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Green Bay, WI: Foth and Van Dyke, 1982

Report

Foth & Van Dyke
engineers/architects
2737 S. RIDGE ROAD
P.O. BOX 3000
GREEN BAY, WI
54303-1200

A FINAL REPORT FOR:

EXXON MINERALS COMPANY

PRELIMINARY ENGINEERING

MINE/MILL ACCESS ROAD (ALTERNATE ALIGNMENT)

Contract # 21615

VOLUME II

AUGUST, 1982

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VOLUME II

APPENDIX 1

ENGINEERING CRITERIA

APPENDIX 1 ENGINEERING CRITERIA

The engineering criteria for this project was given in Section 3.0 of the Engineering Agreement of Contract No. 21615. As part of the contract, the engineering criteria was reviewed and clarified for design class C-4. Referring to Figure 2 procedure 11-15-1 and Figure 1 procedure 11-10-5, which are included, the following criteria was recommended:

1) Design speed - 50 MPH.
2) Stopping sight distance - 108 m (350 ft.).
3) Passing sight distance - 549 m (1800 ft.).
4) Degree of horizontal curve - Maximum 7°30'.
5) Vertical alignment - Maximum grade - 7%.

For design purposes, the design team maintained a maximum degree of horizontal curvature of 5° and a maximum vertical grade of 4%. This was possible by eliminating the requirement of the railroad track crossing the access road.

HORIZONTAL CURVE, GRADE AND SIGHT DISTANCE CRITERIA

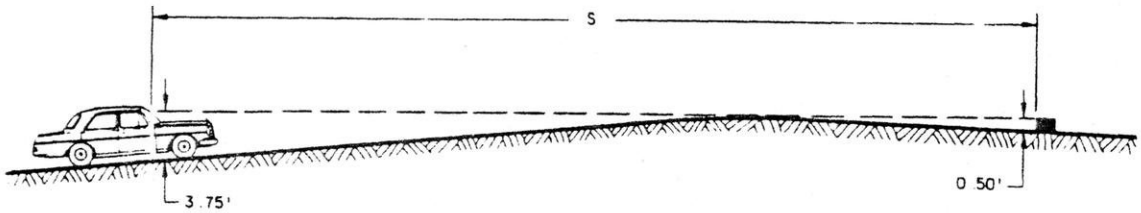
① Design Speed m.p.h	Max. Horizontal Curve Degrees		Max. Grades Percent ②			Sight Distance - Feet			
						Stopping		Passing	No Passing Zone ③ Warrants
	SE = 0.06'/'	SE = 0.08'/'	F	R	H	Minimum	Desirable		
30	21°-00'	23°-00'	6	7	9	200	200	1100	525
40	11°-30'	12°-30'	5	6	8	275	300	1500	686
50	7°-00'	7°-30'	4	5	7	350	450	1800	845
60	4°-30'	5°-00'	3	4	6	475	650	2100	1108
65	4°-00'	4°-30'	3	4	6	550	750	-	-

(1) Except sight distance requirements for No Passing Zones are based on Speed Limit..

(2) Terrain designations are: F = Flat, R = Rolling, H = Hilly. Short grades less than 500 feet in length and one-way downgrades may be one percent steeper.

(3) No Passing Zone sight distance criteria are taken from the Wisconsin Manual on Uniform Traffic Control Devices. No Passing Zone markings are warranted when the sight distance is less than the values shown. Height of eye and height of object are both assumed to be 3.75 feet for this determination (Note: this differs from design passing sight distance where the object height is 4.5 feet - See Figure 4)

STOPPING SIGHT DISTANCE FOR CREST VERTICAL CURVES



WHEN S > L	WHEN S < L
$L = 2S - \frac{1398}{A}$	$L = \frac{AS^2}{1398}$
L = Curve Length (Feet) A = Algebraic Grade Difference(Percent) S = Sight Distance (Feet)	

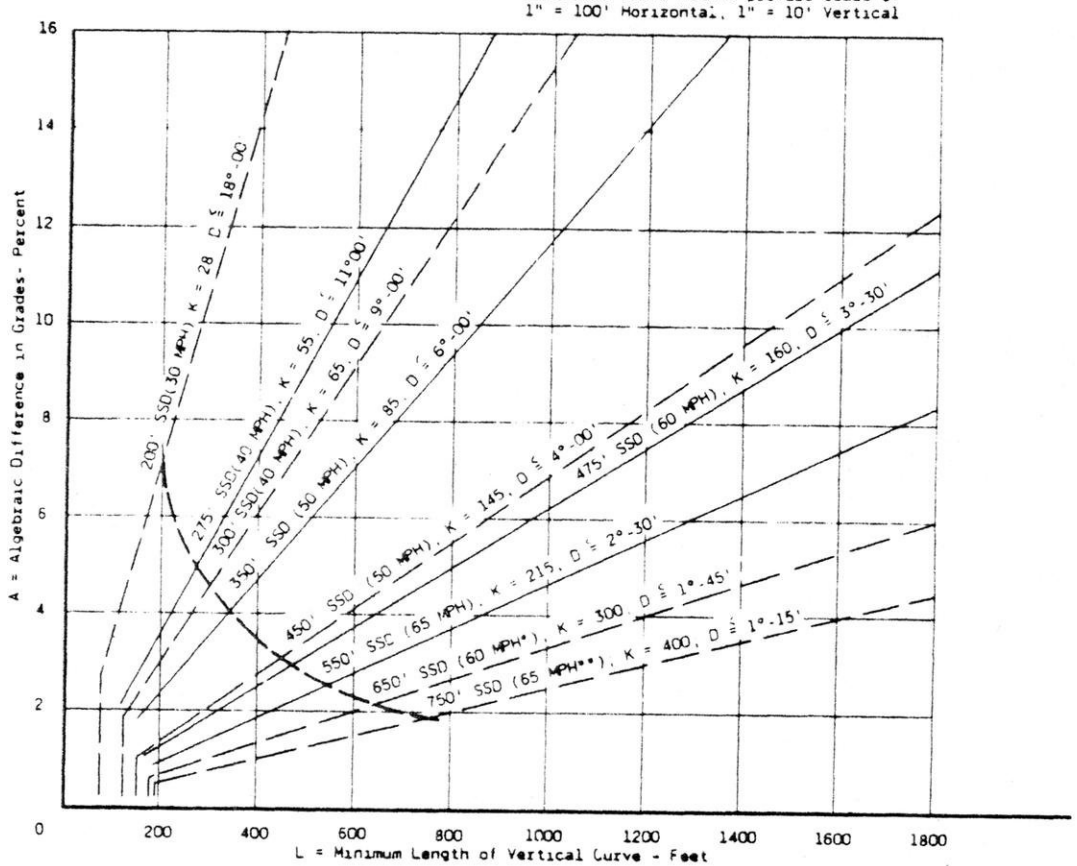
DESIGN SPEED (MPH)	MIN. STOPPING DISTANCE (FEET)	DESIRABLE STOPPING DISTANCE (FEET)
25	160	160
30	200	200
35	240	250
40	275	300
50	350	450
60	475	650
65	550	750

Source: A Policy on Design Standards for Stopping Sight Distance, AASHO, 1971

Desirable Stopping Sight Distance
Minimum Stopping Sight Distance

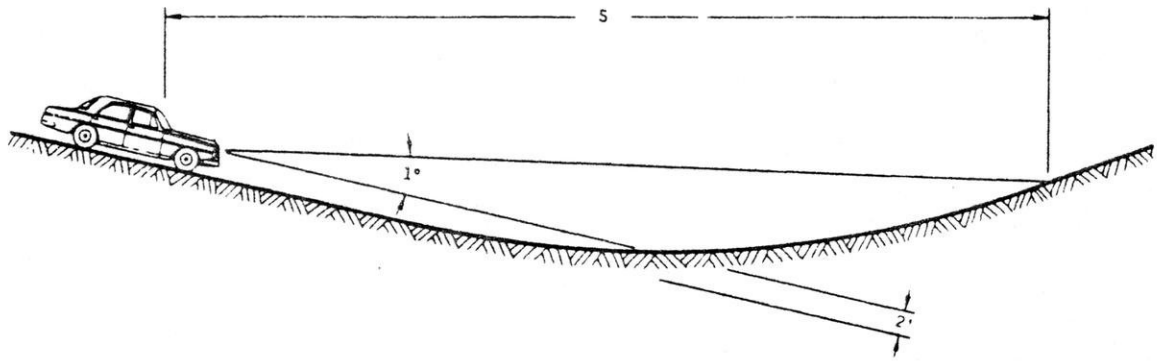
$K = \frac{L}{A}$ $L = KA$

D = Circular curve approx. (in degrees) for parabolic curve with a profile scale of 1" = 100' Horizontal, 1" = 10' Vertical



* Use for 55 mph Speed Limit Design for 2 - lane highways
** Use for 55 mph Speed Limit Design for 4 - lane highways

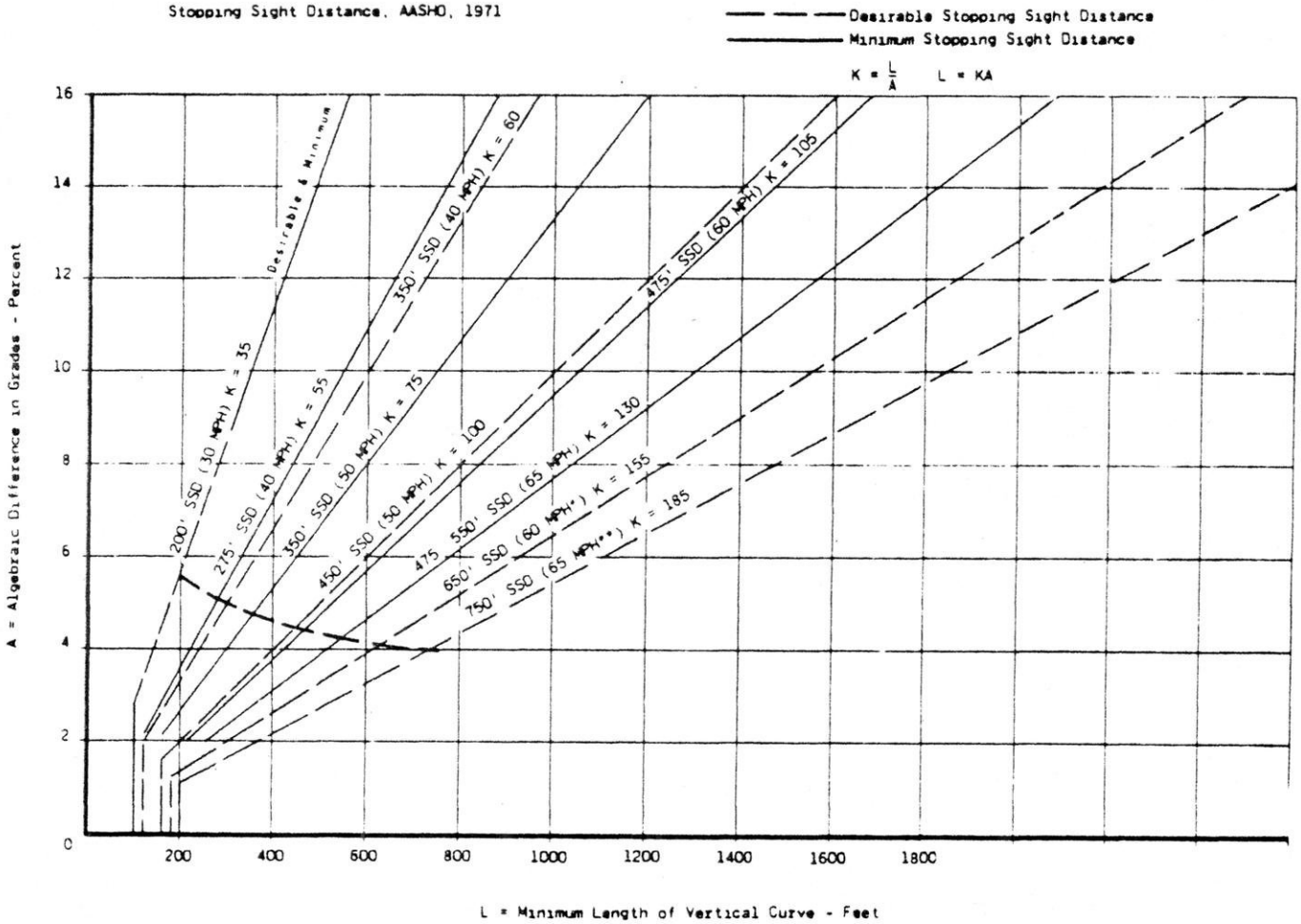
STOPPING SIGHT DISTANCE FOR SAG VERTICAL CURVES



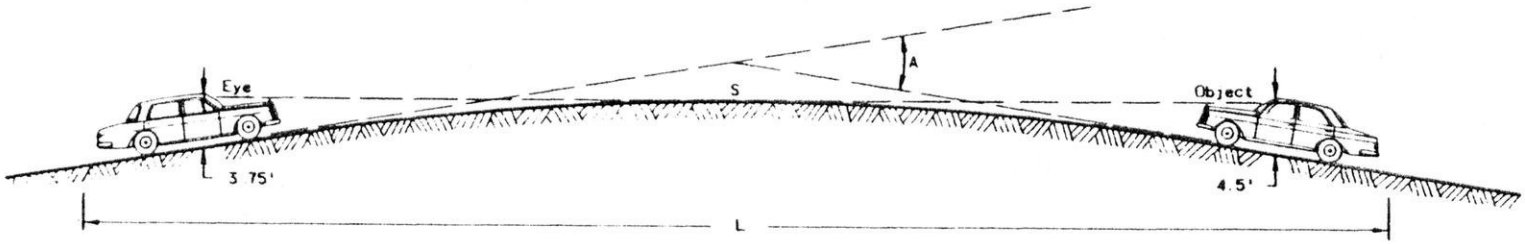
WHEN S > L	WHEN S < L
$L = 2S - \frac{400 + 3.5S}{A}$	$L = \frac{AS^2}{400 + 3.5S}$
L = Curve Length (Feet) A = Algebraic Grade Difference (Percent) S = Sight Distance (Feet)	

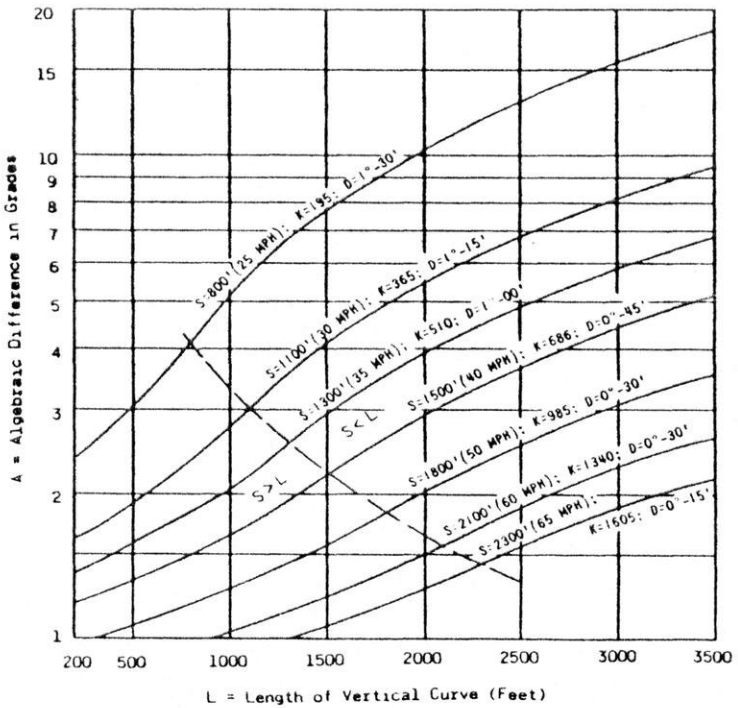
DESIGN SPEED (MPH	MIN. STOPPING DISTANCE (FEET)	DESIRABLE STOPPING DISTANCE (FEET)
25	160	200
30	200	240
35	240	275
40	275	350
50	350	475
60	475	650
65	550	750

Source: A Policy on Design Standards for Stopping Sight Distance, AASHO, 1971



PASSING SIGHT DISTANCE FOR CREST VERTICAL CURVES





DESIGN SPEED (MPH)	25	30	35	40	50	60	65
MIN. PASSING S. D. (FT.)	800	1100	1300	1500	1800	2100	2300

When S is less than L

$$L = \frac{AS^2}{3295}$$

When S is greater than L

$$L = 2S - \frac{3295}{A}$$

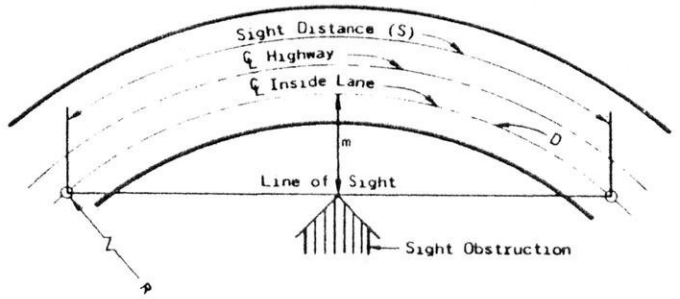
S = Sight Distance in feet
L = Length of Vertical Curve in feet
A = Algebraic Difference of Grades in Percent

FIGURE 4

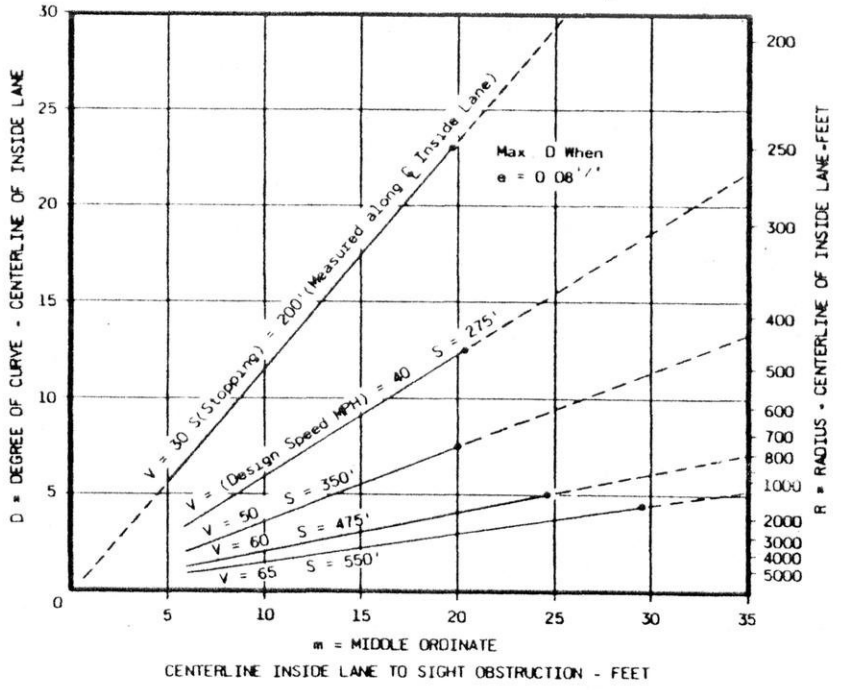
$m = \frac{5730}{D} \text{ vers } \frac{SD}{200}$

Also $m = R(\text{vers } \frac{28.65S}{R})$

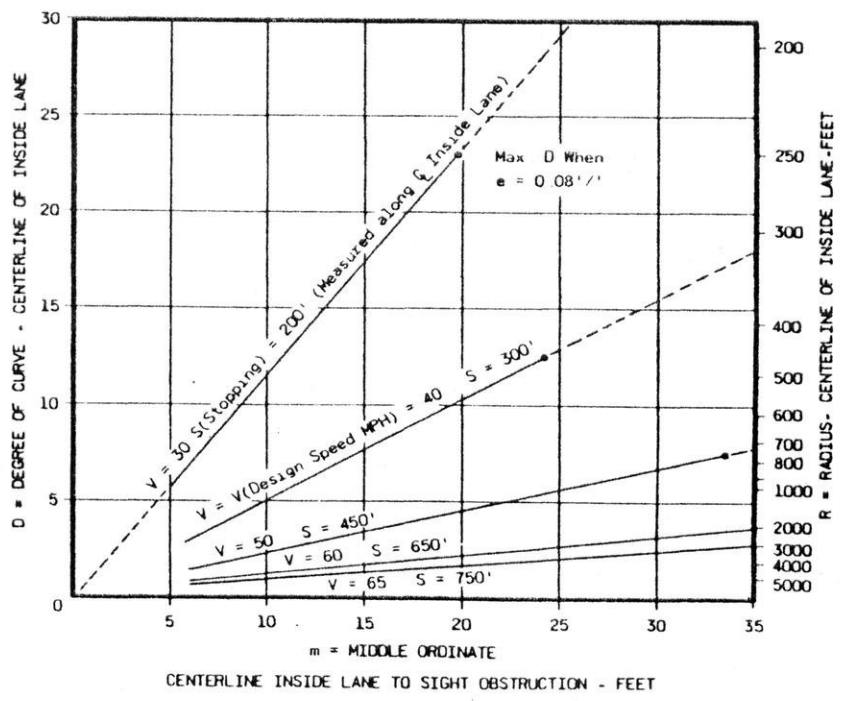
And $S = \frac{R}{28.65} \text{ Cos}^{-1} \frac{R - m}{R}$



Source: A Policy on Design of Urban Highways and Arterial Streets - 1973



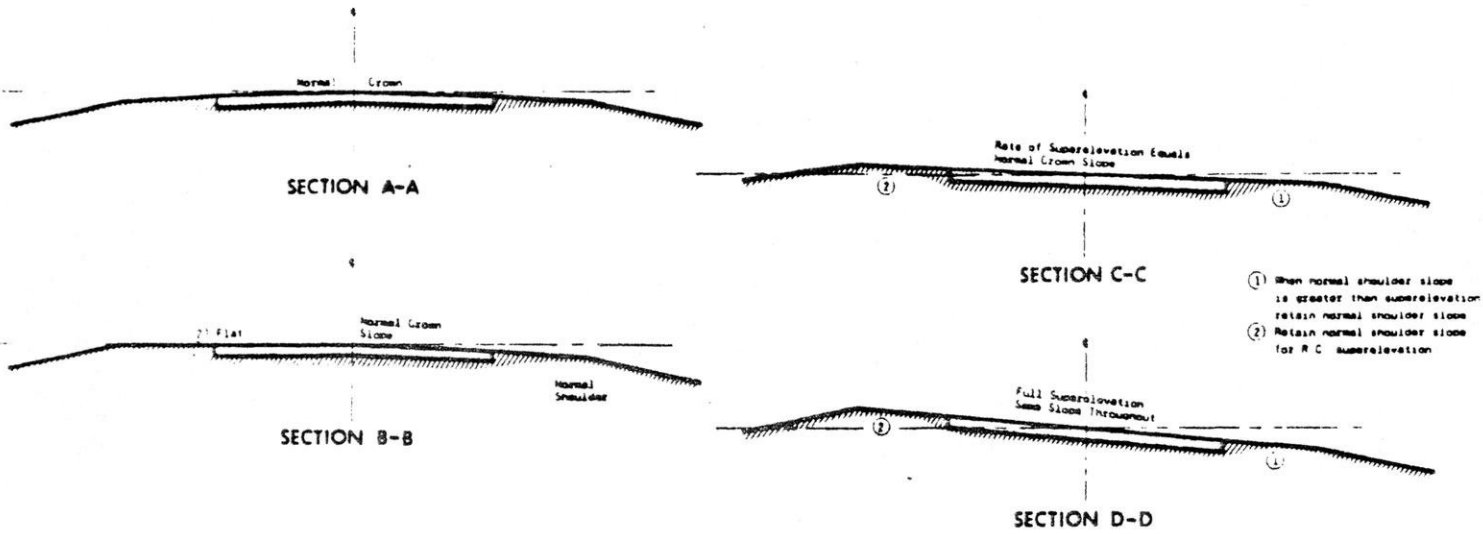
MINIMUM STOPPING SIGHT DISTANCE

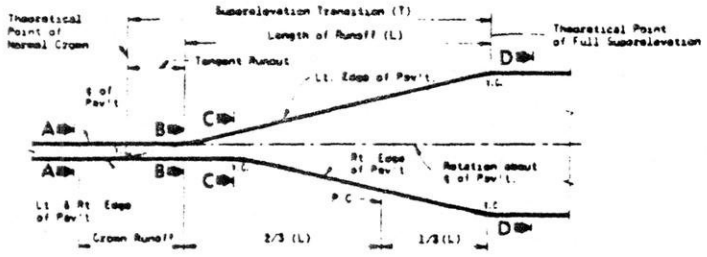


DESIRABLE STOPPING SIGHT DISTANCE

SIGHT DISTANCE ON HORIZONTAL CURVES

FIGURE 5





PROFILE

SUPERELEVATION TABLE (e max. 0.06)

Curve (D)	V = 30 mph Superelevation			V = 40 mph Superelevation			V = 50 mph Superelevation			V = 55 mph Superelevation			V = 60 mph Superelevation			V = 65 mph Superelevation		
	Rate (ft/ft)	% Tangent (L)	% Spiral (T)	Rate (ft/ft)	% Tangent (L)	% Spiral (T)	Rate (ft/ft)	% Tangent (L)	% Spiral (T)	Rate (ft/ft)	% Tangent (L)	% Spiral (T)	Rate (ft/ft)	% Tangent (L)	% Spiral (T)	Rate (ft/ft)	% Tangent (L)	% Spiral (T)
0°-15'	NC	0	0	NC	0	0	NC	0	0	NC	0	0	NC	0	0	NC	0	0
0°-30'	NC	0	0	NC	0	0	NC	0	0	NC	0	0	RC	175	350	RC	190	380
0°-45'	NC	0	0	NC	0	0	RC	150	300	RC	165	330	021	175	300	023	190	315
1°-00'	NC	0	0	RC	125	250	020	150	265	025	165	265	027	175	270	029	190	290
1°-15'	NC	0	0	020	125	230	024	150	245	028	165	255	031	175	260	034	190	275
1°-30'	RC	100	200	020	125	220	028	150	230	033	165	240	036	175	250	040	190	260
1°-45'	RC	100	200	023	125	205	031	150	220	036	165	235	040	175	240	044	190	255
2°-00'	RC	100	200	026	125	195	035	150	215	040	165	230	044	175	235	048	190	250
2°-15'	018	100	180	029	125	180	037	150	210	041	165	230	047	175	230	051	190	245
2°-30'	020	100	175	031	125	185	040	150	205	043	165	225	050	175	230	053	190	245
2°-45'	022	100	170	033	125	180	042	150	205	045	165	220	052	175	225	055	190	240
3°-00'	023	100	170	035	125	180	044	150	200	048	165	220	054	175	225	057	190	240
3°-30'	026	100	160	038	125	175	048	150	195	052	165	215	057	175	220	059	190	240
4°-00'	029	100	150	041	125	170	051	150	195	056	165	210	059	175	220	060	190	240
4°-30'	032	100	150	044	125	170	053	150	190	057	165	210	060	175	220	D Max = 4°-00'		
5°-00'	034	100	140	046	125	165	056	150	190	059	165	210	D Max = 4°-30'					
5°-30'	036	100	140	048	125	165	057	150	190	060	165	210						
6°-00'	038	100	140	050	125	165	059	150	190	D Max = 5°-30'								
6°-30'	040	100	140	052	125	160	059	150	190									
7°-00'	041	100	140	054	125	160	060	150	190									
7°-30'	042	100	140	055	125	160	D Max = 7°-00'											
8°-00'	043	100	130	056	125	160												
9°-00'	046	100	130	058	125	160												
10°-00'	048	100	130	059	125	155												
11°-00'	050	100	130	060	130	165												
11°-30'	051	100	130	060	130	165												
12°-00'	052	100	130	D Max = 11°-30'														
13°-00'	053	100	130															
14°-00'	055	100	130															
16°-00'	056	100	130															
18°-00'	059	110	130															
20°-00'	060	110	130															
	06	110	130															
	D Max = 21°-00'																	

NOTE:

Superelevation rotation is about ℄ of pavement
Curve shown is a horizontal curve to right

V = Design Speed
D = Degree of Horizontal Curve
N C = Normal Crown Slope i.e. = 0.015 ft./ft.

