000000:1.000000

PLOTTED FROM - TRRC11625

CONDUIT LAYOUT FOR BILLBOARD LIGHTS

STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491		

Plotting Date: 16-JUL-2009



STATE OF SOUTH DAKOTA	PROJECT	SHEET	TOTAL SHEETS
	040-491	10	11

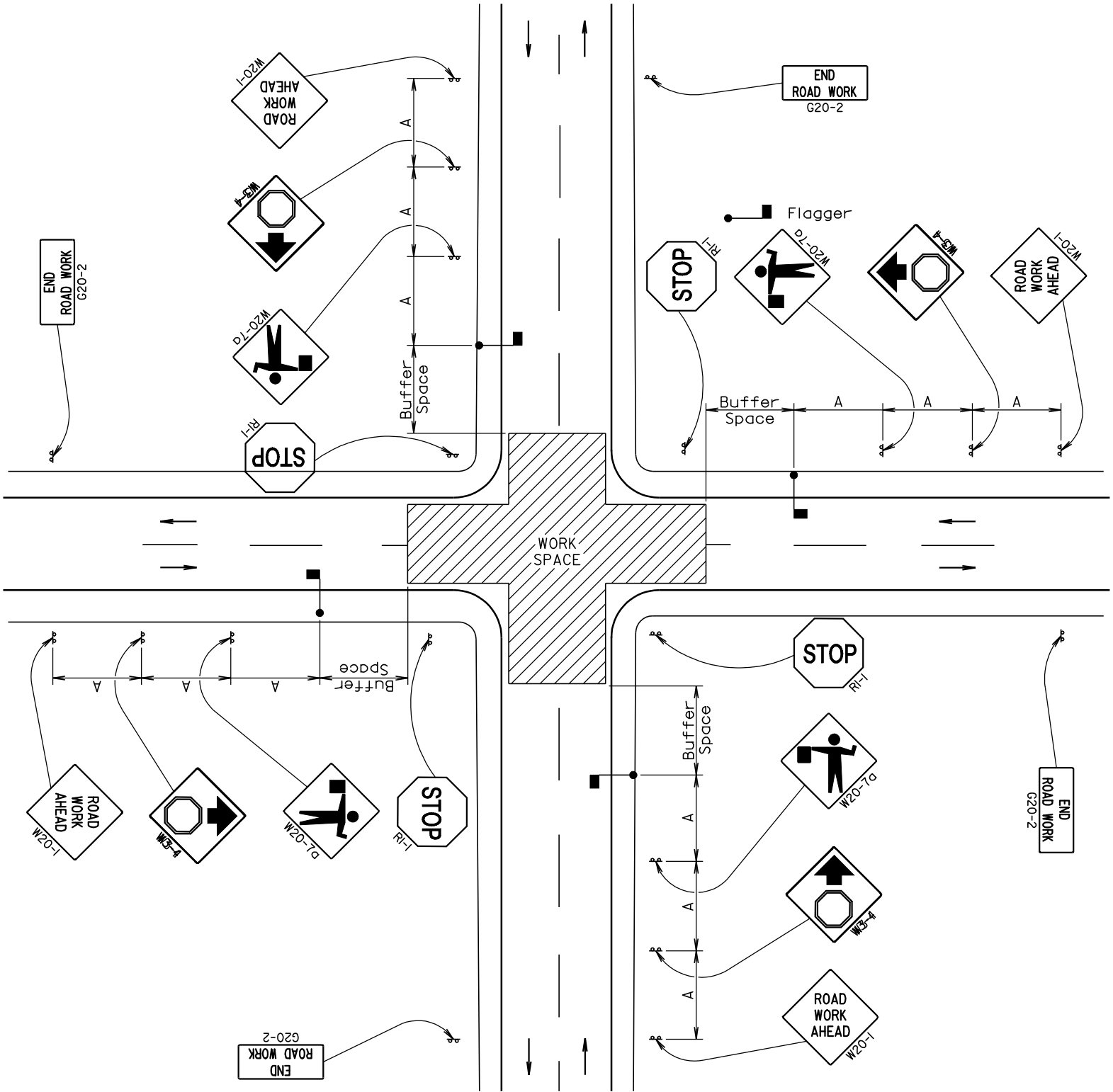
Plotting Date: 16-JUL-2009

TRAFFIC CONTROL LAYOUT

TYPICAL

Conditions represented are for work that requires closings during daytime hours only.

