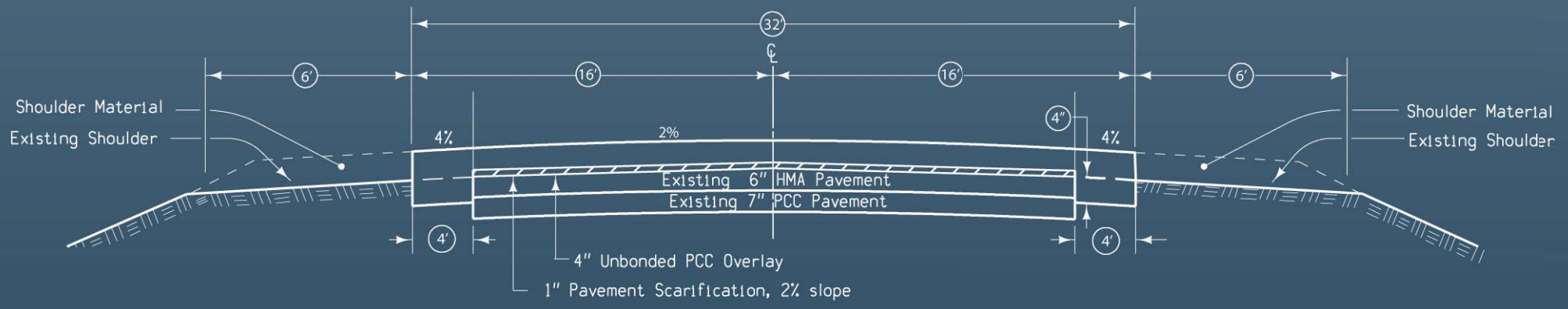
18 4" PCC UNBONDED

OVERLAY

LIVE REVIEW OF A 2-LANE ROADWAY OVERLAYED UNDER TRAFFIC

Chickasaw / Fayette County, Iowa

September 12 - October 26, 2011



Iowa Department of Transportation

Highway Division

Plans of Proposed Improvement on the

Primary Road System - Chickasaw / Fayette County

4" PCC UNBONDED OVERLAY

US 18 From Fredericksburg E. to West Union

Refer to the Proposal Form for list of applicable specifications.

Value Engineering Saves. Refer to Article 1105.15 of the Specifications.

MILEAGE SUMMARY 105-1 09-27-94

Div.	Location	Lin. Ft.	Miles
1	Sta. 340+80.4 - Sta. 632+42.85	29162.45	5.52
	Eq. Sta. 632+42.85 = Sta. 0+00		
	Sta. 0+00 - Sta 344+08.43	34408.43	6.52
	Eq. Sta. 344+08.43 = Sta. 344+15.27		
	Sta. 344+15.27 - Sta 707+73.24	36357.97	6.89
	Omit Bridge Sta. 344+30	-100	-0.02
	Omit Bridge Sta. 418+23	-140	-0.03
	Omit Bridge Sta. 81+19	-22	-0.0
	Omit Bridge Sta. 342+35	-47	-0.01
	Totals	99619.85	18.87

CHICKASAW CO.

04-30-02 101-4

DESIGN DATA RURAL

2008	AADT	1800	V.P.D.
20	AADT	--	V.P.D.
20	DHV	--	V.P.H.
TRUCKS		22	%
Total Design ESALs		--	

FAYETTE CO.

04-30-02 101-4

DESIGN DATA RURAL

2008	AADT	3050	V.P.D.
20	AADT	--	V.P.D.
20	DHV	--	V.P.H.
TRUCKS		13	%
Total Design ESALs		--	

	TOTAL
	82
PROJECT IDENTIFICATION NUMBER	
06-19-018-010	
PROJECT NUMBER	
NHSX-018-7(58)--3H-19	
R.O.W. PROJECT NUMBER	

ROADWAY DESIGN

LICENSED PROFESSIONAL ENGINEER Robert A. Schoenrock 14477 IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Signature — Date: 05-03-2010

Robert A. Schoenrock
Printed or Typed Name

My license renewal date is December 31, 2011

Pages or sheets covered by this seal: A.1-A.3, B.1-B.9, C.1-C.20, D.1-D.34, J.1-J.9, L.1-L.2

FINAL BID COPY 10/19/10

- Late Start Date - April 14, 2011
- Number of working days - 120
- Number of Bidders - 6
- Bid range $8.48 million to 10.51 million
- Prime Contractor - Manatts, Inc., Brooklyn, Iowa

DESIGN TEAM LEADER

Dave Skogenboe
515-239-1612
800 Lincoln Way
Ames, Iowa 50010

PROJECT OBJECTIVE DESCRIPTION

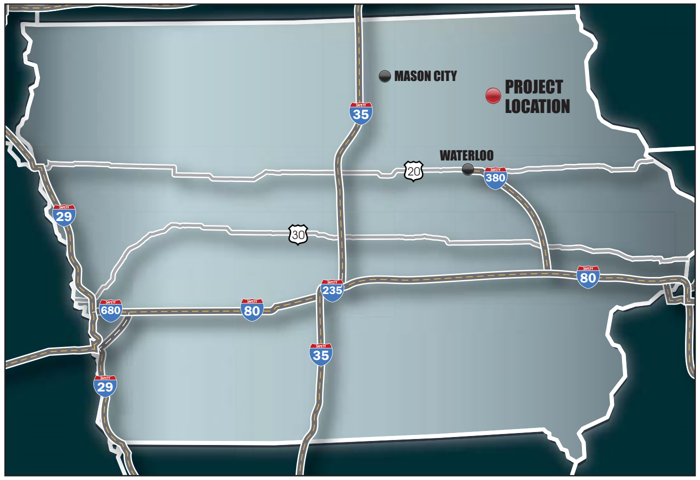
a. Place unbonded PCC overlay while staging traffic through the project with the aid of a pilot car.
b. All preliminary work is to be included in stages one to two prior to overlay paving.
c. Transition pavement is required at the BOP, EOP and four bridge sites.
d. Microsurfacing to be removed on the west portion (BOP to County W-14 by milling.
e. Four paved side roads are affected by the overlay work.

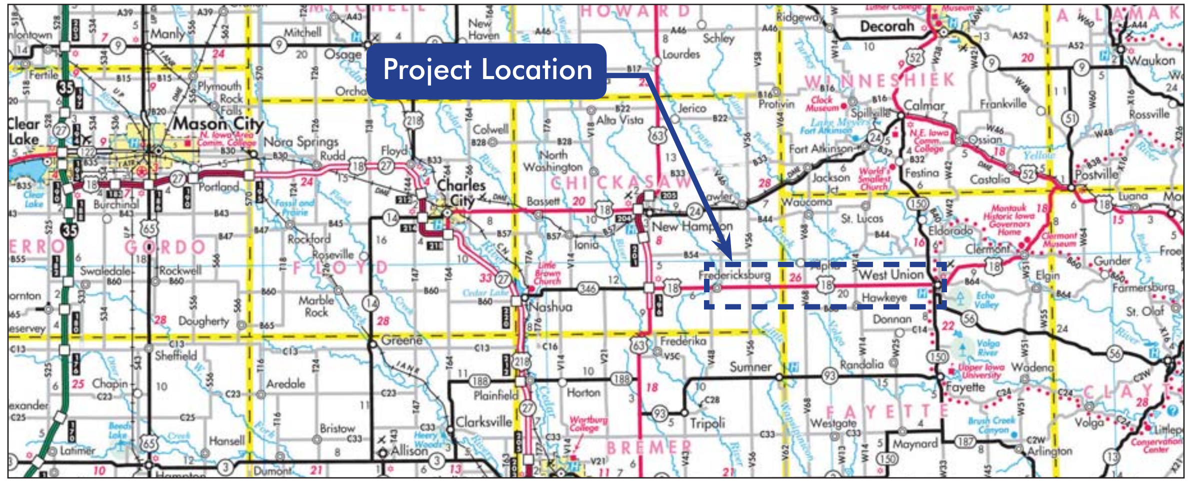
SIGNIFICANT CONTRACT ITEMS

a. Patches by count - 651 PCC patches, 4-30 foot in length
b. Longitudinal subdrains - 113 locations with lengths of 250-540 feet
c. Temporary barrier rail - 6 locations (BOP, 4 bridges and EOP)
d. Temporary traffic signals, bridge approach and railing rehabilitation - 4 bridge locations
e. Shoulder improvement and drainage work - 223 locations