R C = Remove Crown Superelevate at Normal Crown Slope Retain Slope on Both Shoulders
P C = Beginning of Horizontal Curve
V C = Vertical Curve

MINIMUM DESIGN STANDARDS FOR RURAL COUNTY TRUNK HIGHWAYS *

DESIGN CLASS	TRAFFIC VOLUME (1)		ROADWAY							STRUCTURE	
	CURRENT ADT	DESIGN YEAR ADT	DESIGN SPEED	ROADWAY WIDTH	SURFACE WIDTH	MAXIMUM HORIZONTAL CURVE (2)	TERRAIN (3)	MAXIMUM % GRADE	STOPPING SIGHT DISTANCE	HIGHWAY LOAD	CLEAR RDWY. WIDTH FOR STRUCT. (4)
C1	Under 250	Under 500	40	28	20	12°-30'	F	10	275	H 20	24
							R	12			
							M	15			
C2	250-400	500-800	50	30	22	7°-30'	F	6	350	H 20	28
							R	7			
							M	9			
C3	400-750	800-1500	50	34	22	7°-30'	F	6	350	HS 20	28
							R	7			
							M	9			
C4	750-2000	1500-4000	50	40	24	7°-30'	F	6	350	HS 20	40
							R	7			
							M	9			
C5	Over 2000	Over 4000	60	44	24	5°-00'	F	5	475	HS 20	44
							R	6			
							M	6			

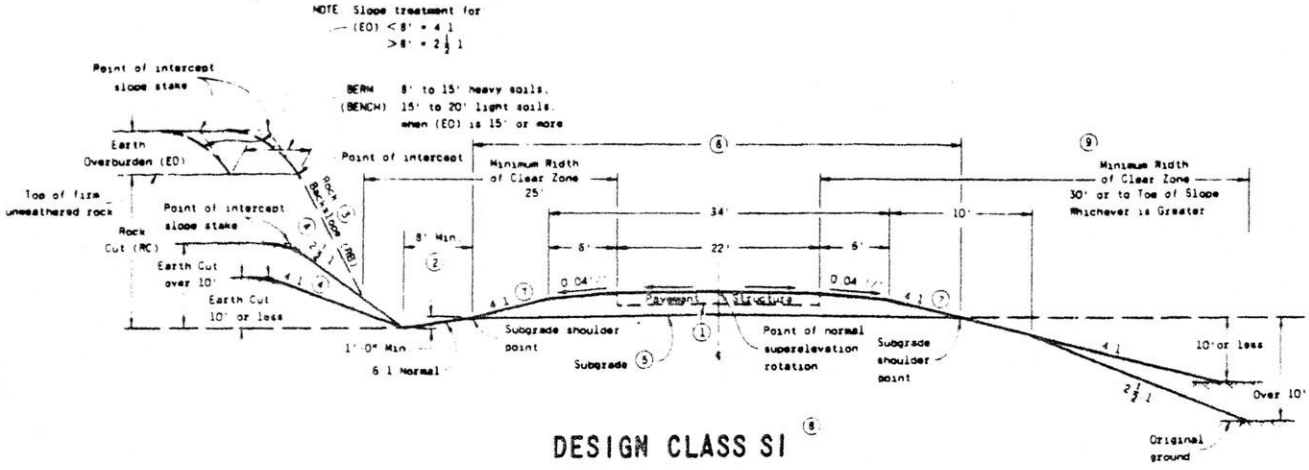
(1) Use DESIGN YEAR ADT to determine DESIGN CLASS for highways where a substantial traffic growth is expected. The ratio of DESIGN YEAR ADT to CURRENT ADT is not necessarily 2:1 as may be interpreted from comparing the two traffic columns.

(2) Maximum curvature for design speed shown and superelevation rate of 0.08 foot per foot.

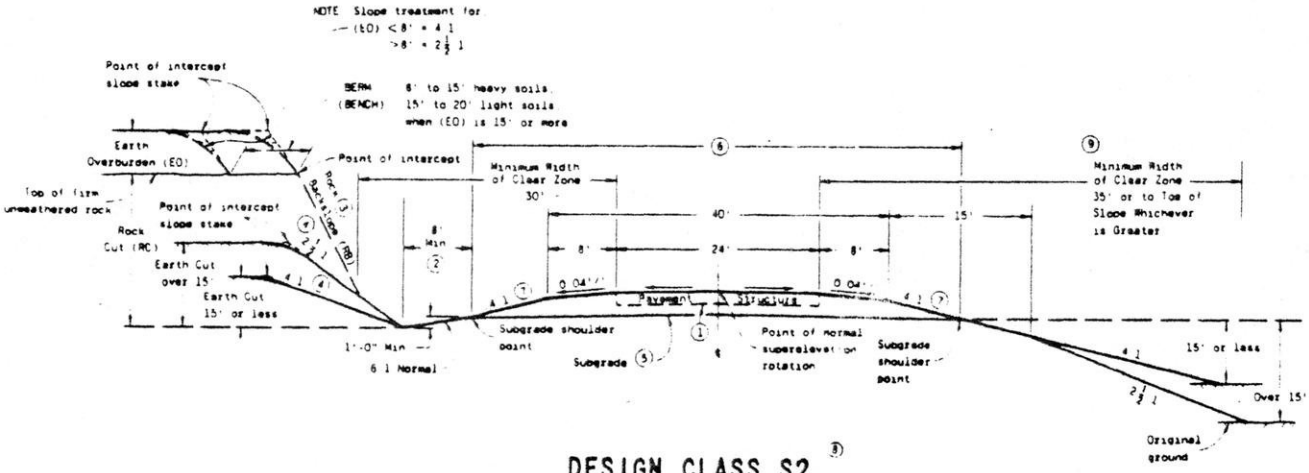
(3) Terrain: Flat (F), Rolling (R), Mountainous (M).

(4) Structures in Design Classes C4 and C5 with a total length over 100 feet may be designed with a clear roadway width of 30 feet.

* SOURCE: Wisconsin Administrative Code, Chapter Hy 34, County Trunk Standards.



DESIGN CLASS S1 (8)



DESIGN CLASS S2 (9)

NOTES

(1) The elements of the pavement structure for flexible and rigid pavements will vary according to the individual pavement design. High type pavements (P.C. Concrete and Bituminous Concrete) should slope 0.015'/'.

(2) When a special ditch grade or greater ditch capacity is necessary for longitudinal drainage, it may be accomplished by varying the width or slope of the ditch.

(3) Rock Cuts - When (RC) is less than 15', (RB) slope in general should be treated the same as backslopes in Earth Cuts. When (RC) is 15' or more, slopes should be as steep as practical for the particular type of rock on the project. A commonly used standard slope for Rock Cuts is ½ 1. Slopes steeper 2½ 1 shall not be located within the clear zone.

(4) Earth Cuts - Backslopes in Earth Cuts should be blended into the natural topography by using a combination of flat slopes and rounding. Special attention should be given to the design of the transitions from cuts to fills to insure that slopes are gradually steepened so as to produce a natural and aesthetically pleasing cross section.

(5) Subgrade slope is parallel to pavement structure.

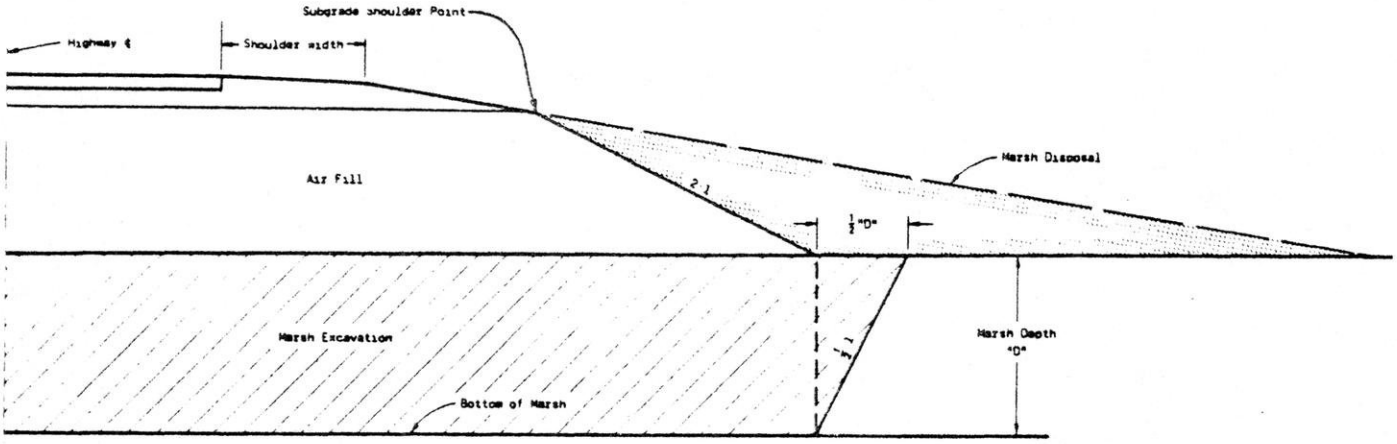
(6) Constant width subgrade dimensions should be determined from the Typical Tangent Section. This constant width should be carried through all superelevated segments, in which case, the shoulder slopes should vary to intersect the subgrade at the limits of constant width.

(7) All disturbed areas including shoulder inslopes should be fertilized and seeded. Topsoil should be used where readily available and appropriate.

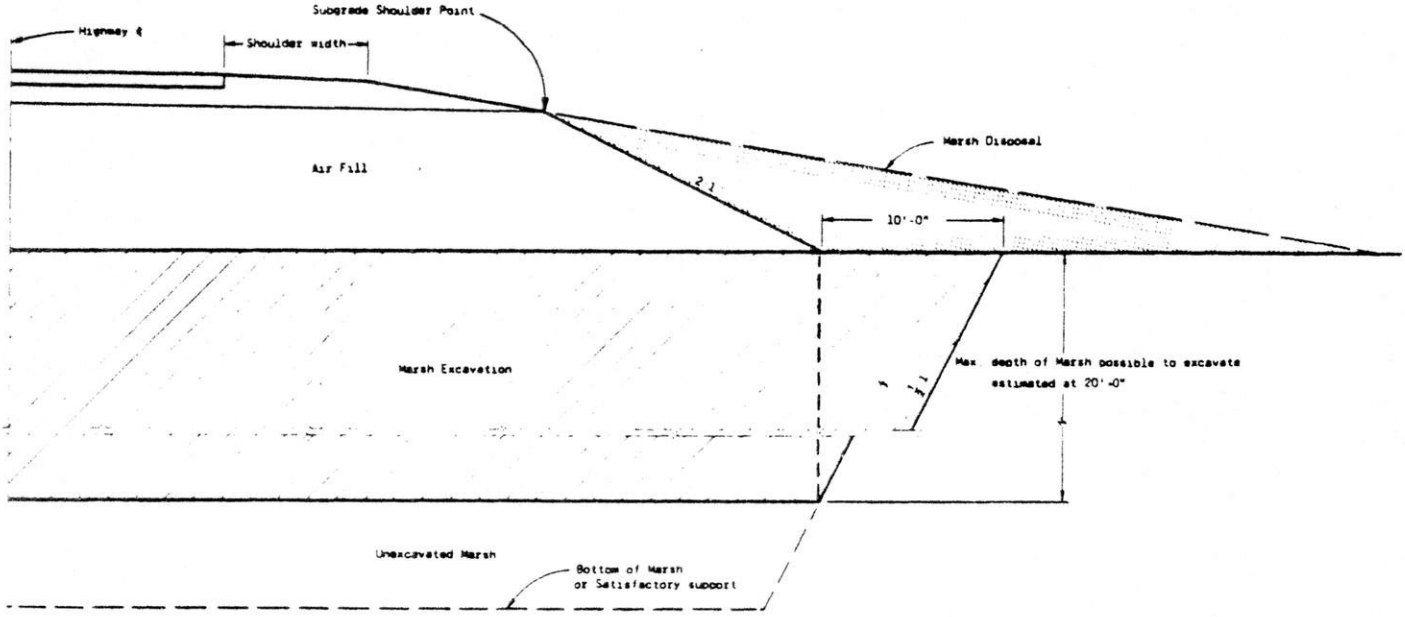
(8) When Fill Height Exceed 20' for DESIGN CLASS S1 or 25' for DESIGN CLASS S2 make an economic comparison between this typical section and an alternative typical section which has the 2½ 1 fill slope from the subgrade shoulder point with a traffic barrier required at the edge of the shoulder.

(9) Clear zone is the roadside border area available for safe use by errant vehicles. Nontraversable hazards or fixed objects should not be constructed or allowed to remain within this zone.

When this is not feasible, the use of a traffic barrier to shield the hazard or obstacle may be warranted. The barrier should be provided only when it is cost effective. (See procedure 11-45-1)



COMPLETE MARSH EXCAVATION



PARTIAL MARSH EXCAVATION

APPENDIX 2

SOILS INVESTIGATION

APPENDIX 2

PRELIMINARY REPORT
SOIL INVESTIGATION FOR
ALTERNATE RIGHT-OF-WAY FOR
EXXON MINE/MILL ACCESS ROAD

SCOPE OF WORK

On July 6, 7 and 8, geotechnical personnel from FOTH & VAN DYKE and Associates, Inc. performed a soil investigation program along the alternate right-of-way for the mine/mill access road. The purpose of the investigation was to provide information for design of pavement, determination of suitability of material for fill, and to locate unsuitable subgrade materials.

The geotechnical investigation included the following field tests and procedures:

1) Hand auger borings numbered 32 through 61 were drilled using a 3½" or 4½" diameter bucket-type hand augers. The soils obtained were visually and manually classified by geotechnical personnel of FOTH & VAN DYKE according to the Unified Soil Classification System. The hand auger borings were performed along the alternate alignment at approximate 150 meter intervals or more frequently depending on conditions. The location and elevation for each auger boring is indicated on the attached boring logs (see Appendix "2A"). Representative soil samples of each major soil horizon were jarred and retained for future reference.

2) A SOIL TEST Model LC-2B Proving Ring Pentrometer was used to determine soil strength characteristics in cohesive soils in fill and cut areas. The results of the test are shown on the test boring logs in the column labeled proving ring pentrometer. All readings are in pounds per square inch (psi).

3) Three bulk samples were obtained at various locations in cut sections to determine the suitability of these soils for use as roadway subgrade fill. The position and depth of the bulk samples are indicated on the test boring logs. No laboratory testing of these soils was performed at this time.

4) In-field density tests were performed in proposed cut areas using the sand cone method. The results of these tests are found in Appendix "2C". These values will be used in another portion of this report to determine shrinkage factors for cut and fill quantities.

5) To aid in calculating topsoil quantities, an Oakfield soil sampler was employed to determine topsoil thickness in swales and drainageways. The results of this work are found in Appendix "2A" following the hand auger boring logs.

SUMMARY OF OBSERVATIONS

For convenience in discussion, the general subsoil stratigraphy will be discussed in sections referred to by using alternate roadway alignment stationing. From the beginning of the alternate access roadway at S.T.H. "55" station 7327.395 to Swamp Creek Station 2740, the land consists generally of gently sloping to steeply sloping uplands and drainageways. The uplands have slopes ranging from less than 1% to up to 15% slope. Discussion of soils in the swales and drainageways will be taken up later in the report and handled separately. The following discussions consider soils in the upland areas only.

General Subsurface Conditions - Uplands (Station 7327 to 2740)

The soil conditions at each boring location are illustrated in the boring logs found in Appendix "2A". A review of the boring logs suggests that the general soil profile consists of a surficial layer of black sandy or silty loam topsoil ranging in thickness from .09 meters to .28 meters underlain by reddish brown, brown or greyish silty fine sand, fine sandy silt, silt or clayey silt. These soils have a Unified Soil Classification of SM, ML or ML-CL and vary in thickness across the uplands from .02 meters at Boring #44 to 1.3 meters at Boring #35. Although the texture and thickness of this strata varies along the route, these soils are similar in nature to those encountered along the original access road route. Underlying the above described soils the hand auger borings encountered sands or sand/gravel mixtures. The soils were grey to brown, occurred in a firm to dense condition and have a Unified Soil Classification of SP, SW, SM and GW. The soils were described as fine sand, fine to medium sand, fine to coarse sand and sand and gravel mixtures.

These soils occurred, in most instances, to the termination of the hand auger borings. Again, the texture and thickness of the above described sandy soils varies laterally and vertically along the route but are generally very similar to what was encountered along the original access road route.

The sands and gravels encountered are probably glacial outwash deposits. These deposits typically have internal structures such as cross bedding or graded bedding. The presence of such internal structures in the soils is of little concern except that soil texture will vary considerably both laterally and vertically with these deposits in cuts.

General Subsurface Conditions in Drainageways

The proposed alternate right-of-way is dissected by a number of surface water drainage features of varying size. A summary of the location and general soil data for each drainageway is found in Table I. A review of the hand auger borings performed in the drainageway suggest that the general soil profile consists of a thin surficial layer of black silt or sandy loam topsoil or a layer of black peat. The thickness of this surficial layer ranges from .11 meters at Boring #43 to a maximum of .62 meters at Boring #47. Only in one drainageway located between Stations 1650 to 1850 was a greater thickness of organic soils encountered. At Boring #48 (Station 1810) silty clays and clayey silts contain some organic materials occurred to a depth of 1.3 meters. The condition at Station 1810 appears to be an exception to the generally thin deposits of topsoils and organic soils along the alternate route.

In most instances the topsoils are underlain by soils with Unified Soil Classification SM or ML being described as fine sandy silts, silty sand or silts. These soils occurred in a moist to wet state and in some instances are mottled. Mottling consists of irregular markings or spots of different colors in soils which usually indicates seasonal saturation and lack of good drainage. The underlying soils consisted mainly of sands and sand/gravel mixtures which were grey to brown in color having a Unified Soil Classification of SP, SM, SW and GW. These sands in some cases were saturated or water bearing depending on the topographic position of the drainageway.

TABLE I

SUMMARY OF DRAINAGEWAY SOILS DATA

Approx. Location of Drainageway From/To	Boring No's.	Topsoil (OL) or Peat (Pt) Thickness	Subsoil Description
7530 to 7680	P#1 B#33	(OL) to .26-.36m	SM and ML to .7m
7890 to 7950	P#2	(OL) to 22m	SM
7970 to 8027	P#3	OL to .12m	ML (mottled)
8070 to 8150	P#4	OL to .28m	ML (mottled)
1070 to 1120	P#5	Pt to .24m	SM and SP to .87m
1130 to 1190	B#42	OL to .16m	ML to .57m
1310 to 1380	B#43	Pt to .11m	SM, ML and CL-ML to .9m
1420 to 1480	B#44A	Pt to .17m	SM to .8m
1690 to 1850	B#47 B#47A B#48	Pt to .62m OL to .2m Pt and OH to 1.3m	SW to .72m SM and SC to .9m SM to 1.68m
2500 to 2550	B#54	Pt to .41m	SM and SP to 1460m

General Subsurface Conditions - Alternate Right-of-Way Station 3700 to 4120

A review of the boring logs along the alignment between Station 3700 to 4120 suggests that the general soil profile consists of a surficial layer of black, silt loam topsoil ranging in thickness from .06 meters to .12 meters underlain by .37 meters at Boring #60 to a maximum of 1.28 meters at Boring #57 of clayey or sandy silt. These soils have a Unified Soil Classification of (ML) being clayey silts and fine sand/silt mixtures. Underlying the above described (ML) soils to the termination of the borings lies a brown to reddish brown silty sand with gravel which occurs in a loose to firm, saturated state. Mottling is evident in the upper portion of this strata at several boring locations, mottling being evidence of poor drainage and seasonal saturation. Apparently, a restrictive layer of soil and/or rock existing beneath this area which is retarding the downward movement of groundwater and causing the saturation of these upper soils. The fact that these soils are wet or saturated may result in some difficulty in construction and necessitate the installation of deeper ditches or an underdrain system for the roadway. The wet or saturated nature of these soils should be taken into account during pavement design.

Purpose of Investigation

We understand that the purpose of the subsurface investigation is to evaluate those segments of the access road which have changed from the earlier study. The subsurface information gathered (See Appendix "2A") will be used to locate unsuitable material, comment on the suitability of in-place soil and the use of various soils as fill materials. The applicable subsurface data gathered in the initial investigation has been included in Appendix "2B".

In general, the subsoil encountered along the alternate right-of-way for the mine/mill access road were similar to those found along the route proposed originally. The most notable exception is that the alternate route dissects less wetland areas than the previous route and thus generally less organic soils (i.e. Pt) were encountered.

Discussion of Soil Properties and Usage

Topsoil and Peats

A thin mantle of topsoil exists in upland areas across the entire access route right-of-way. This topsoil should be removed prior to filling or cutting and stockpiled for future usage in landscaping. Table I summarizes the subsoil data for drainage area where both topsoil and

peat were discovered. In most instances, the thickness encountered was minimal with the maximum undercut necessary to remove all organic soil being located at Boring #48 (Station 1810) where an undercut 1.3 meters is required. These peat and other highly organic soils should also be stockpiled for later use in landscaping.

Silty Subsoils

In most instances along the access road route a layer of clayey silt, sandy silt or silty sand soil underlie the topsoils. These soils were noted as occurring in a wet or saturated state during the original investigation but they do dry out considerably as found in this investigation. The properties of the soil encountered along the alternate route are thought to be very similar to those found in the previous investigation. A review of the laboratory tests performed in conjunction with the earlier investigation (see Appendix "2B") found these soils to be SM or ML soils with P200 ranging from 31 to 56% being slightly plastic (Plastic Index 5.4). Thus, these soils would be considered frost susceptible and consideration should be given to removing these soils in cut or fill areas so that a 1.2 meter separation is maintained between the pavement and frost susceptible materials. These silty soils are suitable for use in fills provided that the following conditions are met: 1) that these silty soils be placed in a lower portion of fills so that a minimum of 1.2 meters of nonfrost susceptible base and subbase soils is maintained; 2) that silty soils be placed at or near optimum moisture for compaction when placed; and 3) that silty soils (Unified Soil Classification SM, ML, ML-CL and CL) be compacted to 100% of the Standard Proctor Density.

Sands and Sand and Gravel Mixtures

Generally, the majority of the subsoils consisted of poorly or well graded sands and sand and gravel mixtures. These sandy soils should have adequate strength in place for fill conditions provided they are "proof rolled" prior to the placement of fill. "Proof rolling" is most critical in drainage ways where it is possible that sands and/or gravel overlie organic soils or very soft clays. "Proof rolling" should define these soft areas so that they can be excavated and replaced with suitable material. As fill soils, sands and/or gravel soils should provide a stable base for the roadway construction provided they are compacted to at least 95% of the Standard Proctor Density.

Some sands were classified as uniformly graded fine or medium sand. These soils may be more difficult to compact and require the addition of water before maximum density can be attained. Appendix "2B" includes the laboratory soil test data presented in our original submittal which is referenced in this report.

SUMMARY OF RECOMMENDATIONS

We feel at this time that further laboratory testing to determine soil properties is not necessary based on the similarity of the subsoils along the two routes. We do, however, recommend that at the time of construction more detailed laboratory soils work be performed to define and confirm the engineering properties of the soils as related to compaction and stability.

The plans and/or specifications should contain the following clauses for roadway subgrade construction:

1) The roadway section shall be cleared and grubbed and all topsoil, peat or other deleterious soils removed. Removal of the above should extend downward out from the outer edge of the roadway at a 1:1 slope or flatter.

2) Topsoil, peat and other organic soils shall be stockpiled for later use as landscaping materials.

3) For silty or clay soils in place or used as fill, consideration should be given to requiring a minimum of 1.2 meters below the pavement.

4) Silty or clayey soils used as fill shall be compact at or near optimum moisture to 100% of the Standard Proctor Density.

5) Sandy soils shall be compacted at or near optimum moisture to 95% of the Standard Proctor Density.

6) Erosion control measures such as silt fences, settlement ponds, berms and ditches will be required as necessary to minimize siltation of nearby streams and wetlands.

7) Subsequent to placing fill, especially in drainageways, the subgrade should be "proof rolled" to locate any "soft" areas. Any "soft" areas encountered shall be undercut and replaced with properly compacted fill material.

8) Further laboratory testing of soils for engineering properties should be accomplished when construction begins.

9) Undercutting of deleterious soils and the placement and compaction of fill soils shall be monitored as part of a field quality control program.

APPENDIX "2A"

LOGS OF HAND AUGER TEST BORINGS FOR
ALTERNATE RIGHT-OF-WAY FOR MINE/MILL ACCESS ROAD

7/6/82

PROJECT Exxon - Access Road

BORING NO. 32

BORING LOCATION Sta. 7410

JOB NO. XX8202

SURFACE ELEVATION 489.66

BORING DEPTH 1830mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Fine Sandy LOAM Topsoil, moist, loose (OL).	
280							
280						Light Yellowish Brown, Fine Sandy SILT, moist, loose (ML).	
420							
420	480-550	A	1			Brown to Light Brown Clayey SILT with Fine Sand, moist, firm (ML).	
600							
600	1700-1800	A	2			Brown, Fine to Medium and Fine to Coarse SAND, some fine to coarse gravel, moist to wet at 1400 mm, firm (SW).	
1830							

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon - Access Road

BORING NO. 33

BORING LOCATION Sta. 7650

JOB NO. XX8202

SURFACE ELEVATION 485.32

BORING DEPTH 1520mm

DEPTH OF STRATA "(mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy SAND Topsoil, moist, loose.	
260							
260						Dark, Slightly Reddish Brown, Medium SAND some Silt, moist, firm (SM).	
700							
700						Light Brown, Fine to Coarse SAND, trace Silt, moist, firm (SW).	
1220							
1220						Brown Fine to Coarse SAND and Fine to Coarse Gravel, moist, dense (SW-GW).	
1520							
1520						Refusal - coarse gravel and cobbles.	