The flaggers shall stop the first vehicle from the position shown, then move to the centerline to stop approaching traffic.

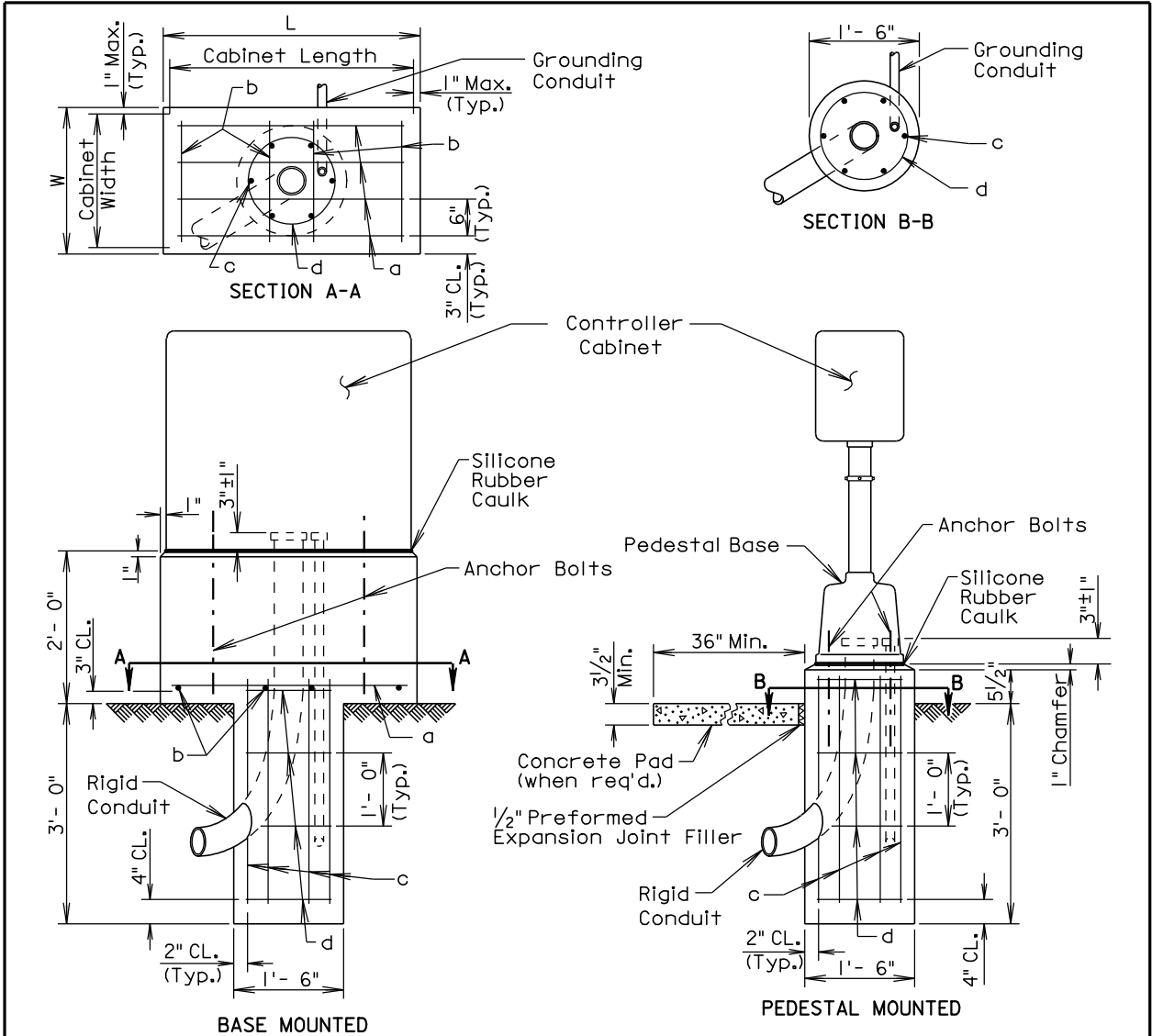


Posted Speed Prior to Work (M.P.H.)	Spacing of Advance Warning Signs (Feet) (A)
0 - 30	200
35 - 40	350
45 - 50	500
55	750
60 - 65	1000

Posted Speed Prior to Work (M.P.H.)	Length of Longitudinal Buffer Space (Feet)
20	35
25	55
30	85
35	120
40	170
45	220
50	280
55	335
60	415
65	485

Buffer space dependent
on work site limitations.