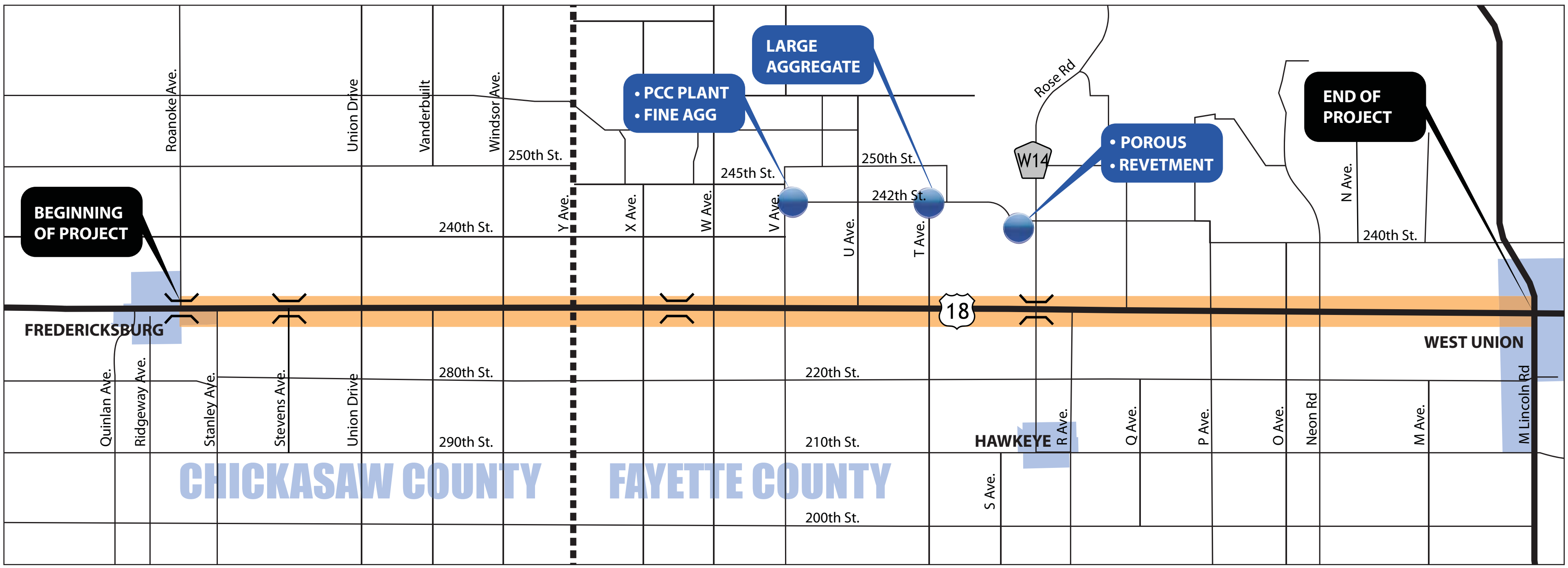
MAJOR CONTRACT QUANTITIES (TOTAL CONTRACT ITEMS)

a. Slipform 9.5 inch class 3 durability pavement .....6,623 sy
b. Concrete Furnish .....48,605 cy
c. Concrete Place .....350,267 sy
d. Surface preparation .....94,681 sy
e. Granular shoulder material, placed ..... 67,741 tons
f. Shoulder strengthening (PCC or HMA) .....3,993 sy
g. Patches full depth repair.....4,337 sy
h. Patches by count ..... 651 each
i. Class 13 widening excavation .....12,894 sy
j. Pavement Scarification .....169,982 sy
k. Granular surfacing ..... 2055 tons
l. Longitudinal subdrain ..... 48,422 LF
m. Pavement removal .....23,858 sy
n. Temporary barrier rail ..... 5,720 LF
o. Longitudinal joint repair ..... 10,920 LF

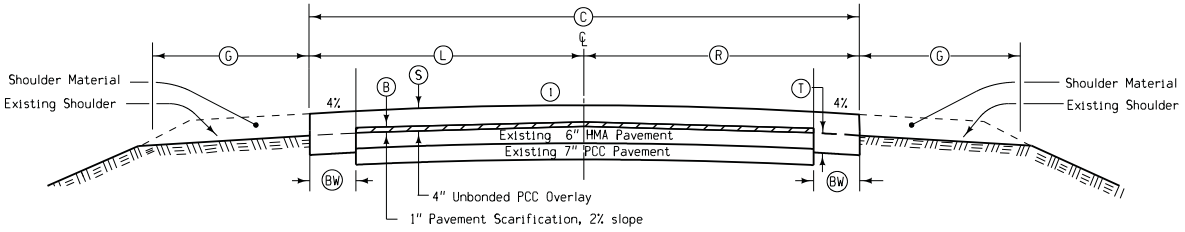




Map courtesy of Iowa DOT



PCC
Overlay



Location			S	B	C (3)	L	R	Overlay Quantities (2) Per Station		T	BW	G	(5)	
Road Identification	Station To Station							(2) Class 13	PCC Overlay				Granular Shoulder	Remarks
			Inches	Inches	Feet	Feet	Feet	Cu. Yds.	Cu. Yds.	Inches	Feet	Feet	Tons	
US 18	346+30.4	416+03	4	1	32	16	16	12.35	49.38	4	4	6	31.36	
US 18	420+43	79+58 *	4	1	32	16	16	12.35	49.38	4	4	6	31.36	
US 18	82+80	99+92.9	4	1	32	16	16	12.35	49.38	4	4	6	31.36	
US 18	99+92.9	100+42.9	Vari	1	32	16	16	12.35	54.32	4	4	6	33.11	
US 18	100+42.9	108+68.8	4	1	32	16	16	12.35	49.38	4	4	6	34.86	
US 18	108+68.8	109+18.8	Vari	1	32	16	16	12.35	54.32	4	4	6	33.11	
US 18	109+18.8	341+28.5 **	4	1	32	16	16	12.35	49.38	4	4	6	31.36	
US 18	343+35.5	706+23.24**	4	1	32	16	16	12.35	49.38	4	4	6	31.36	

(1) Finished slope to be 2%
Refer to tabulation listing of superelevated curves and Standard Road Plans for additional requirements through superelevated curves.
(2) Shoulder is assumed to be 1" lower than existing pavement. Class 13 trench width is BW+1'
(3) Width includes 24' wide mainline pavement.
(4) Provide a vertical edge. Incidental to Class 13 Excavation.
(5) Per side per station

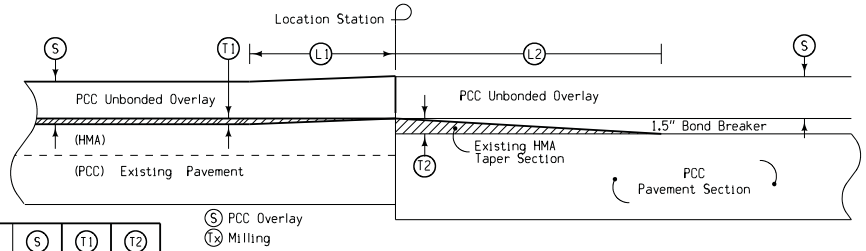
* Sta. 632+42.85 BK = Sta. 0+00 AH
** Sta. 344+08.43 BK = Sta. 344+15.27 AH

TYPICAL CROSS SECTION PCC OVERLAY WITH BASE WIDENING

7307M
Modified

Posted Speed Limit (mph)	Runout Ratio (ft per inch)
45 or More	50
20 to 45	25
Under 20	10 *

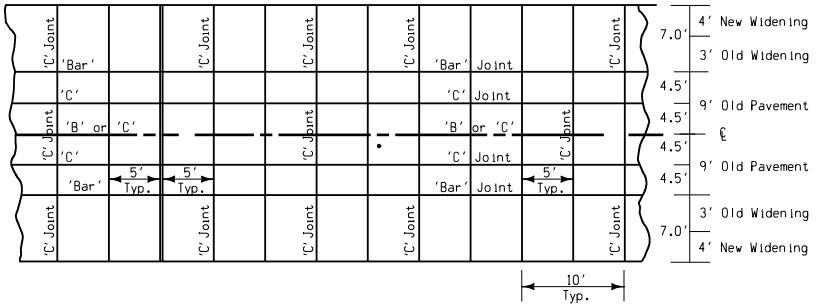
* Based on turning maneuvers at side roads and intersections.