DRILLING DATA: 4" Bucket Type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon - Access Road

BORING NO. 34

BORING LOCATION Sta. 7710

JOB NO. XX8202

SURFACE ELEVATION 488.60

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Dark Greyish Brown, Silt LOAM Topsoil, Moist, Loose (OL).	
280							
280						Light, Slightly Reddish Brown Clayey SILT Some Fine Sand, Moist, Firm (ML).	
600							
600	600-700	A	1			Light Brown, Medium to Coarse SAND, trace Fine Gravel and Silt, Moist, Firm (SP).	
1310							
1310						Light Brown, Fine to Medium SAND, trace Silt, Moist, Firm (SP).	
1530							
1530						Light Brown Fine to Coarse SAND and Fine to Medium GRAVEL with Wet 30cm thick seams of Reddish Brown Silty Fine to Coarse Sand, Firm (SW and SM).	
1920							

DRILLING DATA: 4" Bucket Type Hand Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING LOCATION Sta. 7860

SURFACE ELEVATION 487.76

BORING NO. HA#35

JOB NO. XX8202

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy SAND, some Gravel, Moist Black Topsoil.	
190							
190						Light Brown, Silty Fine SAND trace Gravel, Moist, Firm (ML).	
440							
440	810-890	A	1			Brown to Greyish Brown, Fine Sandy SILT, some Clay, Moist, Firm (ML).	
1120							
1120	1150-1220	A	2			Greyish Brown to Reddish Brown, Sandy SILT some Clay, Saturated, Loose (ML) with few coarse prominent mottles (SM).	
1490							
1490						Light Brown, Fine to Medium and Medium to Coarse SAND, Wet, Firm (SP).	
1920							

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING LOCATION Sta. 290

SURFACE ELEVATION 487.81

BORING NO. HA#36

JOB NO. XX8202

BORING DEPTH 1520mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black to Greyish, Sandy Loam, trace Gravel (Topsoil) Moist, Loose (OL).	
290							
290	400-500	A	1			Light, Slightly Reddish Brown, Silty Medium SAND, Moist, Loose (ML).	
570							
570						Light Brown, Fine to Coarse SAND, some Fine Gravel, Moist, Firm (SW).	
900							
900	1100-1200	A	2			Light Brown, Medium SAND, trace Silt, Moist, Firm (SP).	
1400							
1400						Brown, Fine to Coarse SAND with Fine to Coarse GRAVEL, Moist, Firm (SW-GW).	
1530							
1530						Auger Refusal Coarse Gravel	

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. HA#37

BORING LOCATION Sta. 440

JOB NO. XX8202

SURFACE ELEVATION 487.79

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Silt LOAM Topsoil, Moist, Loose (OL).	
90							
90	200-300	A	1			Light Brown, SILT, some Fine Sand and trace Clay, Moist, Loose.	
500							
500						Light Brown, Medium and Fine to Medium Sand with 30-50mm thick seams of Reddish Brown Silty Medium Sand, Moist, Firm (SP and SM).	
860							
860						Brown, Fine to Medium SAND, some Fine to Coarse GRAVEL, Moist, Firm (SW).	
1200							
1200						Light Brown, Fine SAND, Medium SAND and Medium to Coarse SAND, Wet, Firm (SP and SW).	
1920							

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING LOCATION Sta. 590

SURFACE ELEVATION 487.94

BORING NO. HA #38

JOB NO. XX8202

BORING DEPTH 1620 mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus, Moist, Soft, Topsoil (OL).	
120							
120						Grey-Brown to Light Brown Clayey SILT, Little Fine Sand, Moist, Firm (ML).	
510							
510						Light Brown, Fine to Medium and Medium SAND, Moist, Firm (SP).	
1200							
1200						Light Brown, Medium and Medium to Coarse SAND, with Fine to Coarse GRAVEL and Cobbles, Moist, Firm (SW).	
1620							
1620						Auger Refusal - Coarse Gravel and Cobbles.	

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. HA#39

BORING LOCATION Sta. 740

JOB NO. XX8202

SURFACE ELEVATION 487.07

BORING DEPTH 1610

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus, Moist, Very Soft (OL).	
100						Grey, Fine Sandy SILT, Moist, Loose (ML).	
140						Light Brown, Silty Fine SAND, Moist, Firm (ML).	
480						Light Brown, Fine to Coarse SAND and Fine to Coarse GRAVEL, Moist, Firm (SW-GW).	
1610						Auger Refusal - Coarse Gravel and Cobbles.	

DRILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. HA#40

BORING LOCATION Sta. 890

JOB NO. XX8202

SURFACE ELEVATION 485.83

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus, Moist, V. Soft (OL).	
100							
100						Grey, Silty Fine to Medium SAND, Little Gravel, Moist, Firm (SM).	
310							
310	550-700	A	1			Light Brown, Silty Fine and Fine to Coarse SAND, Little Gravel, Moist, Firm (SM).	
820							
820						Light Brown, Fine and Medium SAND Little to some Fine to Coarse Gravel, Moist, Firm (SP).	
1200							
1200						Brown to Reddish to Yellowish Brown, Fine, Medium and Fine to Medium SAND, Water Bearing, Dense (SP).	
1920							

DRILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING 1760cm

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. HA#41

BORING LOCATION Sta. 1040

JOB NO. XX8202

SURFACE ELEVATION 484.21

BORING DEPTH 1560mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus, Moist, V. Soft	
						(Topsoil) (OL).	
120							
120						Grey, Fine Sandy SILT, Moist, Loose	
						(ML).	
260							
260						Brown, Silty Medium SAND, some Gravel,	
						Moist, Firm (SM).	
520							
520						Light Brown, Medium SAND, Little Gravel,	
						Moist, Firm (SP).	
1200							
1200						Brown, Fine to Coarse SAND with Fine to	
						Coarse GRAVEL, some Silt, Saturated,	
1560						Dense (SM).	
1560						Auger Refusal - Cobbles or Coarse Gravel	

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. HA#42

BORING LOCATION Sta. 1190

JOB NO. XX8202

SURFACE ELEVATION 484.36

BORING DEPTH 1920 mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus, Moist, Very Soft, Topsoil (OL).	
160							
160						Greyish Brown to Dark Brown, Clayey SILT Little Fine Sand, Moist, Loose (ML).	
510							
510						Light Brown, Silty Fine SAND, trace Clay and Gravel, Moist, Firm (ML).	
570							
570	1430-1530	A	1			Light Brown to Yellowish Brown, Mostly Fine SAND, some Fine to Medium Sand, trace Gravel and Silt, Moist to V. Moist, Firm (SP).	
1920							

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. HA #43

BORING LOCATION Sta. 1340

JOB NO. XX8202

SURFACE ELEVATION 482.45

BORING DEPTH 1920

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	PROVING RING (psi)	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black to Dark Grey, Peaty Clay LOAM	
						Topsoil, Saturated, Very Soft (OL-Pt)	
110							
110						Grey, Silty Fine to Medium SAND, Moist,	
						Firm (SM).	
280							
280	300-400	A	1			Grey, Clayey Sandy SILT, with few coarse	
	400-500				83	prominent mottles, Moist to Wet (ML).	
	500-600				100		
650	600-700				65		
650	800-900	A	2			Bluish Grey, Very Silty CLAY to Clayey	
	700-800				115	SILT, some Sand, Miceous, Moist to Wet,	
	800-900				224	Soft (CL-CL-ML).	
900							
900						Grey, Fine to Coarse SAND and Gravel	
						Waterbearing, Firm (SW).	
1920							

DRILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING 880 mm

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA#44

BORING LOCATION Sta. 1420

JOB NO. XX8202

SURFACE ELEVATION 484.8

BORING DEPTH 800 mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus, Moist, V. Soft (OL).	Note" Attempted 4 hand auger around Sta. 1420 encountered refusal due to gravel at depth from 600 to 780 cm. Relocated hole to Sta. 1457
70							
70						Grey, Brown to Brown Silty Fine to Medium SAND, some Gravel, Moist, Firm (SM)	
690							
690						Brown to Light Brown, Fine to Coarse SAND and Fine to Coarse Gravel and Cobbles, Little Silt, Moist, Firm (SW).	
780							

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA#44A

BORING LOCATION Sta. 1457 in Drainage Swail

JOB NO. XX8202

SURFACE ELEVATION 483.9

BORING DEPTH 800mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, PEATY TOPSOIL, Wet, Soft (Pt).	
170							
170						Grey, Clayey SILT, some Fine Sand, Moist, Soft (ML)	
270							
270						Light Brown to Reddish Brown, Silty Fine to Medium SAND, little Silt trace Clay and Gravel, Wet to Saturated, Firm (SM) few prominent coarse mottles	
800							
800						Auger Refusal - attempted 3 more holes, encountering refusal on all attempts.	

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA#45

BORING LOCATION Sta. 1540

JOB NO. XX8202

SURFACE ELEVATION 484.59

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Humus (Topsoil), Moist, Loose (OL).	
50							
50						Grey, Fine Sandy SILT, Little to trace Clay, Moist, Loose (SM-ML).	
110							
110	470-570	A	1			Light Brown to Greyish Brown, SILT some Fine Sand, Little to trace Clay, Moist, Firm (ML).	
860							
860						Brown Silty Medium SAND, little trace Gravel, Moist, Firm (SM).	
1030							
1030						Light Brown, Medium SAND, trace Silt and Gravel, Moist, Firm (SP).	
1710							
1710						Light Brown, Fine SAND, trace Silt and Fine Gravel, Moist, Firm (SP).	
1920							

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA#46

BORING LOCATION Sta. 1660

JOB NO. XX8202

SURFACE ELEVATION 483.78

BORING DEPTH 1520mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy Sand, Topsoil, Moist, Loose.	
80							
80						Brown, Silty Fine SAND trace Gravel, Moist, Firm (SM).	
420							
420						Light Brown to Brown Fine and Medium SAND, little Medium to Coarse Gravel, Moist, Firm (SP).	
1520							
1520						Auger Refusal - Coarse Gravel or Cobbles attempted 2 additional holes.	

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING LOCATION Sta. 1720

SURFACE ELEVATION 477.67

BORING NO. HA#47

JOB NO. XX8202

BORING DEPTH 720mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, PEAT some Fine to Coarse Gravel and Cobbles, Saturated, V. Soft (Pt).	
620						Grey, Medium to Coarse SAND and Fine to Coarse GRAVEL and Cobbles, Waterbearing, Firm (SW-GW).	Auger refusal Tried 3 other holes
720							

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING 400mm

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA#47A

BORING LOCATION Sta. 1750

JOB NO. XX8202

SURFACE ELEVATION 477.9

BORING DEPTH 1320mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy SAND with Humus Topsoil, Moist, Loose (OL).	
200							
200						Greyish Brown, Silty Fine to Medium SAND, trace Gravel, Moist, Firm (SM).	
520							
520	750-900	A	1			Greyish to Reddish Brown, Clayey Medium SAND, some Silt, trace Gravel, Wet, Loose (SC).	
900							
900						Brown to Grey, Medium a... Medium to Coarse SAND, Little Fine Gravel, water-bearing, Firm (SP-SW).	
1320							
1320						Auger Refusal - Coarse Gravel and Cobbles	

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA#48

BORING LOCATION STA 1810

JOB NO. XX8202

SURFACE ELEVATION 477.39

BORING DEPTH 1900 mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	PROVING RING PENT (psi)	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Clayey Peat Saturated V. Soft	
						(Pt)	
120							
120	900-1000	A	1	--	--	Grey to reddish, brown to bluish grey	
	500-600				61		
	1600-700				84	silty CLAY and clayey SILT (micaceous) trace	
	700-800				113		
	800-900				141	medium to coarse gravel - some organic	
1300	900-1,000				205	matter, wet, very soft (OH)	
1300						Light brown to greyish brown silty	
						medium SAND, some clay, little gravel,	
						wet to saturated, loose (SC) mottled	
1680							
1680						Brown, fine to coarse SAND and fine to	
						coarse gravel - water bearing , firm,	
						(SW - GW)	
1900							

DRILLING DATA: 4" Bucket type - Hand Auger

WATER LEVEL INFORMATION

AT DRILLING 1000 mm

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA #49

BORING LOCATION STA 1870

JOB NO. XX8202

SURFACE ELEVATION 479.81

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, loamy medium sand, topsoil moist, loose (SM).	
120							
120						Dark reddish brown, silty medium to coarse SAND, trace fine gravel, moist, firm (SM)	
700							
700						Light brown, medium to coarse SAND - trace fine gravel with a few seams of silty sand - moist - firm (SP+SM)	
1240							
1240	1270-1370	A	1	--	--	Brown to greyish brown, silty medium to coarse SAND, little clay and gravel - moist firm (SM-SC)	
1370							
1370						Yellowish brown, Fine SAND and medium sand - moist - firm (SP)	
1800							
1800						Brown, medium to coarse SAND - Some fine gravel - moist - firm (SW)	
1920							

DRILLING DATA: 4" Bucket Type - Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA #50

BORING LOCATION STA 1990

JOB NO. XX8202

SURFACE ELEVATION 481.89

BORING DEPTH 1820 mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, silt loam - topsoil - moist - loose (OL)	
90						Light reddish brown fine sandy SILT - trace clay and gravel - moist - firm (SM - ML)	
400						Light reddish brown to light brown medium to coarse SAND - little fine sand and fine to coarse gravel - a few lenses of reddish brown silty sand noted - Moist - firm (SP & SM).	
1200						Light brown - fine SAND - trace silt - moist - firm (SP)	
1820							

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING LOCATION STA 2140

SURFACE ELEVATION 480.62

BORING NO. HA #51

JOB NO. XX8202

BORING DEPTH 1830mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - loamy sand (topsoil) moist - loose	
110							
110						Light brown - yellowish brown to dark brown silty fine and fine to medium SAND - trace to little clay - moist - firm (SM - SC)	
860							
860						Light brown to slightly reddish brown fine and medium SAND - little medium to coarse gravel - trace silt - moist - firm (SP)	
1830							

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA #52

BORING LOCATION STA 2290

JOB NO. XX8202

SURFACE ELEVATION 479.72

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - loamy sand - topsoil - moist - loose	
100							
100						Light brown - silty fine SAND - trace clay - moist - loose (SM)	
410							
410						Reddish brown silty medium to coarse SAND - little clay - moist - firm (ML - SC)	
700							
700						Light brown to yellowish brown fine SAND - little gravel - moist - firm (SP)	
940							
940						Brown - medium to coarse SAND and fine to coarse gravel - moist - firm (SW - GW)	
1300							
1300						Light brown - medium SAND - little coarse sand - moist - firm (SP)	
1920							

DRILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING LOCATION STA 2410

SURFACE ELEVATION 478.19

BORING NO. HA #53

JOB NO. XX8202

BORING DEPTH 1900mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - loamy sand with humus topsoil - moist - loose (SM).	
100						Light to reddish brown - silty fine SAND - moist - loose (SM) becomes reddish brown at 240MM	
510						Brown- greyish brown to dark brown silty and/or clayey medium to coarse SAND - some fine to coarse gravel - moist - dense (SM - SC)	
1210	1220-1350	A	1			Dark brown and light yellowish brown - alternating 50 to 100 MM thick seams of light brown fine snad and dark brown silty very fine sand which becomes saturated @ 1800MM - moist to saturated - firm (SP -SM)	
1410							
1900							

DRILLING DATA:

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

ROJECT Exxon Access Road

BORING NO. HA #54

ORING LOCATION STA 2530

JOB NO. XX8202

URFACE ELEVATION 474.64

BORING DEPTH 1460mm

EPTH OF RATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - fibørous SAND - saturated very soft (Pt)	
410						Grey - fine to coarse SAND - little gravel - waterbearing firm (SW)	
1100						Grey - fine SAND - trace silt - water-bearing - firm (SM)	
1460						Refusal - coarse gravel and cobbles	

RILLING DATA: 4"Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING 150MM

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING LOCATION STA 2620

SURFACE ELEVATION 480.1

BORING NO. HA #55

JOB NO. XX8202

BORING DEPTH 1920mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black loamy sand topsoil - moist - loose	
70							
70						Brown - silty medium SAND - trace gravel - moist - firm (SM)	
170							
170						Light reddish brown - medium to coarse SAND - trace finr gravel - moist - firm (SP)	
870							
870						Light brown - fine SAND trace gravel - moist - firm (SP)	
1240							
1240						Light brown - fine to coarse SAND - little fine gravel - moist - firm (SW)	
1920							

DRILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA #56

BORING LOCATION STA 2740

JOB NO. XX8202

SURFACE ELEVATION 479,5

BORING DEPTH 1830 mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - Silt Loam - Topsoil moist - loose (OL)	
240							
240						Dark slightly reddish brown fine sandy SILT - little clay - moist - firm (ML)	
660							
660						Slightly reddish brown - silty medium SAND - trace clay - moist - firm (SM)	
830							
830						Brown - coarse SAND - trace fine gravel - moist - firm (SP)	
1000							
1000						Light brown - medium SAND and fine sand Moist - firm (SP)	
1830							

DRILLING DATA: 4" Bucket Type Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/7/82

ROJECT Exxon Access Raod

BORING NO. HA #57

)RING LOCATION STA 3700

JOB NO. XX8202

/RFACE ELEVATION 503.74

BORING DEPTH 1560 mm

PTH F RATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - Silt loam (topsoil) - moist - very soft (OL)	
120							
120						Light brown clayey SILT - with fine sand - wet - soft (ML)	
240							
240	900-1000MM	A	1			Brown silty fine to medium SAND - little clay and fine gravel - wet to saturated loose (SM - ML)	
1280							
1280						Brown to reddish brown s fine to coarse SAND - some gravel - wate bearing to saturated loose (SM)	
1560							
1560						Refusal - coarse gravel	

RILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING 1280MM

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Asso iates In

7/7/82

ROJECT Exxon Access Road

BORING NO. HA #58

)RING LOCATION STA 3850

JOB NO. XX8202

URFACE ELEVATION 506.52

BORING DEPTH 1220mm

PTH F RATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black - Loamy humus - topsoil (OL)	
60							
60						Slightly reddish brown - fine sandy SILT - trace clay and gravel - moist - firm (ML	
540							
540						Light brown - silty fine and medium SAND - trace clay and gravel - moist - firm (SM) - with few coa[illegible] prominent mottles becoming gravelly at 80[illegible]	
1220							
122C						Auger refusal - coarse gravel and cobbles - attempted two additional holes	

ILLING DATA:

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

PROJECT Exxon Access Road

BORING NO. HA #59

BORING LOCATION STA 4000

JOB NO. XX8202

SURFACE ELEVATION 507.94

BORING DEPTH 1830mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black silt - loam - topsoil - moist - loose (OL)	
60							
60						Light brown to slightly reddish brown - silty medium to fine SAND - trace clay and gravel - moist - firm (SM)	
760							
760						Brown - reddish brown to grey - clayey SAND - some silt - little gravel with seams of sand and many coarse prominent mottles - moist to saturated loose (SC and SM)	
1830							

DRILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

ROJECT Exxon Access Road

BORING NO. HA #60

ORING LOCATION STA 4120

JOB NO. XX8202

RFACE ELEVATION 507.14

BORING DEPTH 1620 mm

PTH F RATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Brown - silty fine to coarse sand and fine to coarse gravel and cobbles - moist firm (SM-GM) - FILL -	
450							
450						Black - silt loam - topsoil - moist - soft (OL)	
580							
580						Grey - clayey medium SAND - some silt - trace ground WGT - loose (SC)	
950							
950						Grey - silty fine to coarse SAND - some gravel - trace clay - wet to saturated at 1550 MM - firm (SM)	
1620							
1620						Refusal - coarse gravel and cobbles	

ILLING DATA: 4" Bucket Type Auger

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/7/82

ROJECT Exxon Access Road

ORING LOCATION STA 7323 - Along Roadway Shoulder

URFACE ELEVATION

BORING NO. HA #61

JOB NO. XX8202

BORING DEPTH 600mm

EPTH OF TRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Asphalt	
200							
200						Brown fine to coarse SAND and fine to coarse GRAVEL - little silt (3/4" crushed gravel) - moist - dense - (SW - GW)	
400							
400						Grey - fine sandy SILT - little to trace clay - moist - firm - (SM-ML)	
600							

RILLING DATA: 4" Bucket Type Hand Auger

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon - Access Road

BORING LOCATION Sta. 7546 (Ctr. of Swail)

SURFACE ELEVATION

BORING NO. P#1

JOB NO. XX8202

BORING DEPTH 800cmm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Fine Sandy LOAM Topsoil, moist, soft (OL).	
360							
360						Light Brown, Fine Sandy SILT, moist, firm (ML).	
800							

DRILLING DATA: Oakfield Soil Sampler

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. P#2

BORING LOCATION Sta. 7920 (Swail)

JOB NO. XX8202

SURFACE ELEVATION 484.98

BORING DEPTH 320mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Loamy SAND, Topsoil, Moist,	
						Loose.	
220							
220						Light Brown, Silty Medium SAND, some	
						gravel, moist, firm (SM).	
320							

DRILLING DATA: Oakfield Soil Sampler

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. P#3

BORING LOCATION Sta. 8010 Swail

JOB NO. XX8202

SURFACE ELEVATION 485.24

BORING DEPTH 600mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Silt LOAM Topsoil, Moist, Loose	
						(OL).	
120							
120						Light to Reddish Brown, Fine to Sandy	
						SILT trace Clay and Gravel, Moist, Firm	
600						(SM-ML) with few coarse prominent mottles.	

DRILLING DATA: Oakfield Soil Sampler

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

7/6/82

PROJECT Exxon Access Road

BORING NO. P#4

BORING LOCATION Sta. 8100

JOB NO. XX8202

SURFACE ELEVATION 484.68

BORING DEPTH 420mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Greyish to Reddish Brown, Silt LOAM	
						Topsoil, Moist, Loose (OL).	
280							
280						Light Brown, Fine Sandy SILT, trace	
						Clay, Moist, Firm (SM-ML) with few	
						Medium prominent mottles.	
420							

DRILLING DATA: Oakfield Soil Sampler

LOG BY: REM

WATER LEVEL INFORMATION

AT DRILLING None

HOURS AFTER DRILLING

FOTH & VAN DYKE and Associates, Inc.

PROJECT Exxon Access Road

BORING NO. P#5

BORING LOCATION Sta. 11+00 Drainageway

JOB NO. XX8202

SURFACE ELEVATION 482.4

BORING DEPTH 870mm

DEPTH OF STRATA (mm)	DEPTH SAMPLE TAKEN	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT.	POCKET PEN.	SOIL CLASSIFICATION	ENGINEERS REMARKS
0						Black, Clayey and Sandy Peat, Wet to Saturated, Very Soft (Pt)	
240							
240						Grey to Brown, Fine and Fine to Medium Sand, Little Silt, Saturated, Loose (SM-SP)	
870							

DRILLING DATA: Oakfield Soil Sampler

WATER LEVEL INFORMATION

AT DRILLING

HOURS AFTER DRILLING

LOG BY: REM

FOTH & VAN DYKE and Associates, Inc.

APPENDIX "2B"

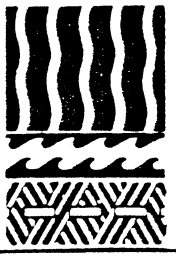
Laboratory Test Results and Boring Logs

From August 1981 Report

Contract No. 21704

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers



PROJECT Exxon Access Road **DATE** 4-23-81

BORING LOCATION Edge of Swamp Creek Sta. 2800 **BORING NO.** 21

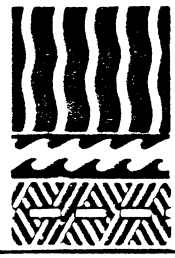
SURFACE ELEVATION 472.0 **JOB NO.** XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	SAMPLE Q_P (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 .25			0-1.5 .5-.30 .30-.95	29 27 55		Black to gray, organic, fine to medium SAND, saturated, loose (SP-PT)
	.25 .50						Gray fine to med SAND Water bearing, loose (SP)
	.50 .80			.45-.6 .6-.75	56 123		Dark brown fiberous PEAT Wet, soft (PT)
	.80 .9			.75-.9	181		Brownish gray, fine to coarse SAND with fine to coarse GRAVEL (SW-GW) (Refusal to to coarse gravel)

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 3½" Flight Augers	**WHILE DRILLING** At Surface
	AFTER DRILLING
	HOURS AFTER DRILLING
LOG BY: REM	

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers



PROJECT Exxon Access Road **DATE** 4/23/81

BORING LOCATION Sta. 2900 **BORING NO.** 22

SURFACE ELEVATION 473.5 **JOB NO.** XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	Q_p (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 .25						Black PEAT Saturated very soft (PT)
	.25 1.0						Dark gray to black fine SAND Some organic matter and SILT Wet, loose (SP-PT)
	1.0 1.25						Dark brown organic SILT Saturated, very soft (OH)
	1.25						Encountered boulder-refusal NOTE: Ice below Peat at 3"

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 3½" Hand Auger	**WHILE DRILLING** At Surface
	AFTER DRILLING
	HOURS AFTER DRILLING
LOG BY: REM	

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers

PROJECT Exxon Access Road **DATE** 4/23/81

BORING LOCATION Sta. 3000 **BORING NO.** 23

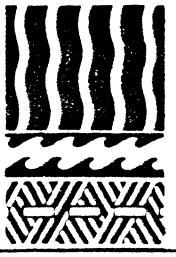
SURFACE ELEVATION 477.5± **JOB NO.** XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	Q_p (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 0.9						Sandy loam with humus (topsoil) (OL)
	0.0 .30						Light brown, fine to medium SAND Trace silt Moist firm (SP)
	.30 1.10						Brown - fine to coarse SAND Little fine to coarse GRAVEL Moist firm (SW)

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 3½" Hand Auger	**WHILE DRILLING** NONE
	AFTER DRILLING
	HOURS AFTER DRILLING
LOG BY: REM	

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers



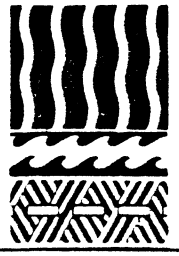
PROJECT	Exxon Access Road	**DATE**	4/23/81
BORING LOCATION	Sta. 3050	**BORING NO.**	24
SURFACE ELEVATION	481±	**JOB NO.**	XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	SAMPLE Q_p (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 .02						Black sandy loam with humas (topsoil)
	.02 .65			.02-.17 .17-.32	103 138		Brown, silty fine to medium SAND Trace clay, moist firm (SM)
	.65 1.95						Lt. brown, fine to coarse SAND Some fine to medium GRAVEL (SW) NOTE: Bulk Sample - .65 to 1.95 m

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 4½" Hand Auger	**WHILE DRILLING** NONE
	AFTER DRILLING
	HOURS AFTER DRILLING
LOG BY: REM	

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers



PROJECT Exxon Access Road **DATE** 4/23/81

BORING LOCATION Sta. 3200 **BORING NO.** 25

SURFACE ELEVATION 483.5± **JOB NO.** XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	Q_p (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 .05						Black, silt loam with humus (topsoil) (OL)
	.05 .45			15-3 3-45	117 165		Light brown to reddish brown clayey SILT some sand mottled, moist to wet, firm (ML)
	.45 1.35						Slightly reddish brown, silty fine to coarse SAND, some gravel, trace clay, moist to wet, firm (SM)

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 3½" Hand Auger	**WHILE DRILLING**
	AFTER DRILLING .52M
	HOURS AFTER DRILLING
LOG BY: REM	

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers

PROJECT Exxon Access Road **DATE** 4/23/81

BORING LOCATION Sta. 3450 **BORING NO.** 26

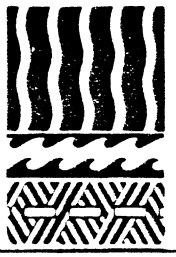
SURFACE ELEVATION 497.5± **JOB NO.** XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	SAMPLE Q_p (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 .045						Black, sandy loam with humus (topsoil) (OL)
	.045 .15						Brown, clayey SILT with sand, wet, loose (ML)
	.15 1.16						Brown to slightly reddish brown, fine to coarse SAND, some SILT and GRAVEL, wet, firm, saturated (SM) NOTE: Partially frozen

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 3½" Hand Auger	**WHILE DRILLING**
	AFTER DRILLING .55
	HOURS AFTER DRILLING
LOG BY: REM	

LOG OF TEST BORINGS

FOTH & VAN DYKE and Associates, Inc.
Consulting Engineers



PROJECT Exxon Access Road **DATE** 4/23/81

BORING LOCATION Sta. 3600 **BORING NO.** 27

SURFACE ELEVATION 502± **JOB NO.** XX8106

ELEV. METERS(FT)	DEPTH METERS(FT)	SAMPLE TYPE	SAMPLE BLOW COUNT	SAMPLE From-To	Q_p (psi)	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
	0 .06						Black, silty loam with humus (topsoil) (OL)
	.06 .45						Brown, clayer SILT, some sand, trace gravel, wet - medium (ML) NOTE: Bulk Sample .06-.45M
	.45 1.22						Brown, fine to coarse SAND, some GRAVEL little SILT (SM-SW)

GENERAL NOTES	WATER LEVEL OBSERVATIONS
DRILLING METHOD 4½" Hand Auger	WHILE DRILLING .305
	AFTER DRILLING .305
	HOURS AFTER DRILLING
LOG BY: REM	

SOIL TESTING SERVICES OF WISCONSIN, INC.