Plotting Date: 16-JUL-2009



GENERAL NOTES:

The above ground portion of the footing shall conform to the base of the controller to the satisfaction of the Engineer.

Conduits shall be sealed and water-tight until the conductor cables are installed.

If the controller is not located within or adjacent to an existing sidewalk, the Contractor shall provide a concrete pad as directed by the Engineer.

Anchor bolts and related hardware shall conform to the controller manufacturer's requirements and recommendations.

A continuous bead of silicone rubber caulk shall provide a weather-tight seal between the base and the concrete.

Reinforcing Schedule (for one footing)					
Mk.	No.	Size	Length	Type	Bending Detail
a	*	3	L - 4"	Str.	
b	*	3	W - 4"	Str.	
c	6	6	3'- 0"	Str.	
d	4	3	4'- 0"	T3	

Note: Dimensions are out to out of bar

* Vary number of bars as required by footing size.

March 31, 2000

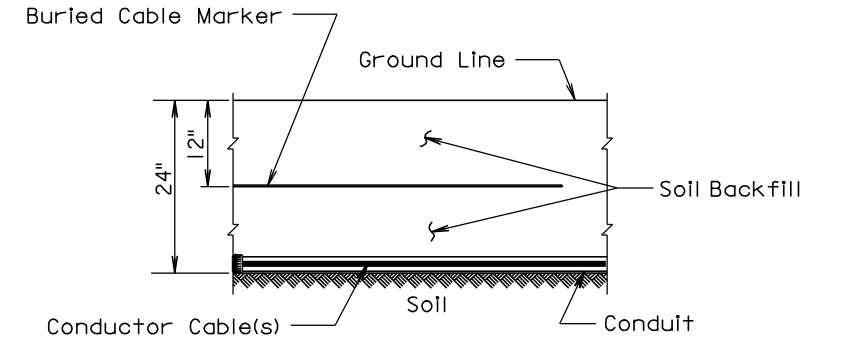
SD
DOT

Published Date: 2nd Qtr. 2009

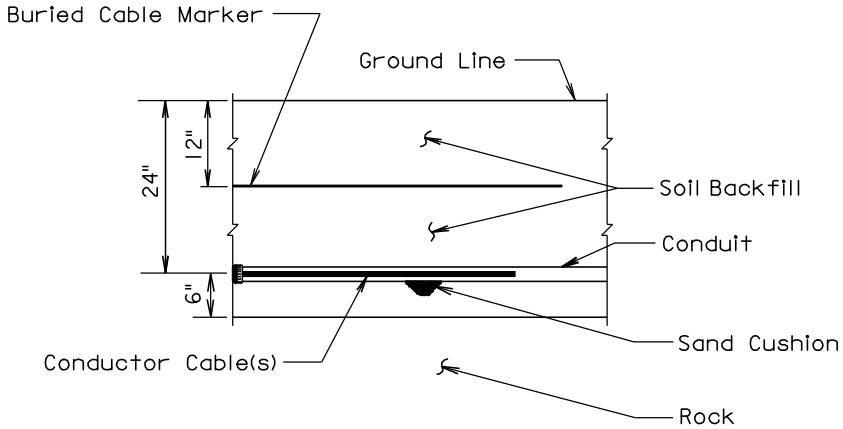
CONTROLLER CABINET AND FOOTING

PLATE NUMBER
635.60

Sheet 1 of 1



SECTION VIEW



SECTION VIEW

GENERAL NOTE:

The Buried Cable Marker shall be plastic, approximately 6" wide, and shall be capable of sustaining a minimum of a 350% tolerance of elongation without tearing. The Buried Cable Marker shall have a life expectancy approximately equal to that of the conductor(s) beneath it. A phrase indicating the presence of a buried electric circuit below shall be printed in a contrasting color on the cable marker. The Buried Cable Marker shall be subject to approval by the Engineer. All costs associated with furnishing and installing the Buried Cable Marker shall be incidental to the contract unit price per Foot for the bid item used for the electrical conductor.

March 31, 2000

SD
DOT

Published Date: 2nd Qtr. 2009

CONDUIT INSTALLATION

PLATE NUMBER
635.76

Sheet 1 of 1