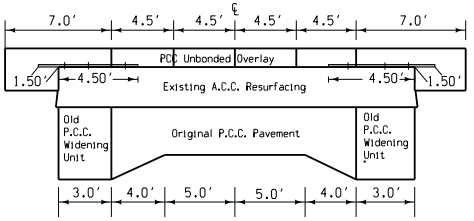


Location Station	L1 Feet	L2 Feet	S Inches	T1 Inches	T2 Inches
223+00	100	150	4	1	1.5
252+00	100	150	4	1	1.5

DETAILS OF TRANSITION FROM PCC OVERLAY OVER EXISTING HMA TO OVERLAY OVER EXISTING PCC PAVEMENT

ML-JNT
18' Pav't



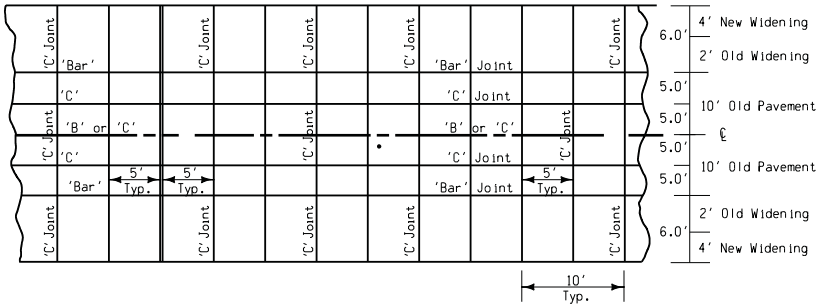


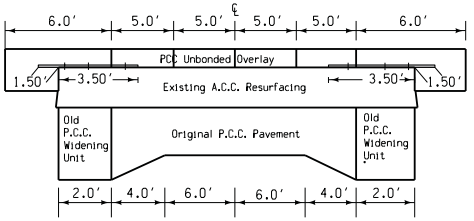
Notes:

① Extend existing expansion joints in kind in new pavement.

TYPICAL CROSS SECTION
AND JOINTING DIAGRAM
PCC UNBONDED OVERLAY
WITH PARTIALLY PAVED SHOULDERS

ML-JNT
20' Pav't



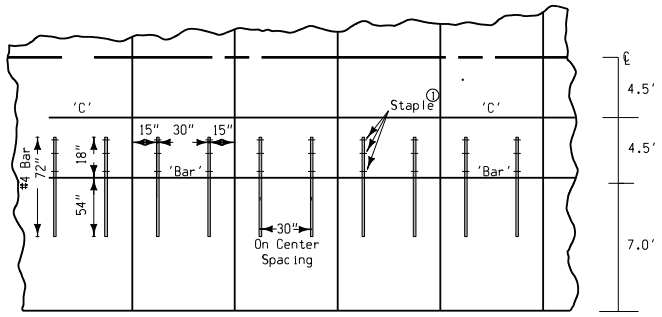


Notes:

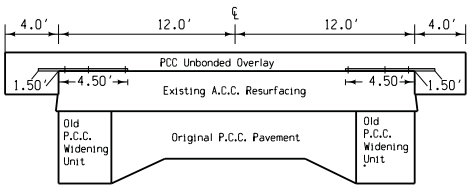
① Extend existing expansion joints in kind in new pavement.

TYPICAL CROSS SECTION
AND JOINTING DIAGRAM
PCC UNBONDED OVERLAY
WITH PARTIALLY PAVED SHOULDERS

BAR
6' length

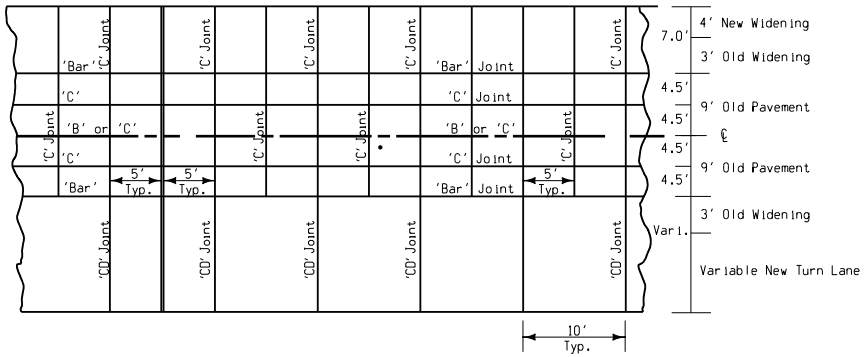


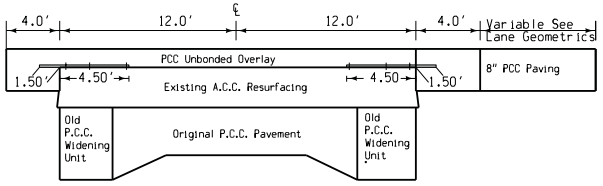
① Minimum 3 staples per Tiebar. Stapling process subject to Engineer approval prior to Paving operation. Approval is based on no tiebar movement during Paving operation.



TYPICAL CROSS SECTION
'BAR' Joint DETAIL

RTL-JNT
New



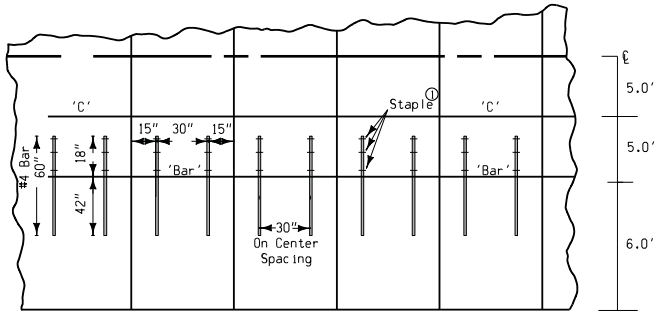


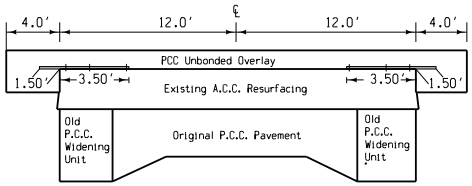
Notes:

① Extend existing expansion joints in kind in new pavement.