CONSULTING SOIL & FOUNDATION ENGINEERS

540 Lambeau Street, Green Bay, Wisconsin 54303 (414) 494-9656
2005 North River Dr., Wausau, Wisconsin 54401 (715) 845-8386
1101 So. Washburn, Oshkosh, Wisconsin 54901 (414) 235-0270
2820 Belknap St., Superior, Wisconsin 54880 (715) 392-9006

JOHN P. GNAEDIN
CLYDE N. BAKER, P.E.
WILLIAM M. PERPICH, P.E.
JACK J. AMAR, P.E.

Foth & Van Dyke and Assoc., Inc.

P.O. Box 3000

Green Bay, Wisconsin 54306

Date June 15, 1981

STS Job No. 10257

Structure Exxon Access Road

Location

Attention: Mr. Ron Meister

Gentlemen:

We are sending ☒ herewith ☐ under separate cover 1 sets of prints of

- ☐ Boring Logs and Location Diagram
- ☐ Laboratory Compaction Data
- ☐ Field Compaction Control Data
- ☐ Classification Test Data
- ☐ Consolidation Test Data
- ☐ Triaxial Compression Test Data
- ☐ Sealed Jar Samples
- ☐ Rock Core Samples
- ☐ Caisson Reports
- ☐ Concrete Report #
- ☒ Results of Aggregate Testing

for the above job.

Remarks

Yours truly,

SOIL TESTING SERVICES OF WISCONSIN, INC.

Thomas W. Wolf, Asst. Proj. Engineer

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 1

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 19 STA 2600 .15-1.45M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
2½-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch	0.0	0.0	100.0	
½-Inch				
⅜-Inch	1.4	0.4	99.6	
No. 4	5.3	1.4	98.2	
No. 8	4.9	1.3	96.9	
No. 10				
No. 16	4.8	1.3	95.6	
No. 30				
No. 40	29.0	7.8	87.8	
No. 50				
No. 80				
No. 100	99.3	26.7	61.1	
No. 200	19.1	5.1	56.0	
Pan	208.5	56.0		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 372.3 grams

Submitted by Ron Meister

Sampled From B-19 STA 2600 .15-1.45M

Identification Brown sandy silt (ML)-trace of gravel

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

56.0% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 6-8-81 Job Name EXXON Job No. 11257

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: BROWN SANDY SILT, TRACE GRAVEL

Material Mark #1 Classification ____ AASHO BPR

Source of Material B-19 STA. 26+00 .15 - 1.45 M

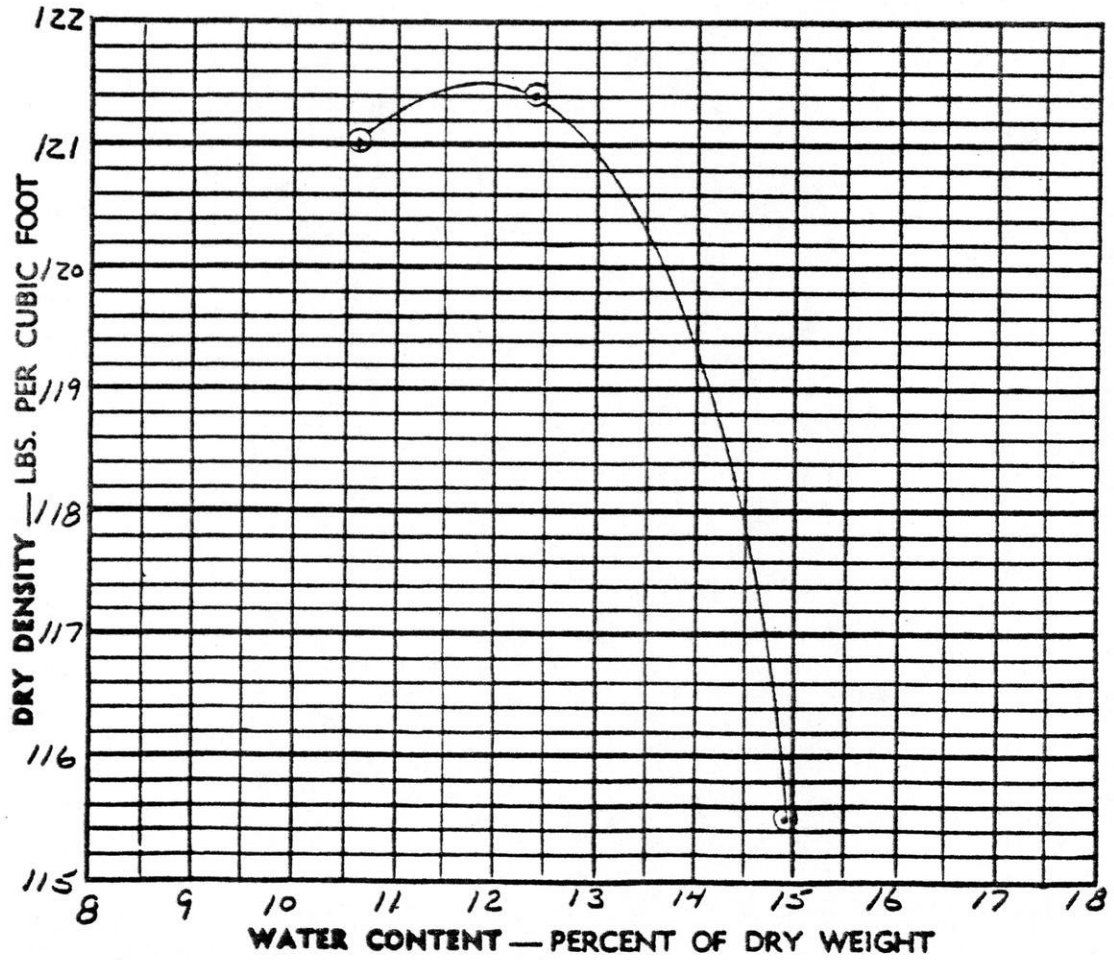
Natural Water Content ____ % Natural Dry Density ____ PCF Specific Gravity ____

Liquid Limit ____ % Plastic Limit ____ % Plasticity Index ____

B. Test Procedure Used: ASTM D-1557-80 METHOD "C"

C. Test Results: Optimum Water Content 11.8 %

Maximum Dry Density 121.5 PCF (at a Wet Density of 135.8 PCF)



BBS92268

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. [illegible]

STS Job No. 11257

Date 6-4-81

Report No. 2

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 8 STA 1100 .25-1.10M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
2½-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch				
½-Inch				
⅜-Inch	0.0	0.0	100.0	
No. 4	14.4	1.3	98.7	
No. 8	12.6	1.2	97.5	
No. 10				
No. 16	22.2	2.0	95.5	
No. 30				
No. 40	168.6	15.8	79.7	
No. 50				
No. 80				
No. 100	435.8	40.8	38.9	
No. 200	39.2	3.7	35.2	
Pan	375.9	35.2		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 1068.7 grams

Submitted by Ron Meister

Sampled From B-8 STA 1100 .25-1.10M

Identification Brown silty fine to medium sand (SM)-trace of gravel

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

35.2% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 3

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 13 STA 1850 09M 10M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
2½-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch	0.0	0.0	100.0	
½-Inch				
⅜-Inch	8.8	1.1	98.9	
No. 4	11.3	1.5	97.4	
No. 8	11.9	1.5	95.9	
No. 10				
No. 16	15.4	2.0	93.9	
No. 30				
No. 40	150.0	19.5	74.4	
No. 50				
No. 80				
No. 100	469.5	61.2	13.2	
No. 200	40.6	5.3	7.9	
Pan	61.1	7.9		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 768.6 grams

Submitted by Ron Meister

Sampled From B-13 STA 1850 09M-10M

Identification Brown fine to medium sand (SP-SM) - trace of silt-trace of gravel

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

7.9% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 4

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 27 STA 3600 .06-.45

REPORT OF TESTS OF Limits Test

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
2½-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch				
½-Inch				
⅜-Inch				
No. 4				
No. 8				
No. 10				
No. 16				
No. 30				
No. 40				
No. 50				
No. 80				
No. 100				
No. 200				
Pan				
Fineness Modulus				

Received at Laboratory

Quantity Represented

Submitted by Ron Meister

Sampled From

Identification Brown sandy silt (ML)-trace of clay

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Liquid Limit 30.4

Plastic Limit 25.0

Plastic Index 5.4

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 6-8-81 Job Name EXXON Job No. 11257

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: BROWN SANDY SILT, TRACE OF CLAY, TRACE GRAVEL

Material Mark #2 Classification AASHO BPR

Source of Material B-27, STA. 36 00, .06 TO .45M

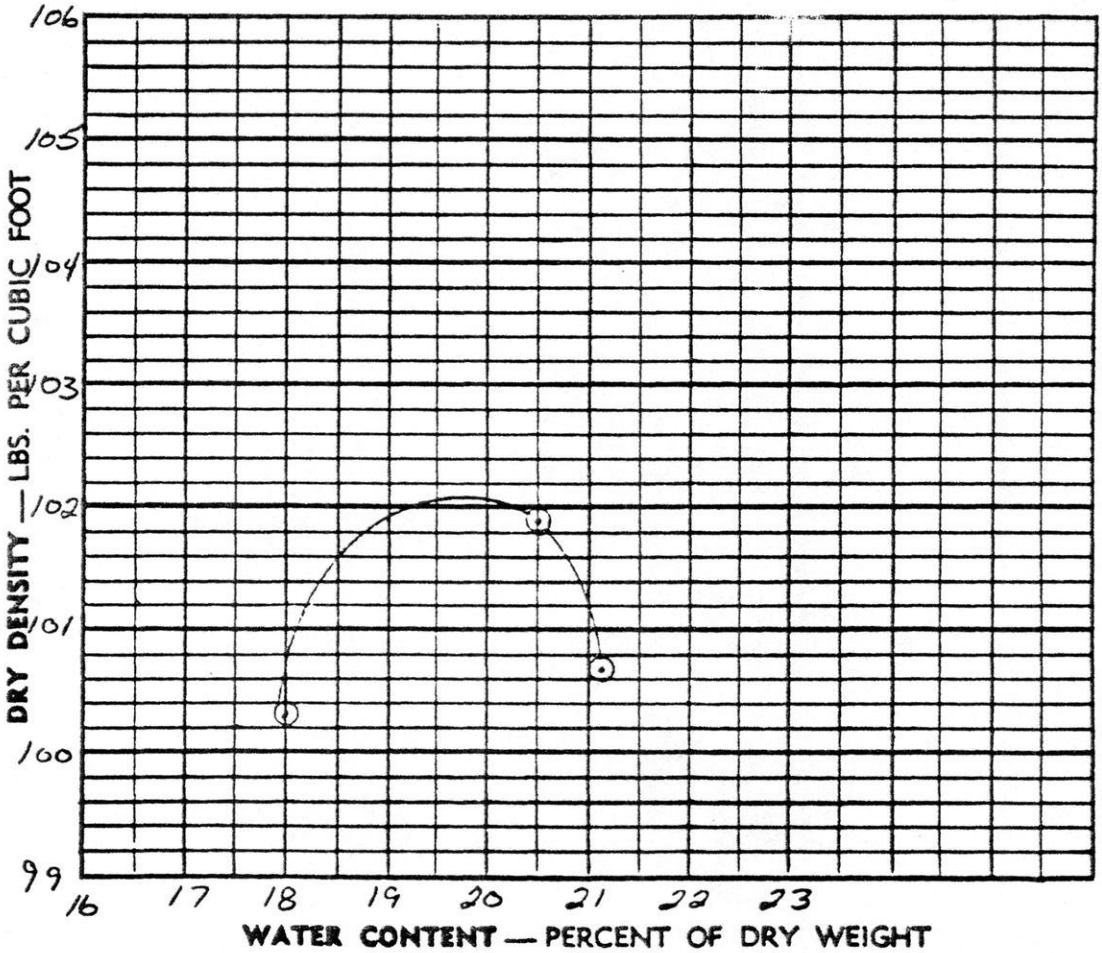
Natural Water Content ____ % Natural Dry Density ____ PCF Specific Gravity ____

Liquid Limit 30.4 % Plastic Limit 25.0 % Plasticity Index 5.4

B. Test Procedure Used: ASTM D-698-78 METHOD "A"

C. Test Results: Optimum Water Content 19.7 %

Maximum Dry Density 102.1 PCF (at a Wet Density of 122.2 PCF)



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SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 5

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 7 STA 1000 .24-1M.

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
2½-Inch				
2-Inch	0.0	0.0	100.0	
1½-Inch				
1-Inch	41.1	5.3	94.7	
¾-Inch				
½-Inch				
⅜-Inch	18.2	2.3	92.4	
No. 4	29.9	3.9	88.5	
No. 8	27.7	3.6	84.9	
No. 10				
No. 16	30.4	3.9	81.0	
No. 30				
No. 40	161.9	20.9	60.1	
No. 50				
No. 80				
No. 100	201.6	26.0	34.1	
No. 200	24.1	3.1	31.0	
Pan	240.7	31.0		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 775.6 grams

Submitted by Ron Meister

Sampled From B-7 STA 1000 .24-1M

Identification Brown silty fine to coarse sand (SM) - a little gravel

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

31.0% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 6-8-81 Job Name Exxon Job No. 11257

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Brown Silty Fine To Coarse Sand, Some Silt, Some Gravel

Material Mark #3 Classification _____ AASHO BPR

Source of Material B-7, Sta. 1000 .24 - 1.0 M

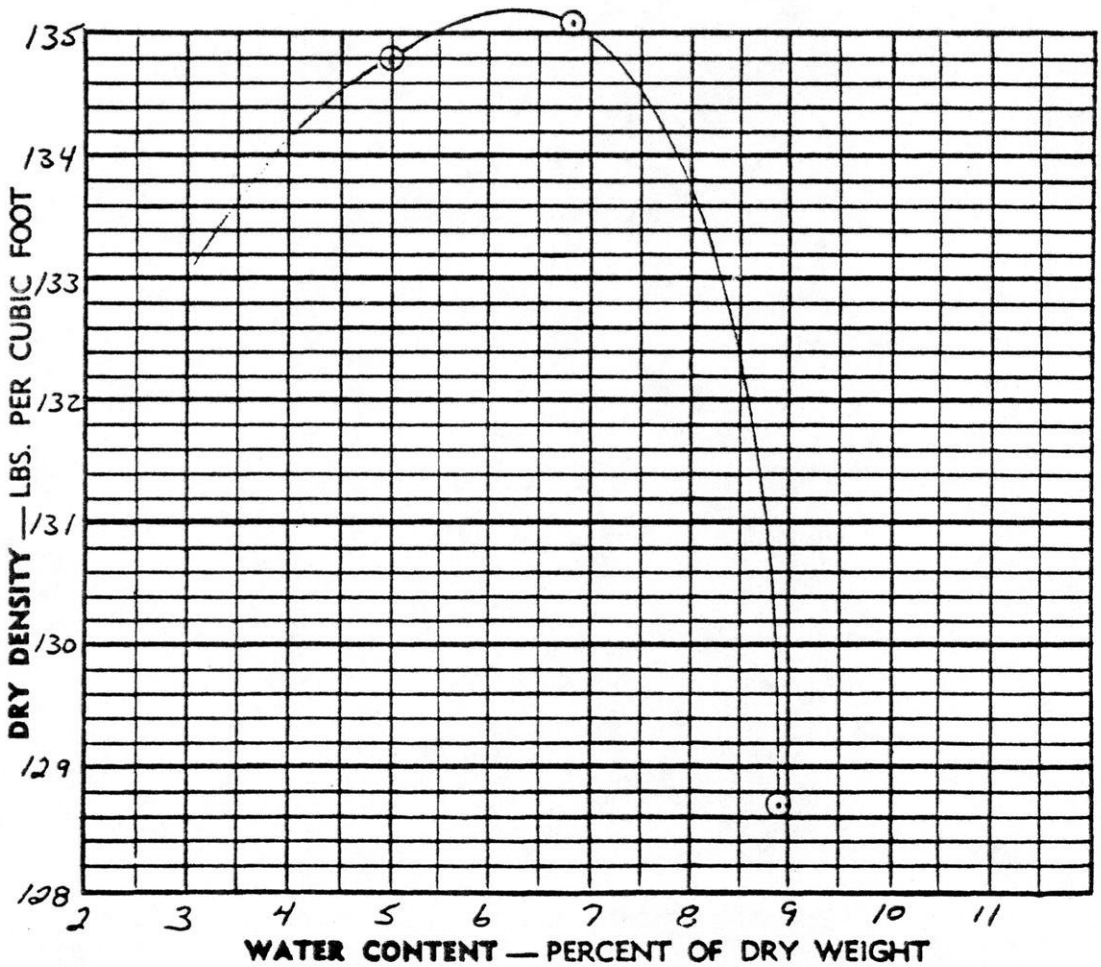
Natural Water Content _____ % Natural Dry Density _____ PCF Specific Gravity _____

Liquid Limit 22.0 % Plastic Limit 20.8 % Plasticity Index 1.2

B. Test Procedure Used: ASTM D-1557-80 Method "C"

C. Test Results: Optimum Water Content 6.3 %

Maximum Dry Density 135.2 PCF (at a Wet Density of 143.7 PCF)



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SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 6

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 4 STA 610 .3-.9M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
2½-Inch				
2-Inch	0.0	0.0	100.0	
1½-Inch				
1-Inch	254.8	6.2	93.8	
¾-Inch	11.0	9.3	93.5	
½-Inch				
⅜-Inch	85.1	2.1	91.4	
No. 4	89.8	2.2	89.2	
No. 8	112.5	2.7	86.5	
No. 10	137.5	3.3	83.2	
No. 16	892.6	21.5	61.7	
No. 30				
No. 40	1152.2	27.8	33.9	
No. 50	91.2	2.2	31.7	
No. 80	1312.7	31.7		
No. 100				
No. 200				
Pan				
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented

Submitted by Ron Meister

Sampled From B-4 STA 610 .3-.9M

Identification Brown silty fine to coarse sand (SM) - a little gravel

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

31.7% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 7

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 3 STA 450 .2-7M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
2½-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch	0.0	0.0	100.0	
½-Inch				
⅜-Inch	2.4	0.9	99.1	
No. 4				
No. 8	0.5	0.2	98.9	
No. 10				
No. 16	1.5	0.6	98.3	
No. 30				
No. 40				
No. 50				
No. 80				
No. 100	30.1	11.8	80.5	
No. 200	5.8	2.3	78.2	
Pan	199.4	78.2		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 255.1 grams

Submitted by Ron Meister

Sampled From B-3 STA 450 .2-.7M

Identification Dark brown sandy silt (ML) - trace of clay

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

78.2% Passing #200 Sieve

Liquid Limit 22.0

Plastic Limit 20.8

Plastic Index 1.2

Checked By: Kenneth D. Kujava

Bob Evenson
Tested By

BBS-62575

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 6-9-81 Job Name Exxon Job No. 11257

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: DARK BROWN SANDY SILT WITH SOME ROOTS, TRACE OF CLAY

Material Mark #4 Classification _____ AASHO BPR

Source of Material B-3, STA 450 .25-1.32 M

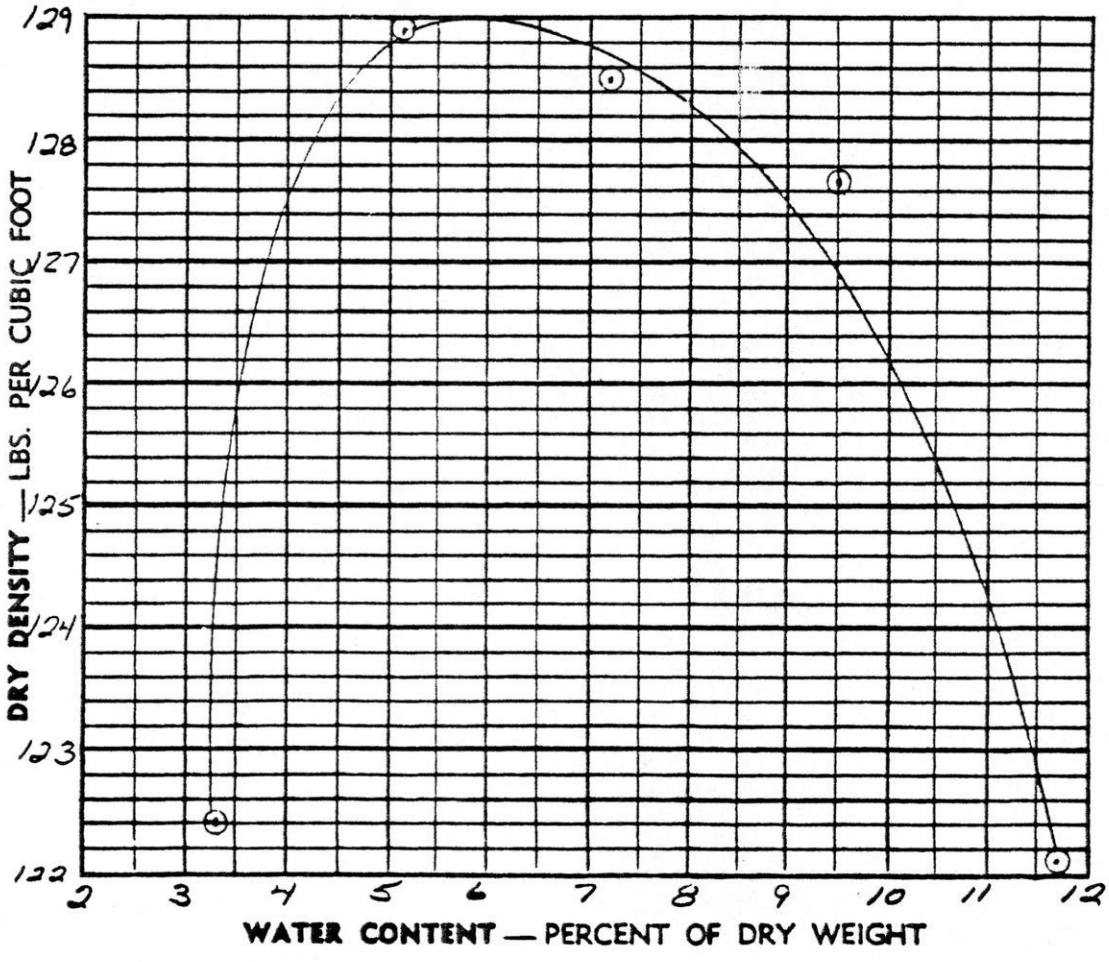
Natural Water Content _____ % Natural Dry Density _____ PCF Specific Gravity _____

Liquid Limit _____ % Plastic Limit _____ % Plasticity Index _____

B. Test Procedure Used: ASTM D-1557-80 METHOD "C"

C. Test Results: Optimum Water Content 6.0 %

Maximum Dry Density 129.0 PCF (at a Wet Density of 136.7 PCF)



BBS92268

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 8

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 3 STA 450 .7-1.7M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
2½-Inch				
2-Inch	0.0	0.0	100.0	
1½-Inch				
1-Inch	162.0	13.5	86.5	
¾-Inch				
½-Inch				
⅜-Inch	21.2	1.8	84.7	
No. 4	22.6	1.9	82.8	
No. 8	35.1	2.9	79.9	
No. 10				
No. 16	49.9	4.1	75.8	
No. 30				
No. 40	315.7	26.2	49.6	
No. 50				
No. 80				
No. 100	506.8	42.1	7.5	
No. 200	27.8	2.3	5.2	
Pan	62.9	5.2		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 1204.0 grams

Submitted by Ron Meister

Sampled From B-4 STA 450 .7-1.7M

Identification Brown fine to medium sand (SP-SM) - a little gravel - trace of silt

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

5.2% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

SOIL TESTING SERVICES, OF WIS., INC.

Quality Control Section:

Project No. XX 8106

STS Job No. 11257

Date 6-4-81

Report No. 9

REPORT OF ANALYSIS OF AGGREGATES

Architect Engineer Foth & Van Dyke and Associates, Inc. Contractor

Project Exxon Access Road Source Boring 24 STA 3050 .7-1.7M

REPORT OF TESTS OF Sieve Analysis

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
2½-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch	0.0	0.0	100.0	
½-Inch				
⅜-Inch	11.9	1.3	98.7	
No. 4	21.9	2.4	96.3	
No. 8	38.0	4.2	92.1	
No. 10				
No. 16	84.9	9.3	82.8	
No. 30				
No. 40	342.1	37.6	45.2	
No. 50				
No. 80				
No. 100	350.3	38.4	6.8	
No. 200	48.5	5.3	1.5	
Pan	14.0	1.5		
Fineness Modulus				

Received at Laboratory 5-22-81

Quantity Represented 911.6 grams

Submitted by Ron Meister

Sampled From B-24 STA 3050 .7-1.7M

Identification Brown fine to medium sand (SP) - trace of gravel

Date Sampled

Intended Use Road Material

Remarks:

Organic matter, colorimetric

Coal and Lignite

Clay Lumps

Chert

Soft Particles

Percent Absorption

Specific Gravity

Dry Rodded Wgt.

Washed Gradation

1.5% Passing #200 Sieve

Checked By: Kenneth D. Kujava

BBS-62575

Bob Evenson

Tested By

Nuclear Density Tests

Project EXXON ACCESS ROAD
Job No. XX 8106
Contractor —
Compaction Eq. Used —
Other Eq. Working —

FOTH & VAN DYKE AND ASSOCIATES, INC.
REPORT OF MOISTURE-DENSITY
TESTS - NUCLEAR METHOD

Date 4/22/81 - 4/24/81
Report No. 1
Weather Cond. 50°F-CLOUDY-RAIN
Site Cond. WET- MUDDY
Type of Const. PROPOSED PLANT ACCESS ROAD

Test No.	Location	Elevation	Lift Thickness	Proctor Used	Wet Density lb/cu.ft.	Water Content %	Dry Density lb/cu.ft.	% Compaction	Description of Soil/Mode
1	STA. 1000	485.5±	—	—	101.3	20.7	83.9	—	BROWN, SILTY SAND, some gravel
2	STA. 3600	502 ±	—	—	93.3	38.2*	67.5	—	BROWN, CLAYEY SILT, some SAND
3	STA 3450	497.5±	—	—	96.3	47.9*	65.1	—	BROWN, CLAYEY SILT, some SAND
4	STA 1850	481 ±	—	—	99.8	44.6*	69.0	—	BROWN, SILTY SAND, trace clay
5	STA 1200	485 ±	—	—	94.1	43.8*	65.5	—	BROWN, SILTY SAND, trace clay
6	STA 450	487.5±	—	—	113.1	32.9*	85.2	—	BROWN, CLAYEY SILT WITH SAND

* NOTE: HIGH WATER CONTENT ARE DUE TO HEAVY RAINS WHICH OCCURRED PRIOR TO TESTING

Trench Moisture Standard Counts —
Moisture (Standard Counts) 1056

Electronic Verification Test
Bulk Density
Dry Density
Moisture

By: RON MEISTER

PROCTOR INFORMATION

Proctor No.	Type	Density @ Optimum % Moist.	Description of Material	% Compaction Req'd.

APPENDIX "2C"

In-Site Density Tests

FIELD DENSITY TEST

FOR

SUBGRADE SOILS

EXXON ACCESS ROAD Date: 7/8/82

Project No.: XX 5202 By: RLM

Location: STA 7770

Sample - CONTAINER "A"

Wt. of Sample plus Container 5.96 #

Wt. of Container (-) 1.48 #

Wt. of Sample (a) 4.48 #

Volume

Wt. of Jar and Sand 13.29 #

Wt. of Jar & Sand After Filling Hole & Funnel (-) 5.41 #

7.88 #

Wt. of Sand in Funnel (-) 3.86 #

Moisture

Wt. of Sample Wet (100 Gr.+) (b) 4.48 Gr.

Wt. of Sample Dry (c) 4.35 Gr.

Wt. of Sand in Hole (e) 4.02 #

Wt. Per Cu. Ft. of Sand (f) 92.20 #/c.f.

$$\%\text{Moisture} = \frac{(b)\,4.48 - (c)\,4.35}{(c)\,4.35} \times 100 = (d)\,2.99\,\%$$

$$\text{Volume} = \frac{(e)\,4.02\,\#}{(f)\,92.20\,\#/\text{c.f.}} = (g).0436\,\text{c.f.}$$

$$\text{Wet Wt. Per Cu. Ft.} = \frac{(a)\,4.48\,\#}{(g).0436\,\text{c.f.}} = (h)\,102.75\,\#/\text{c.f.}$$

$$\text{Dry Density} = \frac{(h)\,102.75}{\frac{1 + (d)2.99}{100}} = (i)\,77.77\,\#/\text{c.f.}$$

Max. Dry Density (From Proctor Test) = (D) _____ #/c.f.

$$\%\text{Compaction} = \frac{(i)\,\_\_\_\_\#/\text{c.f.}}{(D)\,\_\_\_\_\#/\text{c.f.}} \times 100 = \_\_\_\_\%$$

RJR:jkl
9/26/78 (RT)
60c.

FIELD DENSITY TEST

FOR

SUBGRADE SOILS

Exxon Access Road Date: 7/8/82

Project No.: XX5202 By: RBM

Location: STA 530

Sample Continued "B"

Wt. of Sample plus Container 4.52 #

Wt. of Container (-) 1.37 #

Wt. of Sample (a) 3.15 #

Volume

Wt. of Jar and Sand 13.03 #

Wt. of Jar & Sand After Filling Hole & Funnel (-) 6.52 #

6.56 #

Wt. of Sand in Funnel (-) 3.86 #

Moisture

Wt. of Sample Wet (100 Gr.±) (b) 3.15 Gr.

Wt. of Sample Dry (c) 2.63 Gr.

Wt. of Sand in Hole (e) 2.70 #

Wt. Per Cu. Ft. of Sand (f) 92.20 #/c.f.

%Moisture = $\frac{(b)\ 3.15 - (c)\ 2.63}{(c)\ 2.63} \times 100 = (d)\ 19.77\ \%$

Volume = $\frac{(e)\ 2.70\ \#}{(f)\ 92.20\ \#/c.f.} = (g).0293\ c.f.$

Wet Wt. Per Cu. Ft. = $\frac{(a)\ 3.15\ \#}{(g).0293\ c.f.} = (h)\ 107.57\ \#/c.f.$

Dry Density = $\frac{(h)\ 107.57}{\frac{1 + (d)19.77}{100}} = (i)\ 89.81\ \#/c.f.$

Max. Dry Density (From Proctor Test) = (D) _____ #/c.f.

%Compaction = $\frac{(i)\ \_\_\_\_\_\ \#/c.f.}{(D)\ \_\_\_\_\_\ \#/c.f.} \times 100 = \_\_\_\_\_\ \%$

RJR:jkl
9/26/78 (RT)
60c.

FIELD DENSITY TEST

FOR

SUBGRADE SOILS

Erie Airport Road Date: 7/6/82

Project No.: XX 5202 By: RBM

Location: STA 1570

Sample CONTAINER B2

Wt. of Sample plus Container 5.94 #

Wt. of Container (-) 1.37 #

Wt. of Sample (a) 4.57 #

Volume

Wt. of Jar and Sand 13.18 #

Wt. of Jar & Sand After Filling Hole & Funnel (-) 5.76 #

7.42 #

Wt. of Sand in Funnel (-) 3.86 #

Moisture

Wt. of Sample Wet (100 Gr.±) (b) 4.57 Gr.

Wt. of Sample Dry (c) 4.35 Gr.

Wt. of Sand in Hole (e) 3.56 #

Wt. Per Cu. Ft. of Sand (f) 92.20 #/c.f.

%Moisture = $\frac{\text{(b) } 4.57 - \text{(c) } 4.35}{\text{(c) } 4.35} \times 100 = \text{(d) } 5.06$ %

Volume = $\frac{\text{(e) } 3.56 \#}{\text{(f) } 92.20 \#/\text{c.f.}} = \text{(g) } .0386$ c.f.

Wet Wt. Per Cu. Ft. = $\frac{\text{(a) } 4.57 \#}{\text{(g) } .0386 \text{ c.f.}} = \text{(h) } 118.36$ #/c.f.

Dry Density = $\frac{\text{(h) } 118.36}{1 + \frac{\text{(d) } 5.06}{100}} = \text{(i) } 112.66$ #/c.f.

Max. Dry Density (From Proctor Test) = (D) _____ #/c.f.

%Compaction = $\frac{\text{(i) } \_\_\_\_ \#/\text{c.f.}}{\text{(D) } \_\_\_\_ \#/\text{c.f.}} \times 100 = \_\_\_\_$ %

RJR:jkl
9/26/78 (RT)
60c.

APPENDIX 3

SUMMARY AND LOG OF BORINGS

(FROM EXXON)

SOIL REPORT

BRIDGE STRUCTURES
MINE DEVELOPMENT SITE
CRANDON, WISCONSIN

SOIL TESTING SERVICES

GEOTECHNICAL AND MATERIALS ENGINEERS

SOIL TESTING SERVICES
OF WISCONSIN, INC.
540 LAMBEAU ST. GREEN BAY, WIS. 54303

February 17, 1981

Exxon Minerals Company
P. O. Box 813
Rhinelander, Wisconsin 54501

Attention: Mr. Carlton C. Schroeder

STS Job 10935

RE: Subsurface exploration for proposed Bridge Structures for the Mine Development Site in Crandon, Wisconsin.

Gentlemen:

The subsurface exploration as proposed in our letter dated May 9, 1980 and authorized under Exxon Minerals Company (EXXON) Contract No. 21546, dated December 18, 1980 and the contract amendment dated January 23, 1981, has been completed. The attached report contains the logs of eight (8) soil borings, our analyses of the conditions encountered by these borings and recommendations regarding design and construction of the bridge abutments. Five copies of this report have been sent to the above address.

The borings indicate that the soils at each of the three sites explored are texturally similar, ranging from relatively clean sands to silty sand deposits with occasional higher silt content. The near surface soils varied from a sandy silt in the area of Borings AR-3 and AR-4 to a silty or sandy peat at the borings adjacent to Swamp Creek. The relative density of the soils, estimated by standard penetration tests, indicate that the upper zones extending to depths ranging from approximately 6 feet at Borings AR-2 and AR-1 and to 20 feet at Borings RR-1 and RR-2 are in a medium dense condition. Below these depths, the soils were in a dense to extremely dense condition.

Based on the data collected, it appears that the most feasible foundation design will consist of spread footings based on the medium dense to dense sand deposits. Allowable bearing pressure ranging from 4000 PSF for the railroad spur line bridge to 6000 PSF for the two structures associated with the access road are recommended. A second alternative that may be desirable for the railroad structure would consist of driving Class A pretreated timber piling through the medium dense overburden soils to the extremely dense soils at depth. A typical 8-inch

GREEN BAY PHONE (414) 494-9656
WAUSAU, WISCONSIN - 715-845-8386
MARQUETTE, MICHIGAN - 906-225-1417
MILWAUKEE, WISCONSIN - 414-354-1100
SUPERIOR, WISCONSIN - 715-392-9006
OSHKOSH, WISCONSIN - 414-235-0270
KENOSHA, WISCONSIN - 414-657-1211

WILLIAM M. PERPICH, P.E.
JOHN P. GNAEDINGER, P.E.
CLYDE N. BAKER, P.E.
MERLE E. BRANDER, P.E.
DOUGLAS J. HERMANN, P.E.

JAMES J. BOTZ, P.E.
JAMES A. SENGER
JON D. MUELLER
THOMAS W. WOLF
JACK J. AMAR, P.E.

tip diameter pile can be designed for an allowable capacity of approximately 30 tons. Additional information regarding soils encountered and recommendations are contained in the attached report.

We have appreciated this opportunity to provide engineering and testing services for you. If we may be of further assistance in discussing this report, please contact us at your convenience.

Yours very truly,

SOIL TESTING SERVICES OF WISCONSIN, INC.

Thomas W. Wolf
Assistant Project Engineer

Jack J. Amar, P.E.
Director of Geotechnical Services

TWW/pk

INTRODUCTION

In association with the mine development project near Crandon, Wisconsin, EXXON proposes the construction of a vehicular access road and a railroad spur leading to the plant/mill site. Each of these access routes must cross Swamp Creek that flows in a generally easterly direction, approximately 4000 to 5000 feet north of the plant/mill site. At each of these crossings, a bridge will be constructed. Additionally, at the northwest corner of the plant/mill site, a bridge will be constructed to provide grade separation between the access road and the railroad spur. Two soil borings were drilled at the location of each proposed structure to identify soil conditions for design of the abutments. Two additional borings were drilled at the Swamp Creek road crossing site to verify bedrock conditions.

Presently, the proposed access routes are in a preliminary design stage. Therefore, final details regarding the type of structures are not available. We understand, however, that single span bridges or box culverts are possible for the Swamp Creek crossings. A single span bridge will likely be utilized for the grade separation structure. Mr. Schroeder has indicated that a timber trestle-type bridge may be utilized for the railroad spur line crossing of Swamp Creek. No additional design information is available at this time.

The purpose of this report is to describe the soil and ground water conditions encountered by the eight soil borings, to analyze and evaluate those conditions with respect to the proposed project and to present recommendations regarding feasible foundation designs and construction.

FIELD PROCEDURES

The locations of the six soil borings were selected by personnel from EXXON Minerals Company. Mr. Doug Kincaid of EXXON directed our field crew to the appropriate locations. Due to the remote and wooded nature of the areas explored, a track-mounted drilling unit was required for completion of the project. At the present time, ground surface elevations at the boring locations have not been determined. We understand that these elevations will be obtained at a future date. We request that these elevations be forwarded to us when available. The general locations of the soil borings are indicated on the Soil Boring Location Diagram attached to this report.

The initial field work was completed during the period of January 5 through January 9, 1981. Access to the boring locations was provided by EXXON. Near Swamp Creek, access was provided to one side of the creek and it was necessary to cross the creek to drill the boring on the other side. The ice was of insufficient thickness to support the drilling rig and consequently the unit became partially immersed on two occasions.

The initial borings were advanced to the required depths using various combinations of solid-stem flight augers and a washed boring technique utilizing a roller-bit and Revert drilling mud. Borings AR-1 and AR-2 were planned to be advanced to depths of 40 feet each. They were terminated at depths of 30.4 and 21.5 feet, respectively in extremely dense soil or rock deposits after sufficient soil

information had been obtained to formulate foundation recommendations.

The base materials at Boring AR-1 appeared to be a decomposed rock deposit. Therefore, EXXON authorized two additional borings, (AR-1A and AR-2A) to be drilled near Borings AR-1 and AR-2, to better define the base materials. These borings were drilled during the period of February 2 through February 10, 1981.

Soil samples were obtained in general accordance with ASTM Specification D 1586, "Standard Method for Penetration Testing and Split-Barrel Sampling of Soils". Rock core samples were obtained in general accordance with ASTM 2113. Brief descriptions of these sampling procedures are contained in the Appendix.

While drilling and sampling and after completion of the borings, the drill crew looked for the presence of standing water in the open bore holes. Water level observations are indicated on the lower left corner of the logs in the Appendix.

LABORATORY PROCEDURES

The penetration test samples were visually examined by a Geotechnical Engineer to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses and seams and apparent geological origin. The soils were classified according to type using the Unified Soil Classification System. The capitalized symbol in parentheses on the boring logs is the appropriate classification symbol. A chart describing this classification system is contained in the Appendix.

Rock core samples were given directly to EXXON personnel at the site. The core descriptions on the boring logs were prepared by EXXON personnel.

The results of the field and laboratory tests were then plotted on the boring logs. These logs are contained in the Appendix. Similar soils were grouped into strata on the logs. Please note that the strata contact lines represent approximate boundaries between soil types; the actual transition between soil types in the field may be gradual in both the horizontal and vertical directions.

SITE CONDITIONS

Detailed soil conditions are described on the respective soil boring logs in the Appendix. A general overview of these conditions is presented below.

Soil Conditions

In general, the soil borings encountered granular soils with varying silt contents. Texturally, the soils ranged from a relatively clean (having less than 10% by weight passing the No. 200 sieve) fine to medium and fine to coarse sand (Unified Soil Classification SP or SW) to silty sand (Unified Soil Classification SM). Localized deposits of sandy silt (ML) and clayey sand (SC) were also encountered in Boring RR-1. The near surface soils on the plant/mill site (Borings AR-3 and AR-4) consisted of very silty sands or sandy silt. In the remaining borings, the near surface soils, extending to depths ranging from 1.5 to 3.0 feet, consisted of sandy or silty peat (Pt).

The relative density of the granular soils is generally in a medium dense range, Standard N Penetration less than or equal to 29 blows per foot, to depths ranging from approximately 6.0 feet at Borings AR-1 and AR-2 to depths of approximately 20 feet at Boring RR-1. Below these depths, the standard penetration values are substantially higher and lie in the dense to extremely dense range.

At Boring AR-1, at a depth of 23 feet, an extremely dense light brown sandy silt deposit was encountered. Also present were seams of reddish brown silty clay.

Limited recovery of this material hinders a precise identification, however, it appears to be a decomposed boulder or bedrock. Borings AR-1A and AR-2A were drilled to verify and identify the suspected bedrock. Highly fractured rock was encountered from 21 to 35 feet in Boring AR-1A. Between 35 and 40 feet, the rock has been identified as Sericite schist with 10 to 50 fractures per foot. Finally, chert with 5 to 10 fractures per foot was encountered in Boring AR-1A. Boring AR-2A encountered chert with 1 to 5 fractures per foot, at a depth of 25 feet and extending to the base of the boring at 32 feet.

Ground Water Conditions

Prior to introduction of drilling fluid in Borings AR-3 and AR-4, ground water was not encountered. After introduction of the drilling fluid, ground water level observations are not indicative of the true ground water condition. At the remaining borings, excluding Boring RR-1, ground water was encountered within 1 to 2 feet of the ground surface or approximately coincident with the water level in the adjacent creek. An artesian flow condition was observed in Boring RR-1 after boring completion. The ground water level will vary both seasonally and annually depending upon the amount of precipitation, evaporation, surface runoff, and infiltration. We anticipate that ground water adjacent to Swamp Creek will be at or slightly above the water level in the creek. Previous information on the plant/mill site indicates that the ground water level is at a substantial depth although perched water may be present.

ANALYSIS AND RECOMMENDATIONS

Based on the data obtained from the eight soil borings, each of the three sites appears suitable for use of shallow spread foundation systems. It is likely that this type of foundation will be the most economical, particularly for the vehicular access road. Mr. Schroeder has indicated that a timber-trestle type bridge may be utilized for the railroad spur line. In this case, it may be desirable to utilize piles for support of the bridge. These foundation alternatives are discussed below.

Shallow Foundations

Where a shallow foundation system is utilized, they should extend through all surface organic deposits to the medium dense to dense sands and silty sand deposits. We recommend that a minimum footing embedment depth of 5 feet be maintained for frost protection. For abutments adjacent to Swamp Creek, a greater depth of embedment may be required if the anticipated scour depth exceeds 5 feet. A geohydrologic study should be conducted to determine the appropriate design scour depth.

For the two bridge structures along the vehicular access route, foundations may be designed utilizing a net allowable soil bearing pressure not to exceed 6000 PSF. The net allowable bearing pressure is that pressure in excess of the final minimum overburden pressure.

The soil conditions in the area of Borings RR-1 and RR-2 are less favorable in that the zone of medium dense soils extends to greater depths. Therefore, at this location, we recommend that the net allowable bearing pressure be limited to a maximum of 4000 PSF.

Utilizing the above bearing pressure recommendations, we estimate that total settlement of the abutments will be small. A refined settlement estimate can be prepared once structural and loading details are available.

Deep Foundations-Piles

As noted previously, a deep foundation system may be utilized in the area of the proposed railroad bridge crossing. If required, we recommend that Class A treated timber end bearing piles in general conformance with ASTM Specification D25-73 be utilized. We estimate that such piles can be successfully driven through the medium dense deposit extending to approximately 20 feet. It is unlikely that these piles can be driven more than 1 to 2 feet into the substantially more dense deposits encountered below 20 feet. A typical 8-inch tip diameter timber pile will develop an allowable capacity of 30 tons when driven to the dense granular deposits. This capacity contains a factor of safety of approximately 2.

A pile wave equation analysis can be used to establish driving criteria for pile installation once the piles and driving equipment are selected.

Lateral Soil Pressures

One additional concern in the design of bridge abutments will be the lateral soil pressures that will result on the abutments due to backfill. For backfill adjacent to the abutment, we recommend that a granular material having less than 15% by weight passing the No. 200 sieve be utilized. We further recommend that the backfill be compacted to a minimum of 92% of the modified Proctor maximum dry density as determined in accordance with ASTM Specification D 1557. Density tests should be taken to verify that the recommended densitites are achieved. Lateral soil pressures must be considered in computation of lateral and rotational stability of the abutments. For the type of backfill noted above, we recommend that the following design parameters be utilized in computation of the lateral pressures.

$\emptyset$ (angle of internal friction)	33^{o}
K_a (active earth pressure coefficient)	.30
K_o (at-rest earth pressure coefficient)	.45
K_p (passive earth pressure coefficient)	3.40

We recommend that a moist unit weight of 125 PCF be utilized for backfill above the ground water level. Below ground water level, a bouyant unit weight of 65 PCF should be utilized. Additionally, we recommend that a factor of safety of 2 be utilized in all computations of passive earth pressures due to the higher strain required to mobilize the passive pressures.

CONSTRUCTION CONSIDERATIONS

Based on material types observed in Soil Borings AR-1 and AR-2 near Swamp Creek we estimate that construction dewatering, if required, can be satisfactorily performed to a depth of 2 feet below the hydrostatic ground water table using standard sump pit and pump arrangements. If excavations must extend to greater depths below the ground water table, it is likely that a series of well points will be required. A series of well points will likely be required in the area of Boring RR-1, where an artesian ground water condition was encountered, to adequately dewater footing excavations.

We estimate that side slopes of excavations will be stable at approximately 2 horizontal to 1 vertical above the ground water table. Below the ground water table flatter slopes in the range of 3 to 4 horizontal to 1 vertical will likely result.

Care should be taken during construction to minimize disturbance at the base of excavations. If the soils are disturbed due to construction traffic, they should be excavated and replaced prior to placement of the footings. Failure to do so could result in larger settlements.

As noted in this report, pile foundations will likely only be considered for the railroad structure. Borings did not reveal the presence of large boulders within

the upper 20 feet of soil and therefore we do not anticipate substantial problems associated with installation. Additional installation recommendations can be made once design has proceeded and additional information regarding the structures are available.

GENERAL

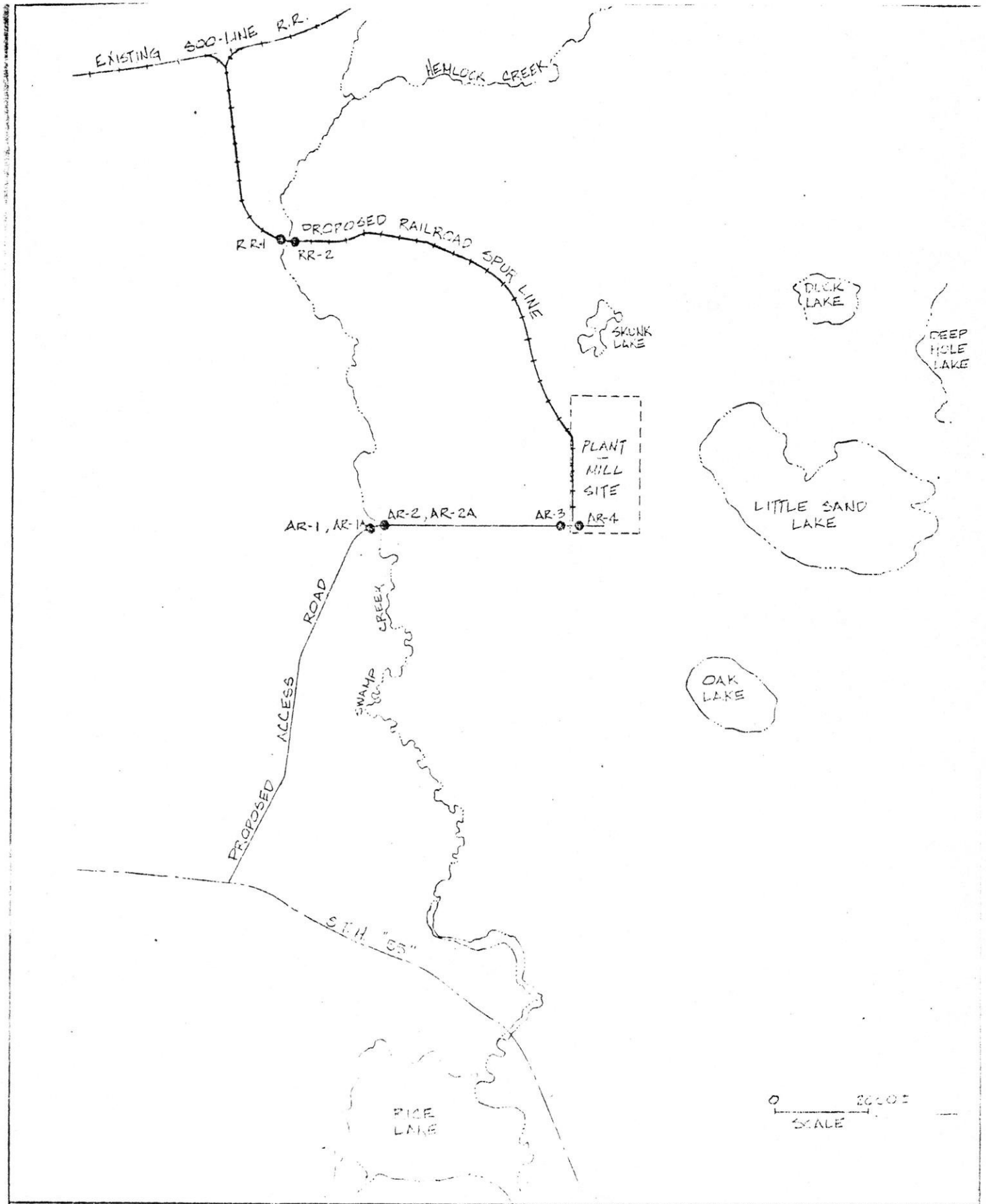
The analysis and recommendations submitted in this report are based on data obtained from eight soil borings. Variations can occur between these borings, the nature and extent of which may not become evident until construction. If variations are encountered, it may be necessary to make a re-evaluation of the recommendations of this report after making on-site observations and noting the characteristics of these variations.

Water level readings have been made in the borings at the times and under the conditions stated on the boring logs. This data has been reviewed and an interpretation made in the text of this report. However, it must be noted that the period of observation was relatively short and that seasonal and annual fluctuations in the level of the ground water will likely occur.