TYPICAL CROSS SECTION
AND JOINTING DIAGRAM
PCC UNBONDED OVERLAY
WITH PCC TURN LANE

BAR
5' length





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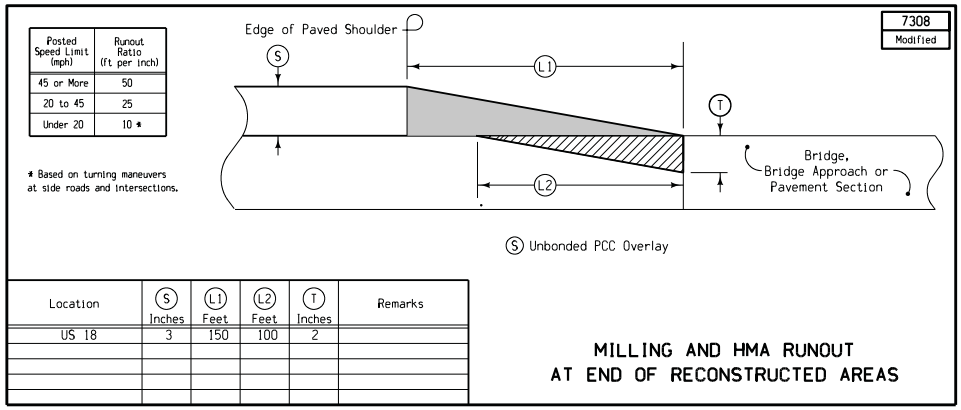
TYPICAL CROSS SECTION
'BAR' Joint DETAIL

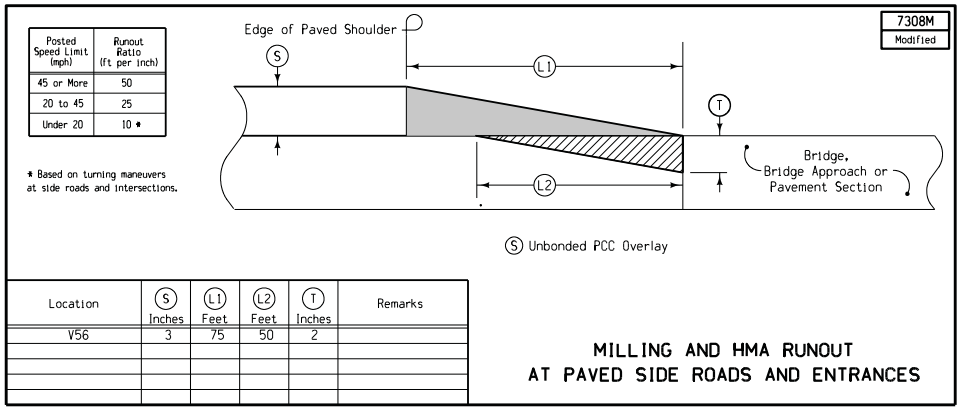


Posted Speed Limit (mph)	Runout Ratio (ft per inch)
45 or More	50
20 to 45	25
Under 20	10 *

* Based on turning maneuvers at side roads and intersections.

Location	S Inches	L1 Feet	L2 Feet	T Inches	Remarks
US 18	3	150	100	2	

MILLING AND HMA RUNOUT
AT END OF RECONSTRUCTED AREAS

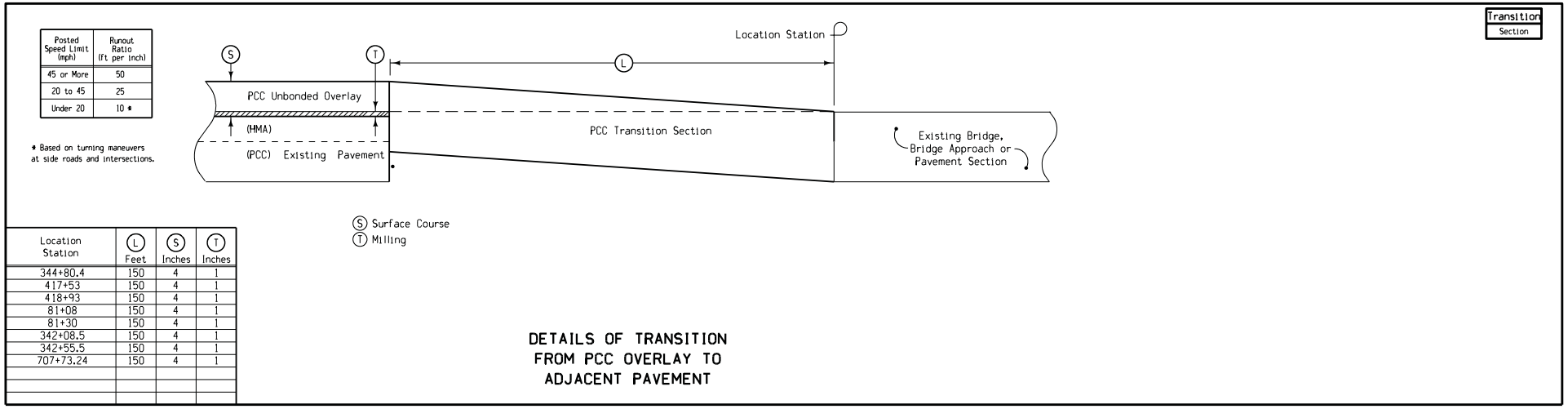


Posted Speed Limit (mph)	Runout Ratio (ft per inch)
45 or More	50
20 to 45	25
Under 20	10 *

* Based on turning maneuvers at side roads and intersections.

Location	S Inches	L1 Feet	L2 Feet	T Inches	Remarks
V56	3	75	50	2	

MILLING AND HMA RUNOUT
AT PAVED SIDE ROADS AND ENTRANCES



Posted Speed Limit (mph)	Runout Ratio (ft per inch)
45 or More	50
20 to 45	25
Under 20	10 *

* Based on turning maneuvers at side roads and intersections.

Location Station	L Feet	S Inches	T Inches
344+80.4	150	4	1
417+53	150	4	1
418+93	150	4	1
81+08	150	4	1
81+30	150	4	1
342+08.5	150	4	1
342+55.5	150	4	1
707+73.24	150	4	1

DETAILS OF TRANSITION
FROM PCC OVERLAY TO
ADJACENT PAVEMENT

US-18 PCC OVERLAY SURVEY METHODS

The following method was used to develop the control system for the overlay of US-18:

SURVEY EQUIPMENT REQUIREMENTS

a. Iowa Real Time Network (RTN) of Base Stations mounted on maintenance garage roofs and maintained by the Iowa DOT.
b. Robotic total station, GPS receive pole, hand held data collector with GPS software and phone connection to the RTN base station nearest the work.
c. One GPS survey operator

THE IOWA DOT PROVIDED –

a. X and Y coordinates and stations for the key points on centerline of the existing US 18 include Points on Tangent, Beginning of Curvature, Point of Intersection, End of Curvature. Each of these points was located by the use of the Iowa RTN system and GPS equipment.
b. X, Y coordinates on all existing land section corners and quarter corners lying within the roadway using the Iowa RTN system and GPS equipment.
c. X, Y,Z coordinates of Bench Marks along the route (1-2 mile distance between points) and the control points at 1000 foot intervals along the project. The DOT staff placed steel rods (40 inches in length) in the north foreslope at approximately 1000 foot intervals. They established a GPS "project network" by referencing the control points and existing benchmarks to known survey markers in the county near the project. These points have been established by precise survey methods under separate contract to the counties in the area.

The Iowa DOT staff used GPS survey equipment and the RTN system to establish new X,Y,Z coordinates on each of the control points and Bench marks along the project. This forms a "Project Level" set of coordinates X,Y,Z for use between the BOP and EOP that are all relative in coordinates to each other. They can be checked against each other with accuracies within the 0.01 to 0.03 foot in elevation and closer accuracy on X and Y at any point. This forms the basis for the project construction coordinate system. In most cases these elevations will check very closely with the USGS elevations on known benchmarks along the route.

CONTROL SET BY CONTRACT SURVEYOR

a. Using the Iowa RTN, the surveyor placed intermediate control points at 250 intervals on alternate sides of the roadway along the project between the Iowa DOT 1000 foot control points. These are metal pins, usually 4 foot in length and driven below the frost line for stability. They can be placed anywhere in the right of way that is visible. They are most often placed in the fore or backslopes of the roadway. Care must be taken when they are placed in the foreslope to assure that they are protected against damage from a haul road or shoulder construction.
b. Using a GPS pole and handheld data collection device connected to the Iowa RTN, the surveyor verifies the X ,Y, Z coordinates of each Iowa DOT point and establishes the coordinates of the new intermediate control points.
c. The contract surveyor can check the Z coordinate for each of the known and established control points and Benchmarks by using robotic total station with 0.01 foot accuracy to traverse between DOT benchmarks and place the elevations on each control point. The traverse is run in one direction only if the variation between bench marks is found to be zero. If not, the traverse must be run in the opposite direction to determine the problem in tie in elevations.