This report has been prepared in order to aid in the evaluation of this property and to assist the Owner and his Architect and/or Engineer in the design of this project. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to soil and foundation characteristics. In the event that any changes in the design, grades or locations of the structures as outlined in this report are planned, we should be informed so the changes can be reviewed and the conclusions of this report modified and approved in writing by the Geotechnical Engineer.

APPENDIX

1. Soil Boring Location Diagram
2. General Notes
3. Procedures Regarding Field Logs, Laboratory Data Sheets and Samples
4. Soil Boring Logs (Borings AR-1, AR-1A, AR-2, AR-2A, AR-3, AR-4, RR-1 and RR-2)
5. Unified Soil Classification Chart
6. Tube Testing Procedures
7. Rock Core Testing procedure



SOIL BORING LOCATION DIAGRAM
PROPOSED BRIDGE CROSSING - EXXON Minerals Co.
MINE DEVELOPMENT SITE - CRANDON, WIS.

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 AMBEAU ST. GREEN BAY, WISCONSIN

JPL	1-17-71		

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS	:	Split Spoon – 1 3/8" I.D., 2" O.D., unless otherwise noted	OS	:	Osterberg Sampler – 3" Shelby Tube
ST	:	Shelby Tube – 2" O.D., unless otherwise noted	HS	:	Hollow Stem Auger
PA	:	Power Auger	WS	:	Wash Sample
DB	:	Diamond Bit – NX: BX: AX	FT	:	Fish Trail
AS	:	Auger Sample	RB	:	Rock Bit
JS	:	Jar Sample	BS	:	Bulk Sample
VS	:	Vane Shear	PM	:	Pressuremeter test - in situ

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

WL	:	Water Level
WCI	:	Wet Cave In
DCI	:	Dry Cave In
WS	:	While Sampling
WD	:	While Drilling
BCR	:	Before Casing Removal
ACR	:	After Casing Removal
AB	:	After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence of ground water elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY:

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive, and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency, and their plasticity.

Major Component Of Sample	Size Range	Descriptive Term(s) (Of Components Also Present in Sample)	Percent of Dry Weight
Boulders	Over 8 in. (200mm)	Trace	1 – 9
Cobbles	8 in. to 3 in. (200mm to 75mm)	Little	10 – 19
Gravel	3 in. to #4 sieve (75mm to 2mm)	Some	20 – 34
Sand	#4 to #200 sieve (2mm to .074mm)	And	35 – 50
Silt	Passing #200 sieve (0.074mm to 0.005mm)		
Clay	Smaller than 0.005mm		

CONSISTENCY OF COHESIVE SOILS:

Unconfined Comp. Strength, Qu, tsf	Consistency
< 0.25	Very Soft
0.25 – 0.49	Soft
0.50 – 0.99	Medium (Firm)
1.00 – 1.99	Stiff
2.00 – 3.99	Very Stiff
4.00 – 8.00	Hard
>8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS:

N – Blows/ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50 – 80	Very Dense
80+	Extremely Dense

PROCEDURES REGARDING FIELD LOGS,

LABORATORY DATA SHEETS AND SAMPLES

In the process of obtaining and testing samples and preparing the report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering.

Specifically, field logs are prepared during performance of the drilling and sampling operations which are intended to portray essentially field occurrences, sampling locations and other information.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by more experienced soils engineers, and differences between the field logs and the final logs exist.

The Engineer preparing the report reviews the field and laboratory logs, classifications and test data, and in his judgement in interpreting this data, may make further changes.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty (60) days and are then destroyed unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are no longer representative of the moisture conditions initially encountered, an inspection of these samples could recognize this factor.

It is common practice in the soil and foundation engineering profession that field logs and laboratory test data sheets not be included in engineering reports, because they do not represent the engineer's final opinion as to the appropriate descriptions for conditions encountered in the exploration and testing work. On the other hand, we are aware that perhaps certain contractors and subcontractors submitting bids or proposals on work might have an interest in studying these documents before submitting a bid or proposal. For this reason, the field logs will be retained in our office for inspection by all contractors submitting a bid or proposal. We would welcome the opportunity to explain any changes that have and typically are made in the preparation of our final reports, to the contractor or sub-contractors, before the firm submits its bid or proposal, and to describe how the information was obtained to the extent the contractor or subcontractor wishes. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

LOG OF BORING NO. RR-1

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures (spur line)

SURFACE ELEVATION 1574.52

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
	1	SS			Black silty fibrous peat (Pt)		2, 5½"
	2	SS					
	2A	SS					
5	3	SS			Grayish brown fine to medium and fine to coarse sand (SP) - trace to a little gravel - trace of silt - very moist - loose to medium dense		6, 12, 11, 16
	4	SS					
	5	SS					
10	6	SS					
15	7	SS			Reddish brown clayey fine to medium sand (SC) - a little gravel - wet - medium dense		15
20	8	SS			Brown sandy silt (ML) - trace to a little gravel - wet - medium dense		13
25	9	SS			Yellowish brown fine to coarse sand (SW) - trace of silt - a little gravel - very moist - dense		35
30	10	SS					32
35	11	SS			Brown slightly silty fine to coarse sand (SP-SM) - a little to some gravel - very moist - very dense		55
40					Brown fine to medium sand (SP) - trace of silt - trace to a little gravel - very moist - extremely dense		
41	12	SS					7½"
					End of Boring Boring advanced to 4.0 feet by solid stem auger Boring advanced from 4.0 to 41.0 feet by roller bit and Revert drilling mud Note: Artesian flow condition observed in borehole after boring completion. Drill crew estimates a 2 to 3 GPM flow rate.		

WATER LEVEL OBSERVATIONS		
W.L.	1.0' W.S.	
W.L.	Surface B.C.R.	Surface A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			1-8-81
BORING COMPLETED			1-8-81
RIG	Bomb	FOREMAN	JJ
DRAWN	JPJ	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. RR-2

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures (spur line)

SURFACE ELEVATION 1572.63 (429.35 m)

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
	1	SS			Black silty peat (Pt) - with some roots and wood - wet - very loose - 0.7 feet of frost		2, 2½, 3
	2	SS					
	2A	SS					3
5	3	SS			Brown fine to medium sand (SP) - trace of fine gravel - wet - medium dense		10, 5
	4	SS			Brown fine sand (SP) - saturated - medium dense		10, 13, 12
10	5	SS					
	6	SS					
15	7	SS					8
20	8	SS			Brown silty fine sand (SM) - trace of clay and clayey sand seams - a little gravel - very moist - loose to extremely dense		67
25	9	SS					105
30	10	SS			Brown silty fine to coarse sand (SM) - a little gravel - very moist - very dense to extremely dense		76
35	11	SS					75
40	12	SS					76
41.5					End of Boring Boring advanced to 4.0 feet by solid stem auger Boring advanced from 4.0 to 41.5 feet by roller bit and Revert drilling mud		

WATER LEVEL OBSERVATIONS		
W.L.	1.0' W.S.	
W.L.	Surface B.C.R.	Surface A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			1-6-81
BORING COMPLETED			1-6-81
RIG	Bomb	FOREMAN	TT
DRAWN	JPJ	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. AR-1

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures (Access Road)

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.)
					SURFACE ELEVATION 471.207 Meters = 1546.03		
	1	SS			Black sandy peat (Pt) - with some roots - moist - 0.7 feet of frost		15
	2	SS			Dark gray to black silty fine to medium sand (SM) and gravel - wet - medium dense 1542		16
5	3	SS					22
	4	SS					33
	5	SS					28
10	6	SS					47
					Reddish brown to brown silty fine to medium sand (SM) - a little to some gravel - trace of clay - moist - medium dense to extremely dense		
15	7	SS					67
20	8	SS			1523 4/61 18"		81
25	9	WS			(ML) Light brown sandy silt, decomposed bedrock (ML) with seams of reddishbrown silty clay (CL) - some gravel size fragments - wet - extremely dense		
30 30.4	10	SS			1515.6 4/61		500/.4'
					End of Boring Boring advanced to 4.0 feet by solid stem auger Boring advanced from 4.0 to 30.4 feet by roller bit and Revert drilling mud Boulders or obstructions encountered from 23.0 to 30.4 feet		

WATER LEVEL OBSERVATIONS			
WL	2.0' W.S.		
WL	1.0'	BCR	0.5' ACR
WL			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			1-8-81
BORING COMPLETED			1-8-81
RIG	Bomb	FOREMAN	TT
DRAWN	JPJ	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. AR-1A

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site-Crandon, Wisconsin	Proposed Bridge Structures

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION → 471.407 meters = 1546.7		
5							
10							
15		RB			Not Sampled SPT 4/6/5 1525.7		
20							
25					Fractured rock (rock sample)		
30					4/60/4 1511.7		
35							
40		DB			Sericite schist bedrock with sparse quartz veins, 10 to 50 fractures per foot 1506.7		
42					Chert bedrock, 5 to 10 fractures per foot 1504.7		
					End of Boring Boring advanced to 35.0 feet by roller bit and Revert drilling mud Boring advanced from 35.0 to 42.8 feet by diamond bit and Revert wash water 10 feet of HW casing used - 25 feet of NW casing used		

WATER LEVEL OBSERVATIONS			
WL	1.0 to 3.0' W.D.		
WL	B.C.R.	0.5' A.C.R.	
WL	5.0' BCR		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			2-9-81
BORING COMPLETED			2-10-81
RIG	Bomb	FOREMAN	IT
DRAWN	MJP	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BDS 102

LOG OF BORING NO. AR-2

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures (Access Road)

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 471.307 meters = 1546.4		
	1	SS			Black silty peat (Pt) - some roots and grass - wet - 1.0 feet of frost 47686 · 1544.9		5
	2	SS			Brown slightly silty fine to coarse sand (SP-SM) - some gravel - wet - medium dense 1540.4 = 1169.47		27
5	3	SS					15
	4	SS					29
	5	SS					27
10	6	SS					39
					Brown silty fine to medium sand (SM) - a little to some gravel - grades to silty fine to coarse sand and gravel from 10.0 to 18.0 feet - very moist - medium dense to extremely dense	1530.4	45
15							
	7	SS					
20							
21.5	8	SS			1524.9 46.77		125
					End of Boring Boring advanced to 4.0 feet by solid stem auger Boring advanced from 4.0 to 21.5 feet by rollet bit and Revert drilling mud Occasional cobbles or obstructions encountered from 0.0 to 21.5 feet		

WATER LEVEL OBSERVATIONS			
WL	2.0' W.S.		
WL	1.0' B.C.R.	0.5' A.C.R.	
WL			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			1-9-81
BORING COMPLETED			1-9-81
RIG	Bomb	FOREMAN	TT
DRAWN	JPJ	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. AR-2A

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures

SURFACE ELEVATION 471.402 Meters = 1546.7

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
5		PA				
10		RB				
15		DB			Not Sampled	
20						
25					1521.7	
30					Chert Bedrock, 1 to 5 fractures per foot	
31.5					End of Boring Borint advanced to 18.0 feet by roller bit ane Revert drilling mud Boulder encountered at 18.0 feet - Boring offset 2.0 feet and advanced Boring advanced from 25.0 to 31.5 feet by diamond bits and wash water 10 feet of NW casing used	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

WATER LEVEL OBSERVATIONS
W.L. 1.0 to 5.0' W.D.
W.L. B.C.R. A.C.R.
W.L.

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			2-6-81
BORING COMPLETED			2-6-81
RIG	Bomb	FOREMAN	TT
DRAWN	MJP	APPROVED	TWW
JOB #	10335	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS 107

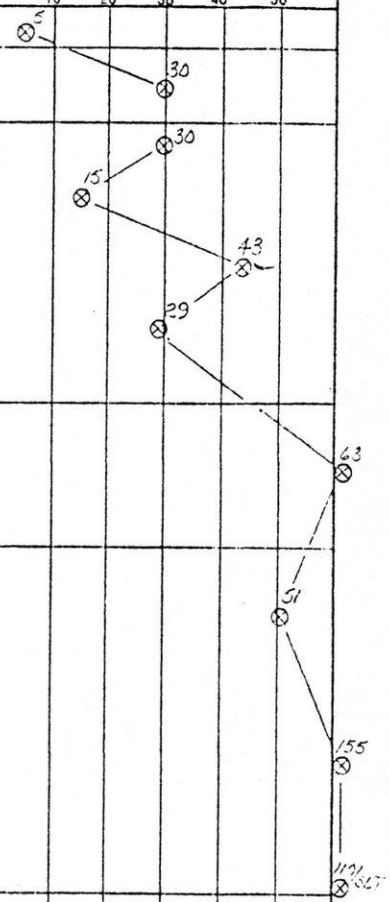
LOG OF BORING NO. AR-3

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures (Grade Separation)

SURFACE ELEVATION 505.300 Mtw

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3
	1	SS			Brown very silty very fine sand (SM-ML) - trace of roots - trace of gravel - moist - loose - 0.7 feet of frost	
	2	SS			Brown slightly silty fine to medium sand (SP-SM) - some gravel - moist - dense	
5	3	SS			Reddish brown silty fine sand (SM) - trace of clay - a little gravel - moist becoming very moist at 6 feet - medium dense to dense	
	4	SS				
10	5	SS				
	6	SS				
15	7	SS			Brown fine to coarse sand (SW) - trace of silt - trace to a little gravel - moist - very dense	
20	8	SS			Brown silty fine sand (SM) - a little medium to coarse sand - a little gravel - moist - very dense to extremely dense	
25	9	SS				
30						
30.5	10	SS			End of Boring Boring advanced to 10.0 feet by solid stem auger Boring advanced from 10.0 to 30.5 feet by roller bit and Revert drilling mud Occasional cobbles or obstructions encountered from 0.0 to 30.5 feet	

UNCONFINED COMPRESSIVE STRENGTH TONS FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS FT.)
10 20 30 40 50



WATER LEVEL OBSERVATIONS

WL				
WL	8.0'	BCR	9.0'	ACR
WL	10.0'	24 hr. A.B.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LANBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			1-5-81
BORING COMPLETED			1-5-81
RIG	Bomb	FOREMAN	TT
DRAWN	JPJ	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. AR-4

OWNER	ARCHITECT-ENGINEER
Exxon Minerals Company	
SITE	**PROJECT NAME**
Mine Development Site - Crandon, Wisconsin	Proposed Bridge Structures (Grade Separation)

SURFACE ELEVATION 504.767

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
	1	SS			Brown sandy silt (ML) - trace of gravel - trace of roots - moist - loose		9
	2	SS			Brown silty fine to medium sand (SM) - trace of gravel - moist - dense		31
5	3	SS					15
	4	SS					20
	5	SS			Reddish brown to brown silty fine sand (SM) - trace of clay - a little gravel - moist becoming very moist at 8 feet - medium dense		9
10	6	SS					15
15	7	SS					38
20	8	SS			Light brown fine to medium sand (SP) - trace of gravel - trace of silt - moist changing to very moist at 20 feet - extremely dense to dense - Note: Boulder encountered at 16.0 to 17.0 feet		42
25	9	SS			Brown silty fine to medium sand (SM) - a little to some gravel and decomposed gravel fragments - moist - extremely dense - boulders or obstructions encountered at 23.0 to 25.0 feet and 28.0 to 29.0 feet		35/1"
30.4	10	SS					100/4"
					End of Boring Boring advanced to 10.0 feet by solid stem auger Boring advanced from 10.0 to 30.4 feet by roller bit and Revert drilling mud Boulders or obstructions encountered from 16.0 to 17.0 feet, 23.0 to 25.0 feet and 28.0 to 29.0 feet		

WATER LEVEL OBSERVATIONS			
WL			
WL	3.0' BGR	4.0' AGR	
WL			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			1-5-81
BORING COMPLETED			1-6-81
RIG	Bomb	FOREMAN	TT
DRAWN	JPJ	APPROVED	TWW
JOB #	10935	SHEET	1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

UNIFIED SOIL CLASSIFICATION SYSTEM

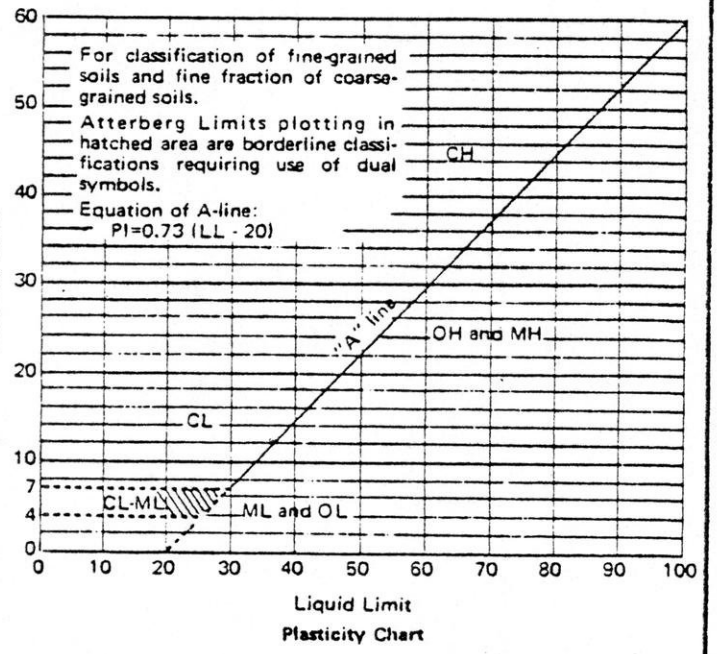
Major divisions			Group symbols	Typical names	Laboratory classification criteria
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
Fine-grained soils (More than half of material is *smaller* than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
Highly organic soils			Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve.
Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 per cent	GW, GP, SW, SP
More than 12 per cent	GM, GC, SM, SC
5 to 12 per cent	*Borderline* cases requiring dual symbols

Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols

Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.



Plasticity Chart

TUBE SAMPLING PROCEDURE

Tube samples were obtained in general accordance with ASTM Specification D 1587-67, "Standard Method for Thin-Walled Tube Sampling of Soils". Briefly, each sample was obtained by hydraulically pushing a 2-inch OD thin-walled tube 2 feet into undisturbed soils at the bottom of the boring. After the tube was retrieved, the length of sample, or recovery, was measured. The soil exposed at the lower end of the tube was preliminarily classified according to type by a Soils Technician and a pocket penetrometer was used to obtain an estimate of the unconfined compressive strength. The tube was then sealed at both ends with rubber caps and returned to our laboratory for extrusion, additional examination and testing.

ROCK CORE SAMPLING PROCEDURES

Rock core samples were obtained using a double-tube core barrel equipped with a diamond bit. Wash water was used to wash the cuttings to the surface. The rate of advancement of the core barrel was carefully observed and any sudden advances were noted as "voids". Return of the wash water was also observed. Loss of wash water or change in color was also noted. After removal of each core from the boring, the length (recovery) was measured. The cores were then carefully extruded into wooden core boxes, labeled and returned to our laboratory for further examination and possible testing.

APPENDIX 4

DRAINAGE STUDY

TO: Files - FOTH & VAN DYKE Project No. XX8207-HYD-05

FROM: Mike Liebman 12-21-82

Water Resources Engineer

SUBJECT: Exxon Crandon Project

Access Road Drainage - Preferred Route

General

In June of 1981, work was completed on the drainage portion of the access road project for the original road route. From this work, preliminary engineering designs were made for structures needed to accommodate all drainage through the proposed access road "in a manner that will avoid, or if that is not viable, substantially minimize any impacts" on the existing creeks and wetlands. Included in this work were tasks required to determine the flood flows at various locations along the access road route and to size the culverts or other drainage structures needed to minimize impacts on surface or subsurface water movement. Although the preferred access road route is significantly different than the original route, the same methods were used for the drainage design. These methods, with their results, are summarized in this memorandum.

Survey Work

On March 10, 1981, this writer accompanied the survey crew to the project site to direct their efforts in acquiring survey information for subsequent hydraulic study. Included in this data acquisition were cross sections taken along Swamp Creek at selected locations, inspection of various road stream crossings upstream of the proposed access road, and cross sections taken at the controlling outlets of Lake Metonga and Lake Lucerne. Direction was also given for future cross section work along some of the minor tributary streams. The survey team completed this creek cross sectioning work at a later date. All survey information was taken in metric units.

Additional survey information was needed for the preferred road alignment. This field work was completed in June of 1982.

Hydrology

Because of the size of the basin tributary to the Swamp Creek crossing and the number of discharge points for which flood flows were required, the Soil Conservation Service hydrologic computer program TR-20 was selected as the

primary hydrology tool. With stream gauge data available, this program's calibration ability made this the most desirable method of most accurately determining flood flows. It should be noted that TR-20 is not capable of handling metric units so this portion of the study was completed in English units.

To assure minimal impacts on the existing drainage along the access road and to abide by the Wisconsin Department of Natural Resources guidelines, the 100-year or regional flood was used to size the proposed drainage structures over navigable streams. To determine this flood flow at the road crossing of Swamp Creek, and lesser flood flows for other areas, the following data was input into the TR-20 program:

1. Basin Areas - The entire watershed was broken down into 25 basins according to topography and existing drainage patterns. Each basin was planimetered resulting in basin areas ranging from 0.04 to 7.82 square miles. The total watershed area studied equals about 47 square miles.

2. Runoff Curve Numbers (CN) - Each basin was assigned a CN value. These numbers are used by the program to determine the amount of runoff that a particular basin will produce from a given rainfall event. Soil types and land uses are used to develop CN values for respective basins.

3. Times of Concentration (Tc) - The travel times from the most remote points on the basin divides to the basin outlets by a unit of water running overland or in drainageways were estimated for each basin. Travel lengths, basin slopes, and ground cover are used to find the respective basin Tc values.

4. Reach Lengths - These values represent the distance, usually along a stream, from one basin outlet downstream to the next basin outlet. Outlet hydrographs from each basin are routed through the reach before being combined with the downstream basin hydrograph.

5. Routing Coefficients ("C") - A value was assigned to each reach to simulate flow conditions through the reach. From these "C" values, the reach velocities may be computed, subsequently affecting the hydrograph routing through the reach.

6. Stage/Discharge Storage - Because of the peak flow reduction potential of the two major lakes - Lake Metonga and Lake Lucerne - stage/discharge/storage relationships were thought necessary. To develop such, each lake's controlling outlet was surveyed and hydraulically evaluated to arrive at the respective stage/discharge relationships. Stage/storage relationships were estimated by planimetering areas corresponding to incremental increases in depth and converting this data to volume in acre-feet. These relationships allowed TR-20 to route the incoming hydrographs through the lakes while allowing for the peak reducing and lagging effects of the lakes.

7. Rainfall Data - The standard Type II rainfall distribution was used for a 24 hour duration storm. This was thought to be fairly accurate since the time of concentration for the entire watershed was in the vicinity of 24 hours. As a check, 6-hour and 12-hour duration distributions were run. One hundred-year, 50-year, 25-year, and 10-year rainfall amounts were used with these unit hyetographs.

Additional rainfall data was used in the program to aid in calibrating the model. The following procedures were used for this calibration:

1. Analyze Gauge Data - Large increases in flow were identified to converge on large storm related flow increases.

2. Analyze Climatological Data - For those storms causing increased flows as detailed on the stream gauge records, hourly precipitation data for the Crandon area was obtained.

3. Run Program With Actual Rainfall - After inputting proper antecedent moisture conditions for each storm along with the hourly rainfall amounts, the program was run. By comparing the results of this actual storm simulation to the stream gauge records, the basin model could be calibrated.

4. Calibrate Model - By modifying the runoff curve numbers and routing coefficients, the results of the storm simulations were made to reasonably meet the actual recorded flow values. Once the basin characteristics were so modified, the design storm may be modeled with confidence.

The 100-year event was then run to determine the flood flows at the various locations. As a final check, the Conger Method was used to determine regional flood flows at the Swamp Creek crossing. Comparison of the two methods was favorable with the Conger results being somewhat conservative. This can be expected because of the standard error of estimate which is added into the initial results.

Hydraulics

This portion of the project consisted of sizing the drainage structures over navigable watercourses so as not to increase backwater from the structure by more than 0.1 feet, or as metric units were preferred, 3 cm. for the 100-year flood flow. In addition, it was required to size culverts providing drainage for non-navigable areas so as to maintain existing drainage patterns. The first priority was to design for the Swamp Creek crossing. The following procedures were used to evaluate this structure.

1. Acquire Cross Section Data - Detailed cross section data was used for both downstream and upstream of the proposed crossing location.

2. Set up HEC-2 - The Army Corps of Engineers hydraulic computer program HEC-2 was used to develop water surface profiles for the 100-year flood. Cross section and other data was input into this program to determine the stream profile for the 100-year flood. The 100-year flood flow of 28.6 cubic meters per second (CMS) or 1010 CFS was used for this location.

3. Size Structure - Various bridge configurations were tried to determine the hydraulic capacity required to cause backwater of less than 3 cm. Existing conditions were finalized and used to gauge the various structure results. It was found that four 10 ft. by 8 ft. box culverts or equal would adequately pass the 100-year flows.

The preferred road alignment crosses no other streams which are considered to be navigable, so a lesser frequency rainfall event was used for design. A combination of the TR-20 results and conservative area proration estimates was used to determine design flows while culvert nomographs were used for sizing the drainage facility required. The various drainage structures required are summarized as follows:

1. Station 7620 - The basin tributary to this point gives a 10-year flood flow of 0.45 CMS (16 CFS). This peak flow would create a total backwater depth of about one meter if a 24-inch culvert were used here. Because of the proximity to farmland, this backwater may be considered somewhat excessive. A 27-inch culvert is therefore recommended for design. If the proposed cattle pass is constructed in this area, the 24-inch culvert should suffice because the cattle pass would discharge a portion of large flood flows thereby decreasing the backwater depths.

2. Station 8104 - Several large depressions intercept much of the basin flow tributary to this location. As such, a 24-inch culvert has more than enough capacity to pass the basin runoff.

3. Station 1100 - This area has a 10-year flow estimate of about 0.43 CMS (15 CFS). A 24-inch culvert will pass this peak flow with a total backwater of just less than one meter. This is reasonable for this area and since over 3.5 meters of depth is needed before the roadway would be overtopped, the 24-inch culvert is considered to be adequate.

4. Station 1352.6 - The area tributary to this point will contribute about 0.40 CMS (14 CFS) from a 10-year recurrence interval rainfall. As other factors are similar to Station 1100 and this culvert need handle lesser flows, a 24-inch culvert will suffice at this location as well.

5. Station 1701 - Although a 24-inch culvert at this location may cause the road to be overtopped once every 20 years, this is not unreasonable for this area and is therefore recommended for design.

6. Station 2535.6 - The estimated flow from the area tributary to this location is, again, less than what may be expected at Station 1100. Therefore, a 24-inch culvert is again recommended for design.

7. Station 2780 - As stated previously, the 100-year flood flow of 28.72 CMS (1010 CFS) can be passed with four 10 ft. by 8 ft. box culverts. This will maintain the flood elevation of 472.03.