CROSS SECTION

a. The sections were established with the aid of the robotic total station, GPS pole and hand held data collector. The station is referenced to a DOT benchmark and then surveyor works within a 400-450 foot radius of its position to locate and record X,Y,Z coordinates of points across the roadway. With pre office loading of the Benchmark station, the centerline and stations can be determined and the location where the required cross section points are located for the field person.
b. The total station operator traverses between the Benchmark, control points and into a second Benchmark. Failure to tie into any of them outside control vertical control limits (example 0.01 foot), requires the surveyor to return to the point of beginning to check back or determine the reason for the error prior to any further survey.
c. The resulting cross sections will be used with 3D modeling software to develop the model of the slipform to follow and can be used to verify minimum depths in the overlay design, and track estimated requirements in concrete quantities.

PROJECT STAGING

STAGE I (CHANGE IN PATCHING TIMING)

a. Maintain through traffic at all times.
b. Patch between BOP and EOP.(entire length of project)
c. Construct subdrains, culvert work, foreslope flatting, ditch reshaping and erosion control from BOP to EOP

STAGE II

a. Maintain through traffic at all times and use TBR/signals where necessary.
b. Place shoulder strengthening, TBR and signals, attenuators, and flood lights at four bridge locations and EOP.
c. Reconstruct bridge approaches, ½ at a time and place temporary HMA wedges

STAGE III

a. Maintain through traffic at all times from W-14 to EOP with pilot car.
b. Close county roads as required to place PCC overlay
c. Prepare base for overlay between W-14 and EOP.
d. Place PCC overlay one lane at a time, shoulder, mark lines as noted and open to traffic between W-14 and EOP.

STAGE IV

a. Maintain through traffic at all times from BOP to W-14 with pilot car.
b. Mill microsurfacing between BOP and W-14.

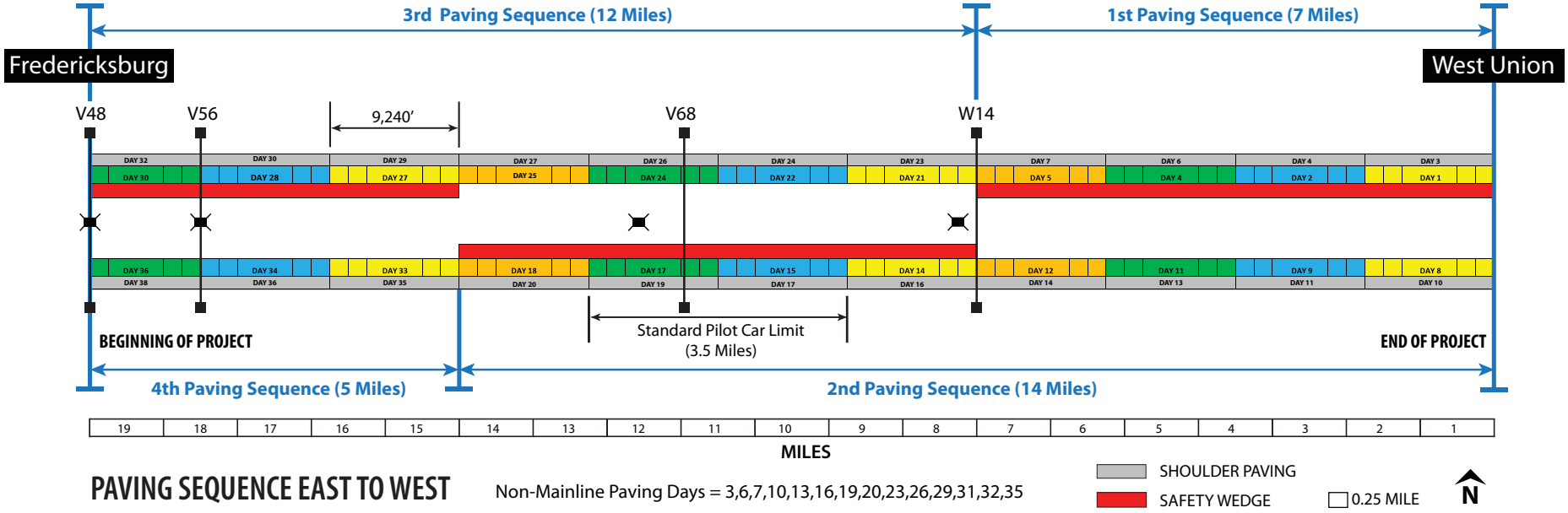
STAGE V

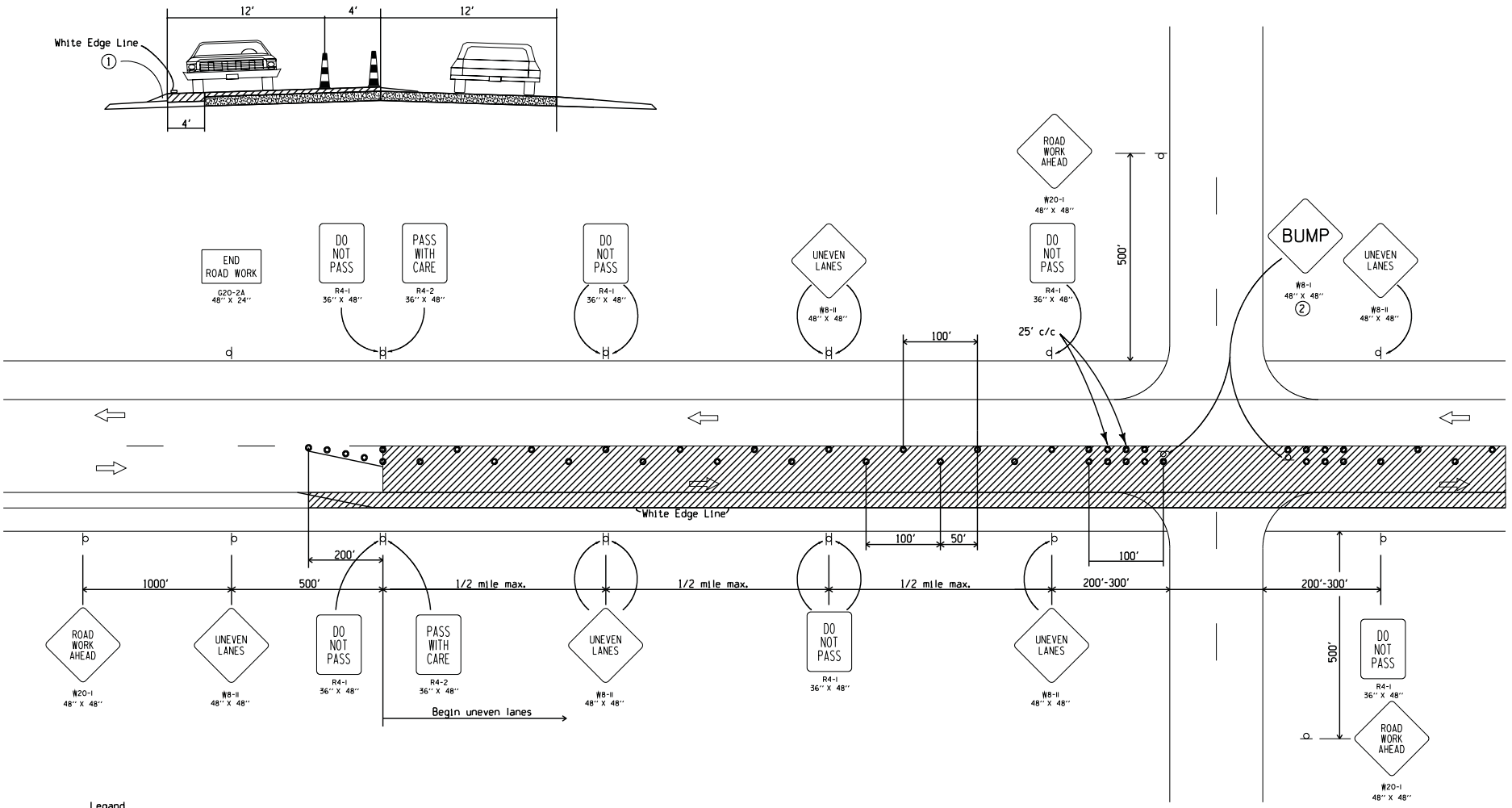
a. Maintain through traffic at all times from BOP to W-14 with pilot car.
b. Close Co Road V-68 and reconstruct tie in areas.
c. Close other county roads as required to place PCC overlay.
d. Place PCC overlay one lane at a time, shoulder, mark lines as noted and open to traffic between BOP and W-14.

STAGE VI

a. Maintain through traffic on US 18 at all times.
b. Construct right turn lanes at V-68 and W-14.
c. Remove and replace paved entrances
d. Place rumble strips from BOP to EOP

PAVING STAGING





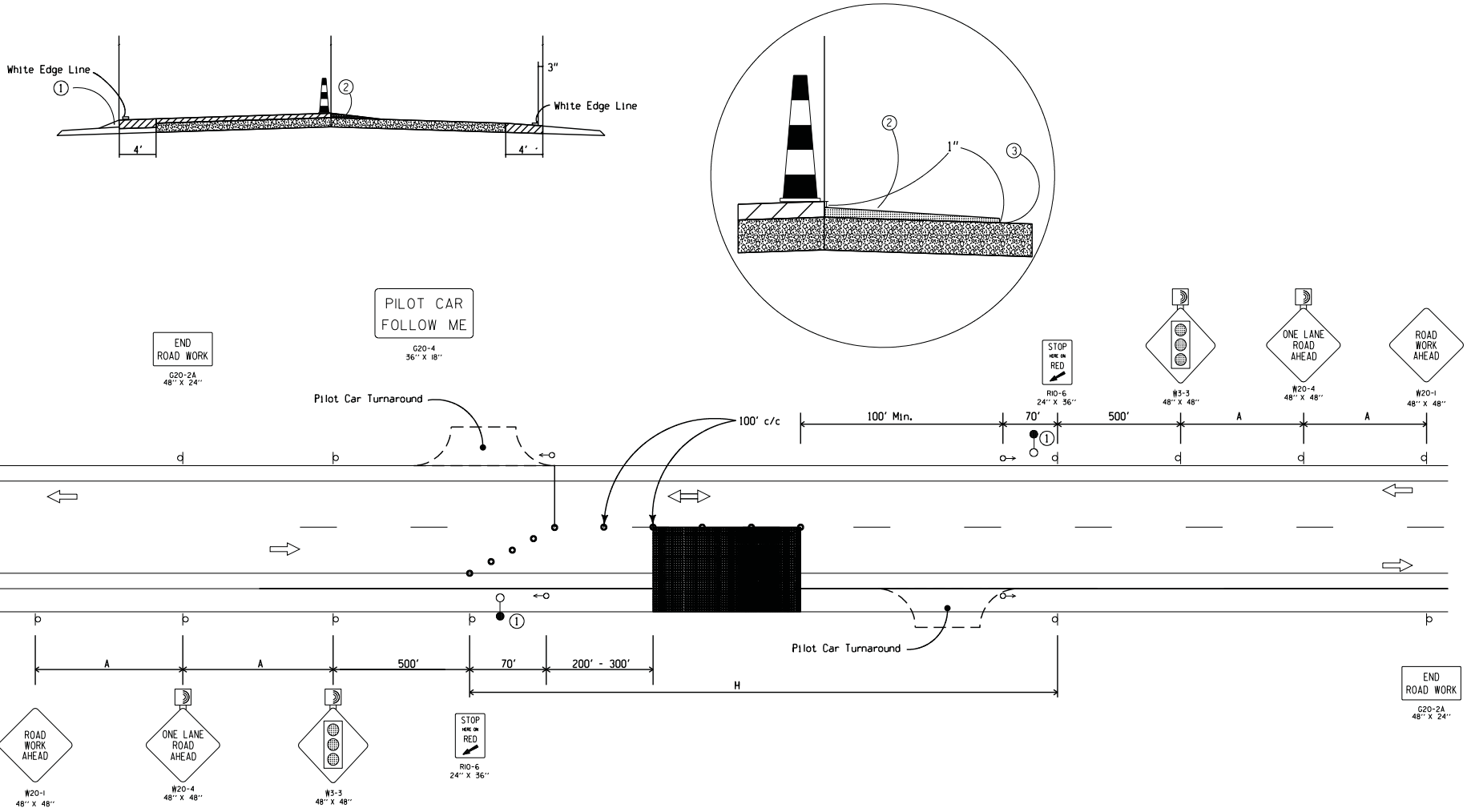
Legand

- Traffic Sign
- Traffic Sign (back/back)
- 42-inch Channelizer
- New Pavement

When a centerline drop-off exists, the maximum length of roadway open to two lane, two-way traffic shall not exceed 7 miles.

1. Shoulder edge drop-offs shall be mitigated according to Article 1107.08.K2 of the Standard Specifications.
2. Refer to Article 2528.03 A 6 of the Standard Specifications for these signs.

Lane Line Drop-off
PCC Overlay



Legand

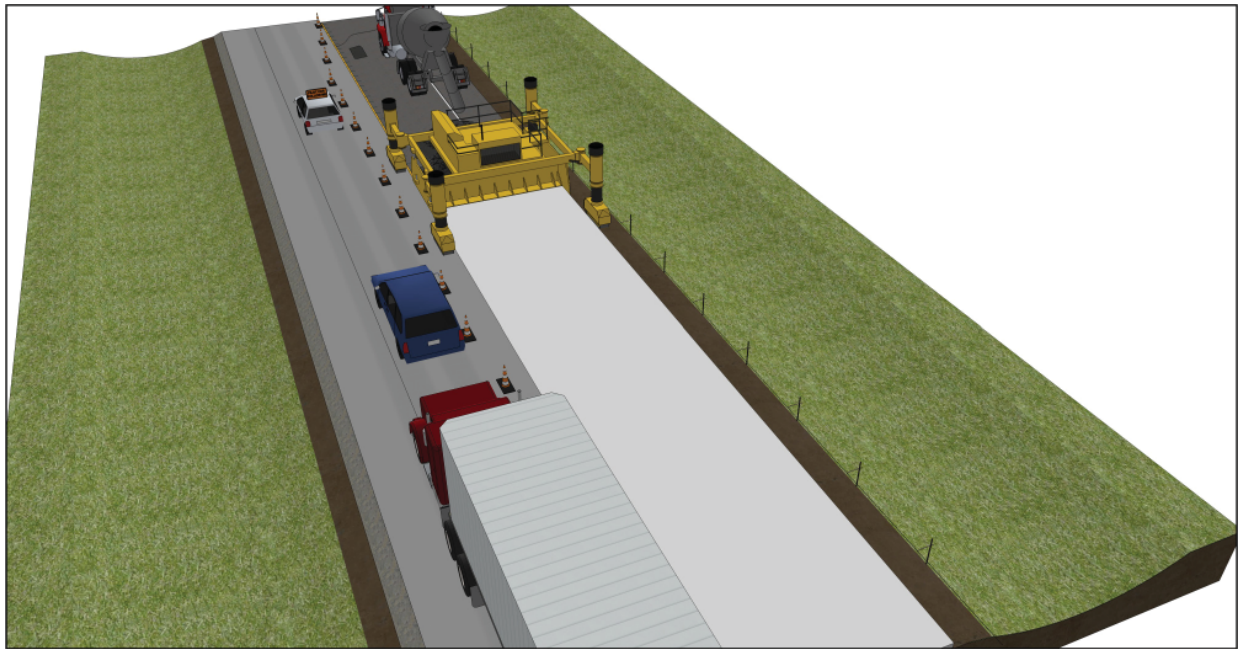
- Traffic Sign
- Traffic Signal
- Temporary Floodlighting
- 42-inch Channelizer
- Work Area
- Type "B" Warning Light

SPEED LIMIT	ADT	A	H
50 mph or Greater	up to 5,000	500'	3.5 mi.