8. Station 4135 - Very little flow is expected upstream of this culvert so a 24 inch CMP culvert will suffice. Ditching north to Swamp Creek may be considered instead of this culvert.

This preliminary study used state of the art hydrologic and hydraulic techniques to determine the sizes of the various drainage structures required to pass flood flows while maintaining backwater depths within acceptable limits. No attempt was made to examine structural integrity, materials of construction, or service life of the given sized culverts. Considerations beyond the scope of this study may make other culvert shapes, sizes, or materials more desirable than those suggested herein. These would be acceptable from a hydraulic standpoint if conveyance is provided equal to or greater than those culverts referred to in this memorandum.

Computer output for both the TR20 and various HEC-2 program runs, as well as other data and documentation is available from this writer if such information is required.

APPENDIX 5

SWAMP CREEK CROSSING

APPENDIX 5

SWAMP CREEK CROSSING

By Ken Englebert, P.E.
Structural Engineer

I. GENERAL

A. Location

The access road will require one bridge located at $\mathcal{L}$ Station 2810.05, spanning over Swamp Creek.

B. Design Parameters

1. Live Load HS 20.
2. Future Wearing Surface 20 psf.
3. Reinforcing Steel Grade 60 Bars (Fy = 60,000 P.S.I.).
4. Concrete Ultimate Strength fc' = 4000 P.S.I.
5. Codes AASHTO 1977 (with interim specifications to 1980).
6. Designed in accordance with Wisconsin Department of Transportation Standards for Highway Bridges.
7. Steel Pile Allowable Stress 9000 P.S.I. (A36 Steel).
8. Clear roadway width 40'.
9. Skew Angle 30°.
10. Span 126 feet.

C. Preliminary Design

All drawings, calculations, and studies have been performed based on the preliminary design of the roadway and on the preliminary design of structural members. Preliminary structural design was performed to the extent necessary to verify member sizing in some cases only. Several members have not been structurally verified, but through experience should be adequate. All members must be verified through final design.

II. CONCLUSIONS

Based upon the estimated construction cost of a 126 foot span prestressed girder bridge, no other alternatives were considered for the bridge structure. Previous cost estimates for alternative bridge types spanning only 95' indicate the prestressed girder bridge to be more cost effective. Listed below are the results of this previous study (Appendix 4, Volume II, Final Report, Contract No. 21704). For a 95 foot span bridge

a. Alternate No. 1	Steel Plate Girder Structure	$ 215,000.00
b. Alternate No. 2	Prestressed Girder Structure	175,000.00
c. Alternate No. 3	Poured in Place Box Culvert	225,000.00
d. Alternate No. 4	Precast Box Culvert	225,000.00

Attached to this report for reference are copies of the previous study pertinent to the Swamp Creek Bridge structure.

III. SELECTED ALTERNATE

1. Bridge Type - 70" Prestressed Girder with 8" Composite Slab
2. Span - 126 feet.
3. Estimated Construction Cost $ 206,480.00
   (Based on 1983 Construction)

70" prestressed concrete girders	635 l.f. @ $90.00	$ 57,150.00
Excavation and undercut	Lump Sum	1,000.00
Concrete Masonry & Reinforcing	323 c.y. @ $300.00	96,900.00
Steel HP Piles 10"x42 lb./ft.	700 l.f. @ $16.00	11,200.00
Heavy Rip Rap	270 c.y. @ $28.00	7,560.00
Type "F" steel railing	258 l.f. @ $50.00	12,900.00
Bearing Pads	Lump Sum	1,000.00
Sub-Total		$ 187,710.00
Plus 10% Contingency		18,770.00
Total Estimated Constr. Cost		$ 206,480.00

IV. CONSIDERATIONS FOR FINAL DESIGN

1. For ease of snow removal, Type "F" steel railings are proposed. If desired, reverting to concrete parapet walls would realize a cost savings of approximately $6,000.00.

2. Relocating the bridge to the west approximately 50 feet would result in a shorter, less expensive bridge due to a narrower stream width. This alignment would afford a bridge span of approximately 80 feet which would allow use of 45 inch girders.

3. The bridge span could also be reduced by 11 feet by lowering the road grade by 3.7 feet. At present, the clear distance between the 100 year flood line and the bottom of the girders is approximately 5.7 feet. Current bridge standards allow for 2 foot minimum clearance and thus the road grade could be lowered. Obviously, the cut/fill quantities would have to be investigated to accomplish this.

   This 11 foot reduction would also apply to (2) above, and would result in a span of approximately 69 feet. This span would even be further reduced depending upon the effect the reduced bridge cross sectional area has upon the high water mark of the 100 year flood. As the 45 inch girders set "higher out of the water", they could be lowered further with an optimum span of approximately 64 feet.

4. All members, reinforcing, and prestress calculations will have to be verified in the final design.

ACCESS ROAD PROJECT

Project I.D. 21074

Preliminary Report

Structures

EXXON MINERALS CORPORATION

Access Road Project
Project I.D. 21074
Preliminary Report
Structures

I. GENERAL

A. Locations

Two bridge structures and two box culverts will be required for the access road identified as follows:

1. Swamp Creek Structure
   Over Swamp Creek at access road station 2773.00.

2. Railroad Overpass Structure
   Over the railroad tracks west of the mill site at access road station 4078.07.

3. Box Culvert No. 1
   Access road station 2005.

4. Box Culvert No. 2
   Access road station 2236.

B. Design Parameters

Applicable to both bridges are the following design parameters:

1. Live Load HS 20
2. Future Wearing Surface 20 PSF
3. Reinforcing Steel Grade 60 Bars (fy = 60,000 P.S.I.)
4. Concrete Ultimate Strength fc' = 4000 P.S.I.
5. Codes - AASHTO 1977 (with interim specifications to 1980).
6. Designed in accordance with Wisconsin Department of Transportation Standards for Highway Bridges.
7. Soil Bearing capacities assumed as per the soils report furnished by Exxon = 6,000 P.S.I.
8. Clear roadway width = 44'.

C. Preliminary Design

All drawings, calculations, and studies have been performed based on the preliminary design of the roadway and on the preliminary design of structural members. Preliminary structural design was performed to the extent necessary to verify member sizing in some cases only. Several members have not been structurally verified, but through experience should be adequate. All members must be verified through final design.

The purpose of this report is to convey the economics of various alternatives considered for each bridge structure and to further investigate the parameters of the selected alternate, to provide the cost estimate for the selected alternate, and an estimated schedule for construction of the alternate.

All construction costs assume estimated construction costs in the year 1982.

II. CONCLUSIONS

Based on estimated construction costs of the various alternates considered for each bridge, the following bridge types and their respective estimated construction costs based on subsequent preliminary designs are as follows:

A. Swamp Creek Structure

1. Bridge type: 54" prestressed girder.
2. Estimated construction cost - $175,000.00.

B. Railroad Overpass Structure

1. Bridge type: 45" prestressed girder (3 span).
2. Estimated construction cost - $248,000.00.

III. SWAMP CREEK STRUCTURE

A. Evaluation of Alternates Considered

Four alternates were initially considered for the Swamp Creek structure as follows:

1. Summary of alternates and estimated costs.

	Description	Estimated Construction Cost
a. Alternate No. 1	Steel Plate Girder Structure	$ 215,000
b. Alternate No. 2	Prestressed Girder Structure	175,000
c. Alternate No. 3	Poured in Place Box Culvert	225,000
d. Alternate No. 4	Precast Box Culvert	285,000

2. Detailed Material Listing and Cost Breakdown of Alternates

a. Alternate No. 1 - Steel Plate Girder Structure

Description Span = 95'

Materials

Main Girders - 5 steel plate girders - ASTM A-588 (Corten Steel) at 10'-0" O.C.
Web = 48" deep x 3/8" thick with stiffeners
Flange = 16" wide x 1½" thick with shear studs.
Superstructure: 8½" thick composite concrete slab.
Substructure: Type A-3 abutments with treated timber piles (20 ton capacity) placed 2'-4" O.C.

Quantitites

Girders	(224 lb/ft)(95')(5 each) ÷ 2000	=	53 Tons
Deck	$(\frac{8.5}{12})(47)(95) \div 27$	=	117 C.Y.
Parapets	(190 l.f.)(1.43) ÷ 27	=	10 C.Y.
Abutments & End Diaphragms	(49 ft^3/ft)(92)÷27	=	167 C.Y.
Piles	44 piles @ 32' each	=	1,408 l.f.

Estimate

Girders	53 Tons @ $ 1500	$	79,500.00
Deck	117 C.Y. @ $ 250		29,250.00
Parapets	10 C.Y. @ $ 250		2,500.00
Abutments	167 C.Y. @ $ 300		50,100.00
Piles	1,408 l.f. @ $ 14		19,712.00
Excavation, Site Work, Rip Rap, etc.			8,200.00
Mobilization, Clean Up, Field Office			12,000.00
Painting (secondary members only)			3,000.00
	Sub-Total	$	204,262.00
	Plus 5% Contingency		10,213.00
	Total Estimated Construction Cost		214,475.00
	Say	$	215,000.00

b. Alternate No. 2 - Prestressed Girder Structure

Description Span = 95'

Materials

Main Girders - 5 each 54" prestressed concrete girder sections @ 10'-0" O.C.
Superstructure - 8½" thick composite concrete slab.
Substructure - Type A-3 abutments with treated timber piles (20 ton capacity) placed 2'-0" O.C.

Quantities

Girders	5 each @ 95 1.f.	=	475 1.f.
Deck	(see Alternate 1)	=	117 C.Y.
Parapets	(see Alternate 1)	=	10 C.Y.
Abutments & End Diaphragms	$(50.3\ ft^3/ft)(92) \div 27$	=	171 C.Y.
Piles	50 piles @ 32' each	=	1,600 1.f.

Estimate

Girders	475 1.f. @ $ 85.00	$ 40,375.00
Deck	See Alternate No. 1	29,250.00
Parapets	See Alternate No. 1	2,500.00
Abutments	171 C.Y. @ $ 300.00	51,300.00
Piles	1,600 1.f. @ $ 14.00	22,400.00
Excavation, Site Work, Rip Rap		8,200.00
Mobilization, Clean Up, Field Office		12,000.00
	Sub-Total	$ 166,025.00
	Plus 5% Contingency	8,301.00
	Total Estimated Construction Cost	174,326.00
	Say	$ 175,000.00

c. Alternate No. 3 - Poured in Place Box Culvert

Description

4 cell box culvert 10' wide x 8' high (each cell) 123 feet long plus 10' aprons on each end.

All walls and slabs 1'-0" thick.

Provide 1.5' gravel fill under base slab (Remove unsuitable soil and replace with gravel fill)

Quantities

4 cell box culvert $\frac{(45)(123)(2) + 5(1)(8)(123)}{27}$ = 592 C.Y. + Haunches	600 C.Y.
Aprons, wingwalls, cut-off walls	50 C.Y.
Gravel fill under base (1.5')(143')(45') ÷ 27 = 357.5	360 C.Y.
Select backfill to road sub-base (8')(45')$\frac{(44+123)}{2}$÷27	1,120 C.Y.
Excavation (2.5')(45')(143') ÷ 27	600 C.Y.

Estimate

4 cell culvert	600 C.Y. @ $ 300.00	$	180,000.00
Aprons, wings, cut-off walls	50 C.Y. @ $ 250.00		12,500.00
Gravel Fill	360 C.Y. @ $ 5.00		1,800.00
Select Backfill	1,120 C.Y. @ $ 2.50		2,800.00
Excavation	600 C.Y. @ $ 3.00		1,800.00
Dam, Sheet Piling or Pumping (Stream Control)	Lump Sum		5,000.00
Rip Rap & Site Work	Lump Sum		3,000.00
Mobilization, Clean Up, Field Office			8,000.00
Sub-Total		$	214,900.00
Plus 5% Contingency			10,745.00
Total Estimated Construction Cost			225,645.00
Say		$	225,000.00

d. Alternate No. 4 - Precast Box Culvert

Description: Same as Alternate No. 3, but use precast sections 6' long (8' x 10') in lieu of cast in place structure.

Estimate

Precast sections	84 sections @ $ 2500.00		$ 210,000.00
Precast Sections	Erection		28,000.00
Aprons, wings, cut-off walls	50 C.Y.	@ $ 250.00	12,500.00
Gravel Fill	360 C.Y.	@ $ 5.00	1,800.00
Select Backfill	1,120 C.Y.	@ $ 2.50	2,800.00
Excavation	600 C.Y.	@ $ 3.00	1,800.00
Stream Control		Lump Sum	5,000.00
Rip Rap - Site Work		Lump Sum	3,000.00
Mobilization, Clean Up, Field Office			8,000.00
	Sub-Total		$ 272,900.00
	Plus 5% Contingency		13,645.00
	Total Estimated Construction Cost		286,545.00
		Say	$ 285,000.00

3. Conclusions.
Based on the foregoing comparisons, preliminary engineering for Alternate No. 2, "Prestressed Girder Structure", was performed to further define the structural system.

B. Selected Alternate - Prestressed Girder Bridge

1. Specific Requirements: Bridge to be located on a 349.276 meter radius horizontal curve with a superelevation of .08 meter/meter, with a 40° Skew.

2. Cost Estimate
Based on the subsequent preliminary design, the cost estimate is as follows:

Excavation	Lump Sum	$	1,000.00
Concrete Masonry	325 c.y. @ $230.00		74,750.00
Prestressed Girders-54"	485 l.f. @ $ 85.00		41,225.00
High Strength Bar Steel Reinforcing	42,400 lb. @ $0.50		21,200.00
Structural Carbon Steel	1,214 lb. @ $0.75		910.50
Treated Timber Piles - Driven	782 l.f. @ $ 1.75		1,368.50
Treated Timber Piles - Delivered	850 l.f. @ $ 11.00		9,350.00
Heavy Rip Rap	200 c.y. @ $ 28.00		5,600.00
Woven Wire Fabric	138 s.y. @ $ 4.00		552.00
Surface Drain	1 each @ Lump Sum		1,500.00
	Sub-TOTAL	$	157,456.00
	Plus 10% Contingency		15,745.60
	Total Estimated Const. Cost	$	173,201.60
	Say	$	175,000.00

3. Considerations for final design.

   a. The skew angle of 40° creates numerous problems. If possible, a skew angle of 35° would be more desirable, and should be investigated in the final design.

   b. For symmetry the Northwest Wingwall could be lengthened to 14' to match the Northeast Wingwall. This alteration would be for aesthetics only and need not be considered for structural reasons.

   c. All members, reinforcing, and prestress calculations will have to be verified in the final design.

APPENDIX 6

ENVIRONMENTAL

ENVIRONMENTAL

APPENDIX 6

The following appendix contains excerpts from the Department of Transportation Facilities Development Manual (F.D.M.) and a summation of environmental concerns in the form of the environmental screening worksheets.

The excerpts from the F.D.M. are included due to the importance to note the environmental action list and the categorization of actions.

Originator	Procedure
BUREAU OF ENVIRONMENTAL ANALYSIS AND REVIEW	21-5-1

Chapter	21	ENVIRONMENTAL DOCUMENTS, REPORTS, AND PERMITS
Section	5	DOCUMENTS
Subject	1	ENVIRONMENTAL ACTION LIST - CATEGORIZATION OF ACTIONS

The first step in deciding the appropriate type of environmental documentation for a project is to compare the proposed action to the Environmental Action List (see Figure 1). This list, prepared for the Wisconsin Environmental Policy Act, is compatible with the regulations issued by the Federal Council on Environmental Quality (40 CFR 1500 et seq), the U.S. Department of Transportation (order 5610.1C) and the Federal Highway Administration (23 CFR 771 et seq). The actions on this list are categorized as Type I, II, IIIA, IIIB, or IIIC.

Type I - Actions for which an Environmental Impact Statement (EIS) is always prepared. An EIS shall be prepared for any proposed major action significantly affecting the environment. (See procedure 21-5-5 for a detailed explanation of this process).

Type II - Actions which may or may not require an EIS. These actions require that an Environmental Assessment (EA) be performed to determine their significance. If it is concluded from the EA that the project's effects will be significant, an EIS is required; if not, a Finding of No Significant Impact (FONSI) is prepared by FHWA. The screening worksheet entitled Environmental Screening of Facilities Development Actions is the document used to evaluate a Type II action. (See procedure 21-5-10 for detailed treatment of the Type II process.)

Type III - Actions for which neither an EIS nor an EA is required. These actions are termed Categorical Exclusions and a determination has been made that they do not have a significant effect on the human environment. They have been further categorized as either IIIA, IIIB, or IIIC to reflect different internal reporting and processing requirements.

IIIA requires documented concurrence by both the responsible district director and the Bureau of Environmental Analysis and Review (BEAR).

IIIB requires documented concurrence by the responsible district director.

IIIC requires no environmental documentation.

DEVELOPMENT OF FACILITIES

Action Identification	Description/Comments	Action Category
1. Major highway construction. Current or first-year traffic level at more than 5000 Average Daily Traffic (ADT); 2-Way. Generally adding lane capacity.	Work of shorter lengths than described or on highways of less traffic volume are Category II. Can include new bridge construction on new location.	
a. Freeways or expressways on new location. Any length if located within a Standard Metropolitan Statistical Area (SMSA). For more than 4.0 miles if located outside an SMSA.	For purposes of this list, a highway is not considered to be on relocation if the new R/W is contiguous to the R/W of the existing location.	I
b. Any other rural type highway on new location for more than 5.0 miles within an SMSA. 10.0 miles if outside an SMSA.		I
c. Reconstruction of an existing two-lane rural type facility to a divided multilane facility for more than 5.0 miles within an SMSA. 10 miles if outside an SMSA.		I
d. Adding through lanes to an existing rural type divided highway with extensive R/W or reworking of interchanges required for more than 5.0 miles within an SMSA. 10 miles if outside an SMSA.		I
e. Same as above, but little additional R/W or re-working of interchange necessary.		I
f. Construction of second roadway of planned divided facility. Most or all R/W and main grading done during first stage.	Environmental documentation of first stage may have adequately documented second stage, but re-assessment is necessary.	II
2. Highway Reconstruction		
a. Total reconstruction of an existing highway, generally oriented to the existing alignment.	Includes improvement of horizontal and vertical geometrics and short segments on new location. Could require fairly extensive amounts of right of way. Does not generally involve increasing capacity by adding more through lanes on rural highways.	II

Originator	Procedure
BUREAU OF ENVIRONMENTAL ANALYSIS AND REVIEW	21-5-10

Chapter	21	ENVIRONMENTAL DOCUMENTS, REPORTS, AND PERMITS
Section	5	DOCUMENTS
Subject	10	ENVIRONMENTAL ASSESSMENTS (TYPE II ACTIONS)

OBJECTIVES

This procedure describes the documentation and processing of Type II Actions.

BACKGROUND

In implementing the Wisconsin Environmental Policy Act (WEPA), WisDOT established a category of actions which may or may not significantly affect the quality of the human environment. The actions under consideration here are designated Type II according to the Environmental Action List (Procedure 21-5-1, Figure 1).

Completion of an Environmental Assessment (EA) is a means to decide whether a proposed action will require an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). If it is determined that the proposed action will not have a significant effect, the EA becomes a FONSI by obtaining the cover sheet signatures. When review of the EA indicates that there are significant impacts, a decision may be made to prepare an EIS in which case the procedure for Type I Actions is then followed, starting with the "Notice of Intent". (See Procedure 21-5-5.)

PROCESS

The environmental assessment (EA) process requires both the completion of an environmental document and a 30 day period of availability for it. An assessment consists of the appropriate portions of the Screening Worksheet (21-5-10, Figure 1) and pertinent signatures.

An EA is prepared by the transportation district office and forwarded to the Bureau of Environmental Analysis and Review (BEAR). Send two (2) copies of the EA signed by the District Director (lower RIGHT-HAND signature block on Basic Sheet 1). BEAR will review the document and transmit it to FHWA. Once the FA is accepted (i.e., signed by BEAR and, if a federal action, FHWA), a copy of Basic Sheet 1 (with signatures) will be returned to the district. Any additional copies (beyond the first two) of the EA forwarded to BEAR will be signed and returned to the district.

information is presented, it might be necessary to rewrite some or all of the Environmental Assessment sheets and include them when forwarding sheets 1 and 4a. Changes resulting from comments and a summary and disposition of public hearing comments are placed on Basic Sheet 4a which is then added to the EA as Addendum A. A REVISED ASSESSMENT SHOULD SUPPLEMENT RATHER THAN DUPLICATE WHAT WAS STATED IN THE ENVIRONMENTAL ASSESSMENT.

The revised assessment, having the District Director's signature in the lower LEFT-HAND block on Basic Sheet 1 is forwarded to BEAR for review and concurrence. If in agreement, the revised assessment is signed and dated by the Director of BEAR. For a state action the assessment then becomes an FONSI. If the action is a federal one, the FHWA Division Administrator signs the assessment and it becomes an FONSI. A copy of Basic Sheet 1 with all appropriate signatures will be forwarded to the district, completing environmental documentation for a Type II Action.

An overview of this process in chart form is found in Figure 1 of Procedure 21-5-5.

FORMAT AND CONTENT

Environmental Assessment (EA)

An Environmental Assessment must contain the following information:

1. Description of the Proposed Action - Describe the length, termini, proposed improvements, etc.

2. Purpose (Need) of Proposed Action - Identify and describe the problem which the proposed action is designed to address. Any of the items discussed under "Purpose and Need" in Procedure 21-5-5 may be appropriate in specific cases.

3. Alternatives Considered - Discuss any alternatives to the proposed action which were considered and why they were not proposed for adoption.

4. Impacts - Describe the social, economic, and environmental impacts and provide an analysis of their significance.

5. Comments and Coordination - Describe all early coordination efforts and all comments received from government agencies and the public.

WisDOT has developed a standard format for presenting this information. It consists of a series of environmental Screening Sheets which are divided into Basic Sheets and Factor Sheets. Use of the Basic Sheets plus as many Factor Sheets as are appropriate to a specific action enable an Environmental Screening of Facilities Development Actions to be made. Each sheet of the series is illustrated in Figure 1 of this procedure.

Screening Sheet Flexibility

The key to using the environmental Screening Sheets is flexibility, in that only as many need be used as are necessary to adequately describe the impacts present (e.g., if there are no wetlands, no wetland factor sheets need be filled out).

Basic Sheet 1
E-D-850 1-80

WISCONSIN DEPARTMENT OF TRANSPORTATION

ENVIRONMENTAL SCREENING OF FACILITIES DEVELOPMENT ACTIONS

Project ID	Federal No.	Highway	County
		Exxon Access Rd.	Forest

Project Termini	Length
S.T.H. 55 - Exxon Mine/Mill Site	4.80 km (2.98 mi.)

1. Description of proposed action

Construction of entirely new highway on new right-of-way, Design Class C4 (12' lanes, 8' shoulders). Project will begin at STH 55 just south of the north line of Section 23, T35N, R12E; proceed in an easterly direction to the range line between R12E and R13E; then proceed southerly along the range line to the mine/mill site in the SW¼ of Section 30, T35N, R13E.

2. Purpose and need of proposed action. Include description of existing facilities, abutting facilities, and how the action links into the overall system. When appropriate, show that commitment for future work is not being made without evaluation. and that viable alternatives in a larger framework are not being unduly foreclosed.

Road needed to provide access to a proposed mine and mill to be constructed by Exxon Minerals Co.

14.5 hectares

3. Approximate amount of R/W to be acquired 35.8 acres (including all easement types) 0 Businesses, and 0 Residences will be acquired.

4. The following environmental documentation is appropriate:

- ☐ Type I Action – EIS required
- ☒ Type II Action – Environmental Assessment required
  - ☐ Assessment shows significant impacts. EIS required.
  - ☒ This initial Assessment does not indicate significant impacts.
- ☐ Type III Action (Categorical Exclusion). No significant impacts.
  - ☐ A. – Pertinent screening sheets attached for Internal coordination
  - ☐ B. – No further documentation necessary

Finding of No Significant Impact (FONSI) After Public Availability	ACCEPTED
Action has no significant environmental impacts	
District Director — Date	District Director — Date
Director, Bureau of Environmental Analysis & Review — Date	Director, Bureau of Environmental Analysis & Review — Date

ENVIRONMENTAL FACTORS	SIGNIFICANCE IN VIEW OF OVERALL ISSUES								
	Weighting of Factors								COMMENTS
	IMPORTANT		OF SOME IMPORTANCE		SMALL IMPORTANCE		NO EFFECT	DOES NOT APPLY	
	BENEFIT	ADVERSE	BENEFIT	ADVERSE	BENEFIT	ADVERSE			
General Economics	X								Mine/mill development is important to local economy.
Community or Residential								X	
Commercial & Industrial	X								Mine/mill development cannot proceed without roadway construction.
Agriculture						X			2.4 hectares (5.9 acres) of "Prime" farmland will be converted to highway use.
Wetland, Flood-plain & Water						X			0.5 hectares (1.2 acres) of wetland will be destroyed.
Upland Wildlife Habitat				X					11.6 hectares (28.7 acres) of upland habitat will be destroyed.
Unique Area								X	
Air Quality							X		Comparison of projected conditions to the conditions as shown in the generalized ECM analysis in Fig. 1 of Proc. 22-15-5 of the Wisc. DOT Facilities Development Manual indicates that percent of NAAQS standard will not exceed 15%.
Sound Quality							X		No noise impact - no receptors within the influence of the project.
Other									

5. Summary of the alternatives considered and, if they are not proposed for adoption, why not.

Proposed Alignment - See "Description of proposed action", page 1.
Alternate Alignment - beginning at STH 55 approx. 900' south of the north line of Section 23, T35N, R12E; proceed east southeasterly to a point on the range line between R12E and R13E just north of Swamp Creek, then southerly along the range line to the mine/mill site in the SW¼ of Sec. 30, T35N, R13E. Not proposed due to DNR concerns.

6. General Description of existing land use for Project and Surrounding areas: (Include land use maps if available).

Farmland, commercial forest, wetlands.

a. Is there an adopted plan for the area? No If yes, briefly describe, or attach appropriate descriptive material.

b. Is the recommended alternate compatible with the adopted plan? N/A If not, how does it differ?

c. Is the project within a Coastal Zone County? No If so, is it or does it tangibly affect a GAMC? N/A

7. Briefly summarize status and results of agency coordination; coordination with elected officials; status of public involvement plan, (include consultation with DNR, SHPO, U.S. Fish & Wildlife, local planning commissions, GAMC officials in Coastal Zone.)

DNR - Proposed alignment was developed in consultation with the DNR.