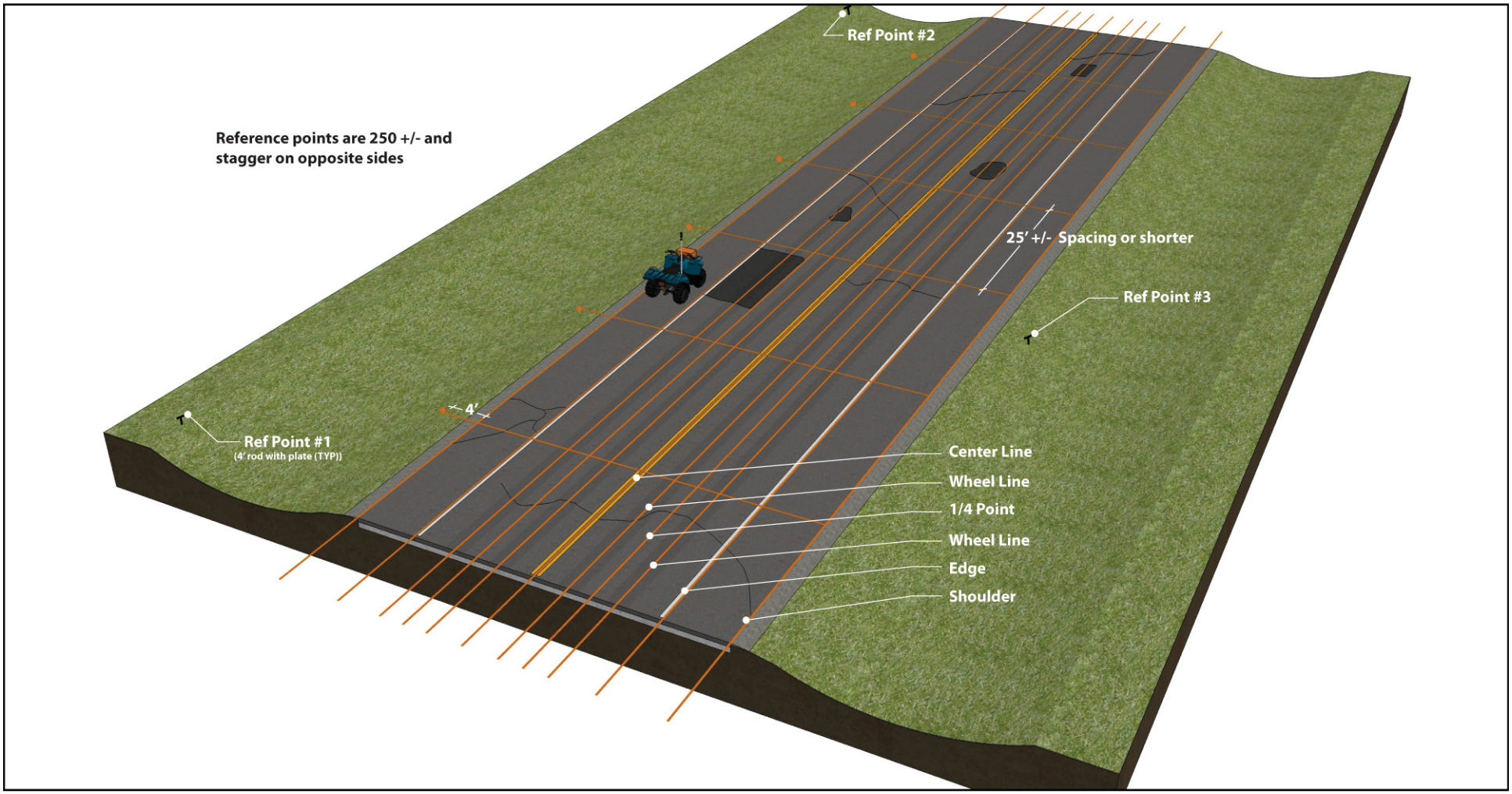
A FLAGGER AHEAD (W20-7a) sign Shall be erected 500' in advance of side road intersections.

1. Temporary Floodlighting is required at all flagger Stations during nighttime operations.
2. PCC Fillet
3. Tar paper or something similar shall be placed under thr fillet so it could be sawed and removed prior to paving opposite lane.

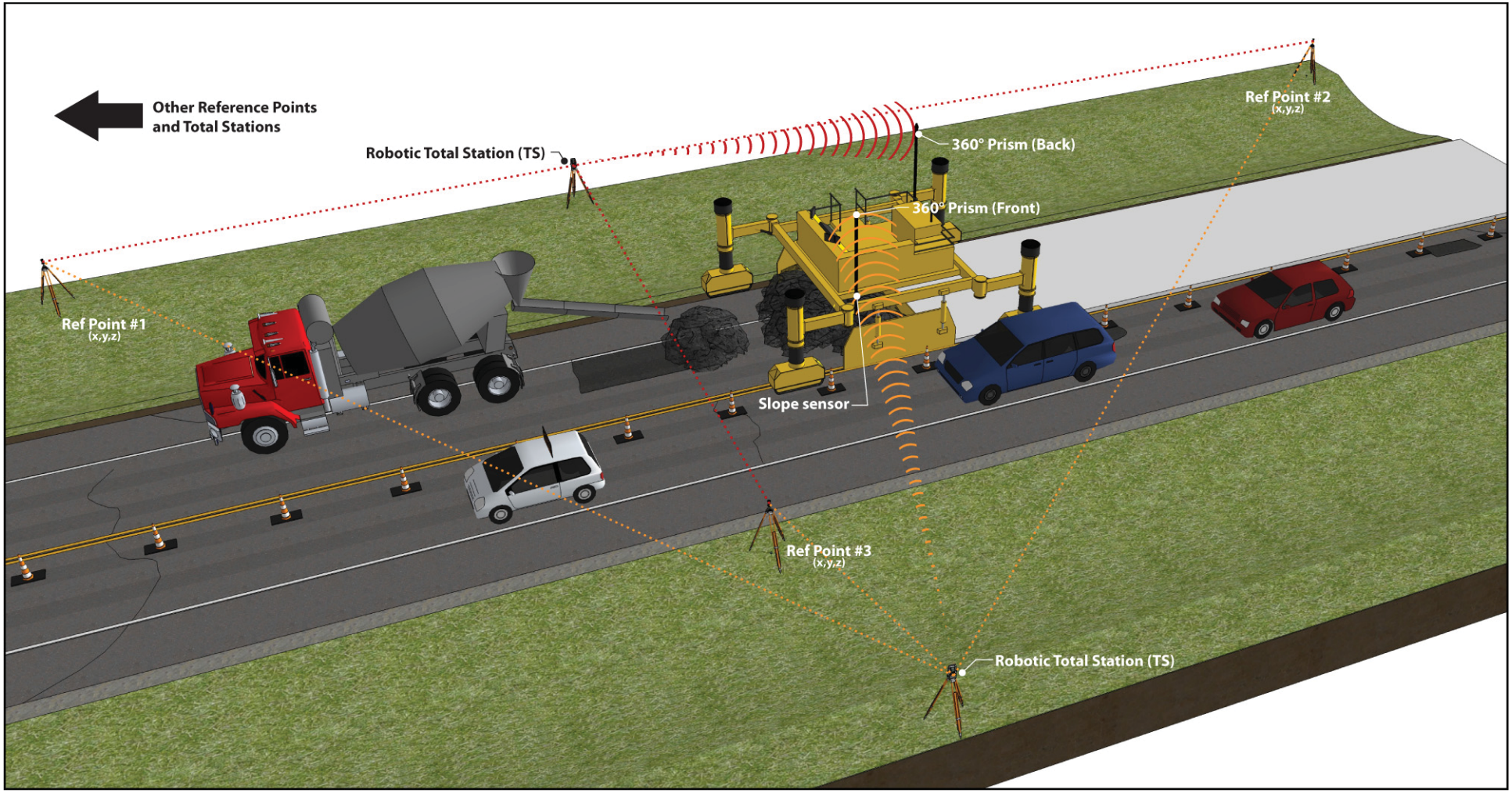
Lane Closure With
Pilot Car and Signals



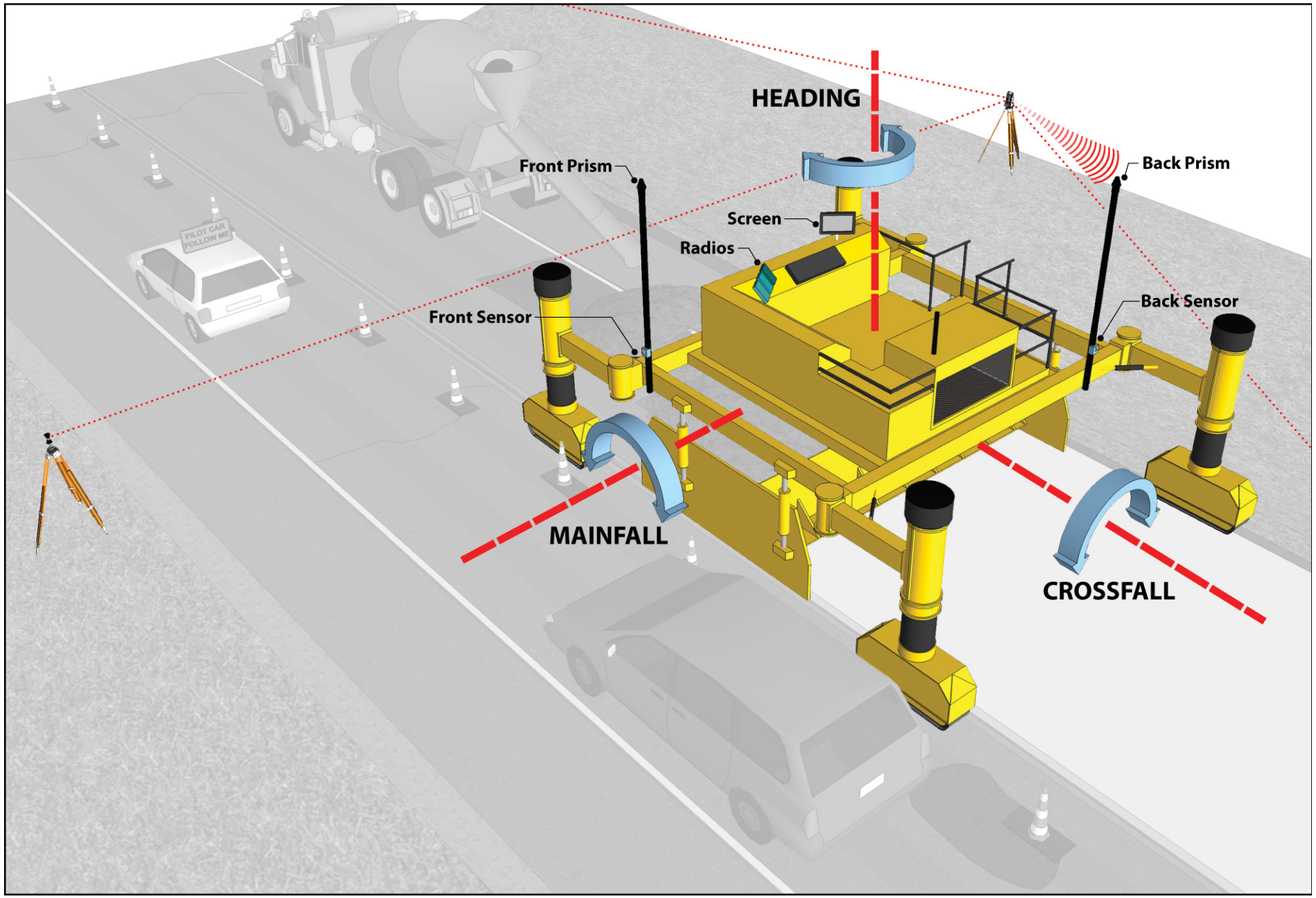
PAVING WITH MACHINE CONTROL WITHOUT CENTERLINE STRING LINE



SURVEY MAPPING USING GPS AND ATV WITH LASER SYSTEM (ALTERNATE USING TOTAL STATIONS)



STRINGLESS MACHINE CONTROL


HEADING
Front Prism
Back Prism
Screen
Radios
Front Sensor
Back Sensor
MAINFALL
CROSSFALL
PILOT CAR
FOLLOW ME

US 18, CHICKASAW-FAYETTE CO. PCC OVERLAY

National Concrete Pavement Technology Center Suggestions

1. March 17, 2011 – Patch surface suggestion

PCC patches are specified for the existing composite pavement which has an HMA surface. Patches were to receive a double sand seal surface prior to the PCC overlay.

Suggestion: Due to the use of a full depth PCC patch in an HMA surfaced pavement and the application of a thin (4 inch PCC overlay), it was suggested that the sand seal be omitted and that the patches be isolated with transverse joints at each edge. Tie bars to connect the patch area to the widening would be spaced accordingly through the patch area

Response: Approved for implementation

2. April 12, 2011 – Surface milling suggestion

The plans call for milling 0.5 inches of surface from the west 2/3 of the project to remove a surface layer. The contractor proposed a "mill to grade" alternative for part or the entire project to remove surface across the entire width of the pavement and reduce concrete overruns due to irregularities in the pavement surface.

Suggestion: Select a one mile test section, conduct a nine shot cross section survey at 25 foot increments and analyze the results for the optimum in cross section intervals, cross section shots and milling depth to achieve the best overall product and minimize concrete overruns.

Response: The test mile was selected by the Center staff, the contractor has surveyed the section and the results are under consideration.

3. June 2, 2011 – Intersection and Bare PCC suggestions

The plans call for modifications to two existing PCC county road connections and involve some removal and replacement of relatively new pavement at one of the locations.

Suggestions: Two alternates were suggested for the construction through Fayette Co. V-68. The first involves building the planned overlay of the intersection, but using a partial depth milling and filling with PCC to make the vertical transitions with the existing county road. The second alternate involves removal of six inches of HMA on US 18 through the intersection down to the original PCC pavement, placement of a geotextile bond breaker and placement of six inches of new PCC in the same area. In this way, no other work is required on the county road approaches.

Response: Under consideration by IA DOT District Staff.

This project contains a short section of PCC that was placed in the mid 1980s as part of a railroad grade separation removal. It is in good condition and shows minimal distress. The plans call for a 1.5 inch HMA bond breaker and the 4 inch PCC overlay to be placed on the area.

Suggestion: Conduct a FWD deflection analysis and associated overlay design to determine the need for more structure at this location. Based on those results add dowels to the existing pavement and no overlay or construct an overlay as per plan.

Response: Under consideration by IA DOT District Staff

4. June 18, 2011 – Prepour conference and field review suggestions

The project team identified a need for a prepour conference prior to paving to assure that all parties understood the paving process to be used.

Suggestion: The Center staff has prepared a draft document for use nationally by contractors and agencies for this type of event. This document was supplied to the project staff for their consideration and use in the planned conference.

Response: Information only.

This project has gained national interest by state officials, highway agencies and contractors due to the nature of one lane paving, under traffic. Due to the management of through traffic and concrete delivery, personnel congestion at the paving site for viewing cannot be allowed.

Suggestion: The Center Staff has developed a "Field Review, Drive Through" plan that allows viewing of the paving from the traffic stream behind the pilot car. It allows for offsite discussions and viewing from a distance, but not at the paving operations.

Response: Information only.