E-D-850-77 Basic Sheet 4

TRAFFIC SUMMARY

		ALTERNATE	A11							
		SEGMENT TERMINI								
TRAFFIC VOLUMES	Existing	ADT (1982)	0							
	Const. Year	ADT (1982)	802							
	Const. + 10 Yr.	ADT (1992)	802							
	Design Year	ADT (2000)	802							
		DHV (2000)	125							
TRAFFIC FACTORS	Design Year	K (%)	13.7							
		D (%)	50							
		T (% of ADT)	5							
		T (% of DHV)	-							
		Level of Service	B							
SPEEDS	Existing	Posted	-							
	Design Year	Posted	55							
		Spot	-							
OTHER (Specify)		P (% of ADT)	-							
		K_8 (% of ADT)	-							

REMARKS:

GENERAL ECONOMICS IMPACT EVALUATION

Alternate

Length of centerline and termini this sheet is evaluating (if different from sheet 1)

1. Estimated cost of project (~~including R/W acquisition~~) construction only. $ 1,280,000

2. Describe briefly, the existing economic profile of the project area, where appropriate. This would include existing types of employment, property values, tax base, trade centers, markets, industrial areas, raw materials, or other factors contributing to the areas' economy.

   Farming, lumbering and tourist trade are major economic contributors. Area is generally depressed economically.

3. Estimate how the proposed action will affect (or change) the conditions described in (2).

   Construction of access road is necessary for development of mine/mill. The employment generated by the mine/mill will be of major significance to the economy of the area.

4. In general, will this action increase or decrease the potential for economic development?

   This action will significantly increase the potential for economic development in this area.

COMMERCIAL & INDUSTRIAL IMPACT EVALUATION

Alternate

Length of centerline and termini this sheet is evaluating? (If different from sheet 1)

1. Describing the existing pavement and shoulder width, type and condition at the commercial or industrial site.

   None

2. Describe nature of proposed change to roadway at this site, and discuss whether the proposed action will change the type or volume of traffic through commercial/industrial area.

   New roadway to be constructed to provide access to proposed mine/mill site.

3. Describe commercial or industrial operation and its current use of, or dependence upon, the roadway.

   Mine/mill cannot be developed without new roadway.

4. Describe any direct/indirect benefits or adverse impacts expected and describe any measures to minimize adverse impact or provide benefits.

   Construction will be beneficial to proposed mine/mill.

AGRICULTURAL IMPACT EVALUATION

Alternate

Length of centerline and termini this sheet is evaluating (if different from Sheet 1)

1. Describe general agricultural practice in area (produce truck farming, cash grain crop, dairying).

   Dairying

2. Describe acreage and quality of land to be acquired and effect on farm operations. If buildings are part of acquisition, describe type, condition, and importance to farm operations.

   2.4 hectares (5.9 acres) of land classified as "Prime" by the Soil Conservation Service and the U.S. Department of Agriculture.

3. Describe any severances of, or changes in access to, farm properties and the effect it will have on current operations.

   Road will sever parcel, leaving remnant of 8.0 hectares (20.0 acres) north of the road. Agricultural crossings may be provided.

4. Is a land use change or secondary development expected to occur in this area due to the proposed facility? Yes If yes, specify.

   Mine/mill will be developed in conjunction with this project.

5. Discuss any factors perceived to be beneficial or controversial by the operator and discuss measures to minimize adverse effects or provide benefits.

   None.

6. Results of coordination with DATCP:

   ☐ DATCP determined that an AIS would **not** be prepared for this project.

   ☐ DATCP published an AIS for this project on _____ . (date)

   Wis. Department of Agriculture, Trade and Consumer Protection (DATCP) has not been contacted.

WETLAND, FLOODPLAIN & WATER IMPACT EVALUATION
(WETLANDS)

Exxon Mine Access Road - Selected Alternate
Alternate

Swamp Creek Crossing
Length of centerline and termini this sheet is evaluating (if different from Sheet 1)

1. Wetland type or combinations of types (use DOI Circular 39 classifications); Wetland Name (if applicable) Wetland types 6, 7 and 8; Shrub swamp, wooded swamp and bog.

2. This wetland is X contiguous (in contact with), _____ adjacent (within 5-year floodplain) to a streamthread; _____ isolated from stream.
   NOTE: If wetland is contiguous or adjacent to a stream, answer stream questions also.

3. Approximate acreage of wetland 480 acres associated with this area of Swamp Creek (above Rice Lake)

4. Describe the wetland vegetation and indicate the dominant plant community(ies). (e.g. predominantly a sedge meadow, interspersed with tag alders, etc.)
   Birch, hemlock, dogwood, and tag alders. Ground layer consisting of sphagnum moss as well as other typical bog species.

5. List any observed or expected waterfowl/wildlife inhabiting or dependent upon wetland (both permanently and temporarily, such as migratory waterfowl, furbearers, deer may be dependent upon a bog for wintering, but do not inhabit it in other seasons.)
   Wetland does not offer good waterfowl habitat. However, fur bearers and white tail deer would be expected to inhabit the wetland area.

6. Are there any known rare/endangered species of plants or animals inhabiting or using the wetland?
   A bald eagle was observed flying east toward the Swamp Creek wetland area from Hwy. 55. However, no birds nor nesting areas were sited within the vicinity of the proposed project.

Wetlands (Continued)

7. Describe proposed work in wetland (fill, excavation, marsh disposal, etc.)

Proposed work would include clearing, excavation of muck, filling of other material and grading to build up the surface to roadway grade elevation. The right-of-way needed is 100' for the roadway. Excavated muck will be used to flatten fill slopes elsewhere along the roadway.

8. Total acres expected to be converted from wetland habitat to other use(s). (Include marsh disposal areas)

0.5 hectares (1.2 acres)

9. Summarize briefly why there are no "practicable" alternatives to the use of the wetland.

The roadway must cross Swamp Creek and associated strip of wetland at some point. This location minimizes the amount of wetland encroachment.

10. Describe proposed measures to minimize adverse effects or to enhance area (include any wetland areas to be "created" or replaced, placement of equalizer culverts, etc.).

After the muck is excavated, a granular drainage blanket will be constructed under the road bed to provide horizontal groundwater transfer. This will provide adequate groundwater drainage across the fill areas to prevent upland flooding. A bridge will be constructed across Swamp Creek which will pass floodwaters with no increase in existing flood elevations. The bridge will also allow passage of wildlife. Settling basins will be used prior to stream discharge of surface water runoff.

WETLAND, FLOODPLAIN & WATER IMPACT EVALUATION
(Streams and Floodplains)

1. Name:	Location:
Swamp Creek	S.24, T.35N.R12E; S19,T35N.R.13E

2. Stream Type: ☐ warm water ☒ trout stream ☐ unknown

3. Watershed area: 46.2 sq. miles ☒ Permanent flow (year around) ☐ Temporary flow (dry during part of year)

4. Briefly

a. Substratum: ☒ sand ☐ silt ☐ clay ☐ cobbles ☐ other (e.g., combinations of above, specify)

b. Average Water Depth	c. Vegetation in Stream	d. Briefly Describe Bank Vegetation
2-3'	☐ present ☒ absent	Birch, Alder, Dogwood, Hemlock

e. If known, list fish species.	f. Are there any known rare/endangered plant or fish species present?
Brook Trout	☐ Yes ☒ No

g. If water quality data is available, include this information (e.g., DNR or local dischargers might have such records).

5. Identify upstream or downstream dischargers or receivers (if any) in the project vicinity (within approximately 1/2 mile) of the project site.

None

6. Describe proposed work in, over, or adjacent to stream. Indicate whether the work is within the 100-year floodplain and whether it is a crossing or longitudinal encroachment.

The proposed crossing will be within the 100-year flood plain. A prestressed concrete girder bridge will be placed over Swamp Creek and roadway fills will be constructed. Associated with this, stream bank vegetation will be cleared.

7. Where structures are involved give existing waterway opening N/A. Proposed opening above min. required Discuss backwater effects, consistency and coordination with State and Local floodplain zoning authorities, including National Flood Insurance Program if applicable.

A flood flow study was completed and utilized in the design of the bridge for Swamp Creek. The opening will be adequate to handle 100 year flood flows without any increase in existing backwater elevations.

Streams & Floodplains (Continued)

8. Would the proposal (structure, design flood, or backwater) cause any of the following impacts? If yes, explain briefly.

   a. Significant interruption or termination of emergency vehicle service or a community's only evacuation route? No

   b. Significant flooding with a potential for property loss and a hazard to life? No

   c. Significant impacts on natural floodplain values? No

9. Will the proposal stimulate change to existing floodplain use/development? No If yes, explain briefly.

10. Discuss probable primary impacts to water quality during construction within the floodplain.

During construction, a short term increase in sediment load will occur. Some bank vegetation will be also lost. However, this is not expected to significantly raise water temperatures.

11. Describe proposed measures to minimize adverse effects or enhance stream or floodplain.

The bridge will be designed to accommodate 100 year flood flows. There will be sufficient clearance under the structure to allow the passage of wildlife. The stream banks will also be rip-rapped to eliminate erosion from the cleared areas. In addition, settling basins will be used along the length of the proposed roadway prior to stream discharge of surface water runoff.

UPLAND HABITAT IMPACT EVALUATION

Alternate

Data on pages 12 and 13 for general information only

Length of centerline and termini this sheet is evaluating (if different from Sheet 1)

1. Give a brief physical description of the area and generally categorize the upland plant communities.

   The area is commercial forest.

2. Describe predominant plant community(ies) **at the project site** (list vegetation with an estimate of acreages of each community type if more than one present).

   Various coniferous and deciduous species.

3. Discuss observed or expected wildlife associations with the plant community(ies).

   Large and small mammals and birds.

4. Are there any known rare/endangered plant or animal species inhabiting or dependent upon these areas? No

5. Discuss present land use for project area. Is it expected to change due to this project? If yes, how?

   Commercial forest will change on location of proposed mine/mill site.

6. Nature of proposed work (grading, clearing, grubbing, etc.).

   Clearing, grading and grubbing 30 m (100 ft.) corridor.

7. Estimate of acreages of each community type to be altered.

   11.6 hectares (28.7 acres) total.

Upland Habitat (Continued)

8. Are there any known wildlife or waterfowl migratory use areas or movement corridors that will be severed or eliminated by the roadway?

   No

9. Discuss other possible primary impacts on wildlife and estimate significance.

   Destruction of habitat and interruption of normal travel routes. Car kills will occur after road is opened.

10. Estimate acreages and types of habitat to be replaced or preserved within R/W, and wildlife species likely to inhabit these areas.

    None

11. Discuss any potential secondary impacts which may occur (strip development, frontage or access roads, other changes in land use which may result due to project).

    Mine/mill site will be developed. No other development anticipated.

12. Describe measures to minimize adverse effects or enhance area.

    Disturbed areas will be seeded to prevent erosion.

GENERALIZED ECM AIR QUALITY ANALYSIS
GUIDELINES FOR PROJECTS REQUIRING NO INDIVIDUAL ECM ANALYSIS

A series of air quality analyses has been done using the Environmental Capacity Screening Method. These were done for the peak-hour analysis for the year a project would be completed and for ten years hence for the worst conditions[1] for a range of average running speeds.

If the peak-hour traffic volumes are such that:

In the year the project will be completed for a given average running speed, the volumes do not exceed:

Average Running Speed	Peak-Hour Volume
15	900
20	1100
25	1350
30	1600
35	1800
40	2000
45	2150
50	2200
55	2250
60	2550

250 projected

And for ten years after the project is built, for a given average running speed, the volumes do not exceed:

Average Running Speed	Peak-Hour Volume
15	2650
20	3200
25	3800
30	4500
35	5000
40	5500
45	5750
50	5850
55	6050
60	7000

250 projected

Then, no individual ECM analysis need be done for this project. This series of ECM analyses encompasses the input variables for the individual project and indicates that the "% of the NAAQS standard" for the project is less than 15 percent.

50% cold starts violates "worst conditions" below, however volumes are extremely low, therefore % of the NAAQS std. should be < 15%.

[1] "Worst conditions" for this analysis is defined as 1980 as the year of construction completion and 1990 as ten years hence; vehicle mix of 80% LDV, 6% LDT 1, 6% LDT 2, 6% HDG, and 2% HDD; 25% cold starts; no inspection/maintenance; receptor distance of 43 feet from edge of the traveled lane of the roadway; and 15% of standard as the maximum for the ratio of actual peak-hour volume to critical peak-hour volume.

APPENDIX 7

TRAFFIC ANALYSIS

S.T.H. 55 - EXXON ACCESS ROAD INTERSECTION CAPACITY ANALYSIS

The Wisconsin Department of Transportion (D.O.T.) Facilities Development Manual recommends the use of a "Type B At - Grade Side Road Intersection" with optional passing lane for the anticipated Average Daily Traffic (ADT) volumes. (See Figures I through IV) The unusual peaking characteristics of the Exxon work force may, however, cause some short term capacity problems. Consequently, it is necessary to investigate the intersection capacity on a more detailed design hour basis.

For the purpose of this analysis, it was assumed that the design hour will center around the 3:00 P.M. mine shift change. The mine employs the most people, and shift changes for other employees occur at different times. To determine the amount of traffic on S.T.H. 55 at this time of day, an analysis was made of data from the nearest permanent traffic counting station which is located on U.S.H. 8 - S.T.H. 32 approximately 3 miles west of Laona. (See Figure V) The 100th highest hourly traffic volume was picked for design, which corresponds to the 30th highest hourly traffic volume occuring between 2:00 P.M. and 5:00 P.M. on non-holiday weekdays. (The 30th highest hourly traffic volume is often used for design purposes in Wisconsin). The amount of traffic occuring during the 100th hourly traffic volume is equal to 13.7% of the ADT. This 13.7% value (referred to as a K value) was then applied to the ADT of S.T.H. 55 as projected for the year 2000 (see figures I and II). The amount of traffic during the design hour on the Exxon Access Road was determined by applying an average per vehicle occupancy rate of 1.5 persons to the projected number of workers on a mine shift.

Capacity analysis is based on an analysis of the peak 15 minutes traffic within the design hour. To arrive at this volume on S.T.H. 55, a peak hour factor (PHF) of .75 was used. The PHF is the ratio of ¼ of the hourly traffic volume to the peak 15 minute traffic volume. In this specific case, it indicates that 33% of the design hour volume will occur in the peak 15 minutes of that hour. The peak 15 minutes traffic on the Exxon Access Road cannot be estimated by the use of a PHF because there is only one traffic generator (the Exxon Mine/Mill) and the times that traffic occurs and the duration of the traffic are controlled by conditions at the mine/mill. For shift dismissal two controlling factors are the mine elevator capacities and the provision of shower facilities for the workers. Analysis of these factors indicates that 60% of the shift traffic will occur during the peak 15 minutes. Shift arrival patterns are more dependent on personal choice with regard to how early they arrive at work and whether they need to change clothes. The 60% factor was assumed to be representative here as well, and as will be seen later in the analysis, the arrival capacities are not critical.

The design hourly traffic volumes and peak 15 minute traffic volumes are shown on Figures VI and VII. Traffic on the Exxon Access Road not generated by employees is assumed to be negligible during the shift change and is shown as zero. A separate diagram is shown for shift arrival and shift departure since this traffic is not coincident and does not conflict.

Table I shows that satisfactory capacity is provided for all movements on all approaches for the Wisconsin D.O.T. recommended Type "B" At-Grade Side Road Intersection with passing lane. The passing lane is provided because of the periodically high left turn volumes from the north. The peaking conditions on the Exxon Access Road do not warrant a higher type design for this intersection. Using the same K value and PHF as on S.T.H. 55, the equivalent ADT on the Exxon Access Road to produce the anticipated peaking is 1640. This result also shows that the Type "B" intersection should be selected (See Figure III).

TABLE I

CAPACITY - DEMAND - COMPARISONS

Movements	Capacity**		Year 2000 Design Hour Volumes	
	Hourly	Peak 15 Min.	Hourly	Peak 15 Min.
North Approach				
Total	1640	546	195	90
Left Turn	791	207	94	56
Ahead	849	339	101	34
South Approach				
Total	1505	483	132	53
Right Turn	275	128	31	19
Ahead	1230	355	101	34
East Approach				
Total	345	115	125	75
Right Turn	259	86	94	56
Left Turn	86	29	31	19
North mainline*	352	117	296	124
South mainline*	352	117	233	87
Exxon mainline*	651	217	125	75

Note: Capacity calculated for Level of Service B.

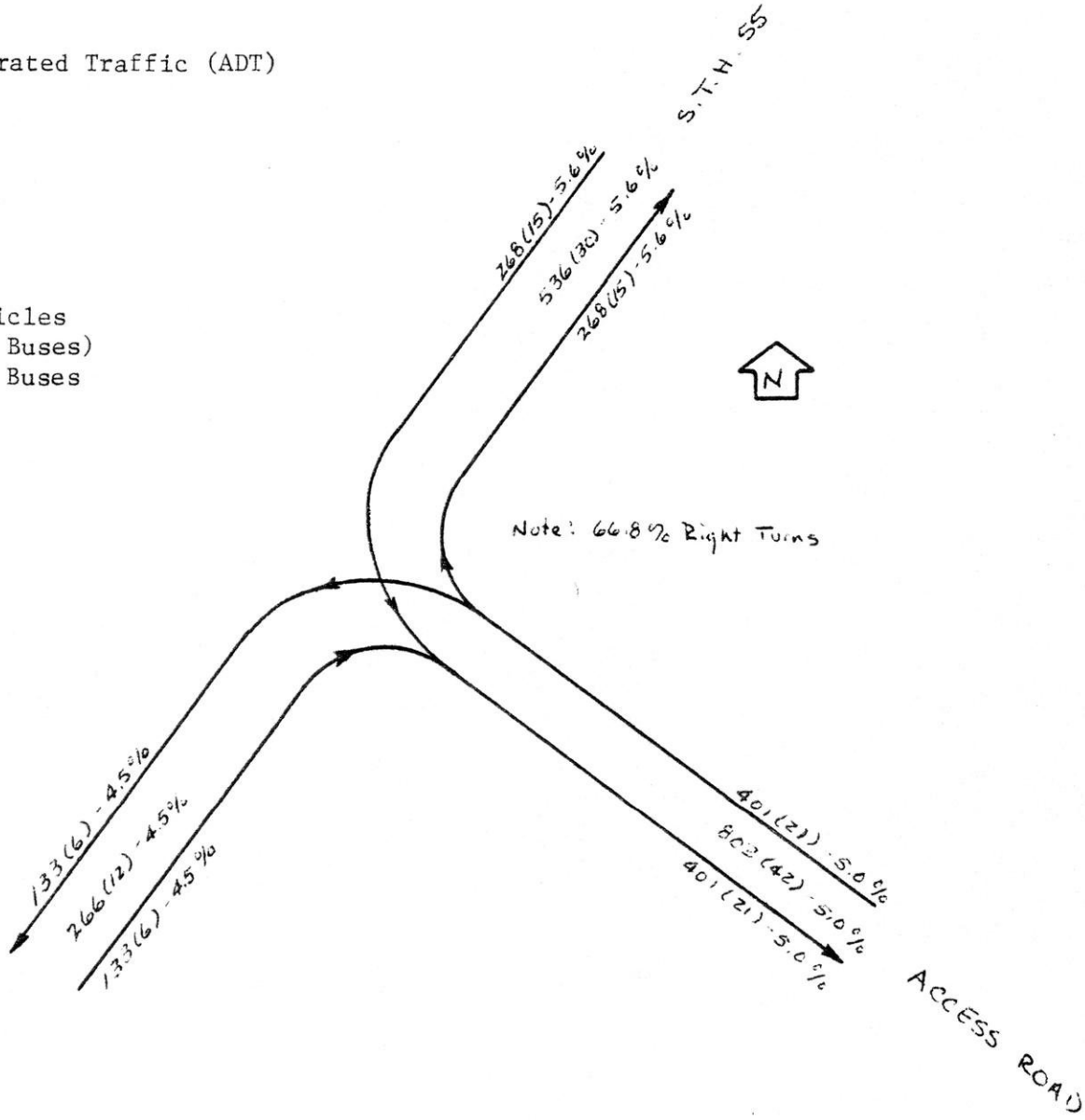
Level of Service is a qualitative measure of how well a section of roadway or an intersection is handling traffic. Levels of Service range from "A" through "F"; with Level of Service "A" reflecting very little traffic, completely free flow on the through roadway, and no delay beyond the required stop on the crossroad; and Level of Service "F" reflecting a large amount of traffic, stop-and-go flow on the through roadways, and extensive delays for traffic stopped on the crossroad. Level of Service B, then, reflects a moderate amount of traffic, generally free flow on the through roadway, and little delay for traffic stopped on the crossroad. Therefore, the capacities listed in Table I are the volumes of traffic that can be handled without cousing conditions worse than those for Level of Service B at the intersection. The capacity on S.T.H. 55 is actually controlled by the mainline as can be seen above

*Two-way volumes

**Capacities on each approach were calculated assuming the projected turn percentages and the design hour volumes on the opposing legs.

Site-Generated Traffic (ADT)

Total Vehicles
(Trucks & Buses)
% Truck & Buses



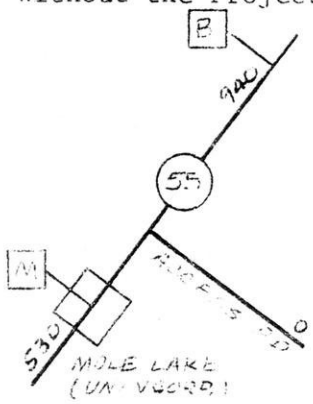
Source: Inman - Foltz

FIGURE I

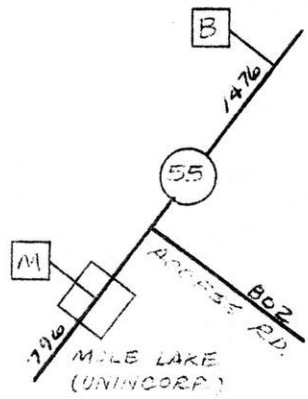
Two-Way Traffic (ADT)

Current Traffic

Without the Project

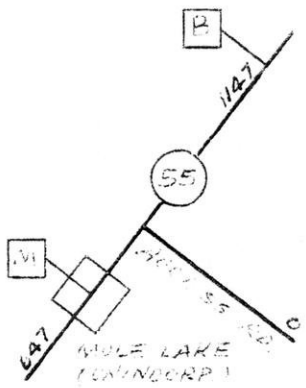


With the Project

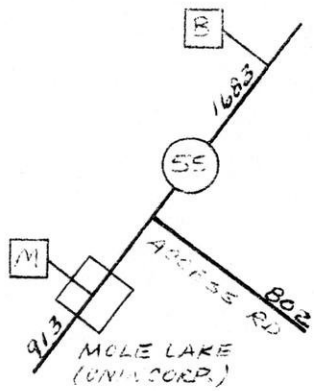


Future Traffic (20 yr.)

Without the Project



With the Project



Projections of future traffic without the project are based on an assumed growth rate of 0.95% per year. This number is derived from other work in a nearby community, but must be regarded as approximate.

The % trucks on S.T.H. 55 is unknown. Based on studies at other locations, this could range from 7.5 to 12.5% of the total traffic.

FIGURE II

Originator	Procedure
CHIEF DESIGN ENGINEER	11-25-1

Chapter	11	DESIGN
Section	25	INTERSECTIONS AT GRADE
Subject	1	GENERAL

RURAL

At-grade intersections will normally be of Type A, B, or C, as shown on Standard Detail Drawing entitled, "Layout Details for At-Grade Side Road Intersections." Warrants for selecting the standard at-grade intersections are:

1. Type A: To be used when current traffic volumes on the through highway exceed 2,500 ADT and on the side road, exceed 1,000 ADT.

2. Type B: To be used on new construction, reconstruction, and RRR projects when current traffic volumes on both the through highway and the side road exceed 250 ADT and the sum of both exceeds 1,500. However, if the acquisition of new right-of-way or substantial earthwork would be required, the merits of improved traffic flow should be weighed against increased construction costs, lengthened project development time to acquire R/W, disruptions to adjacent property, etc. If a Type "B" intersection cannot be justified at a specific location, the designer should consider modifying the design as would best meet the needs of the particular situation. If this results in no material advantage, then a Type "C" intersection should be used.

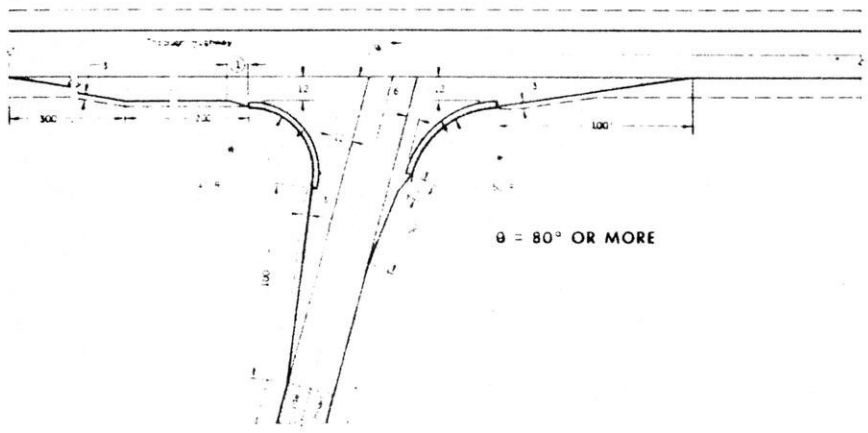
3. Type C: To be used at all intersections not meeting warrants for Type A or Type B intersections.

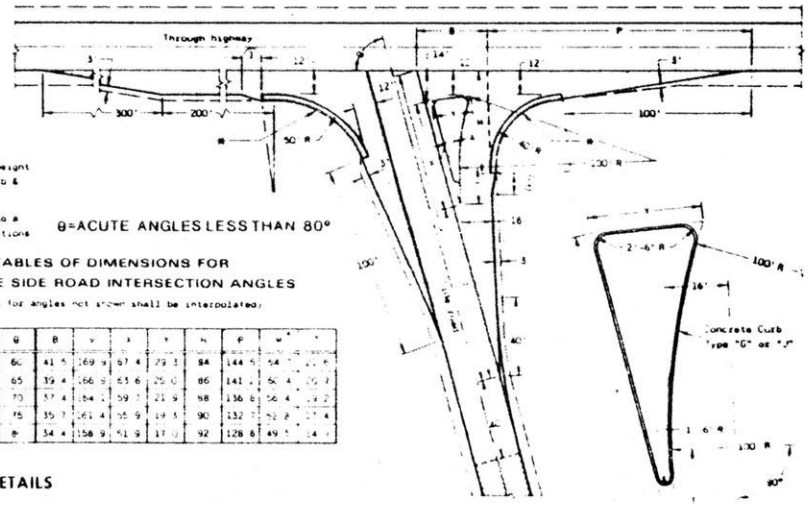
4. Passing Lane: To be used on all "T" intersections of Type A. A passing lane may be used on Type B and Type C intersections when warranted by unusual traffic conditions.

Sight distance requirements for intersections should be in conformance with AASHTO policy as stated in "A Policy on Geometric Design of Rural Highways," AASHO, 1965 (pp. 393-401), using a minimum time of eight seconds to perceive a situation and act to avoid another vehicle. See the equation on page 395, $d = 1.47\ (J + T_a)$, in which the minimum value of $(J + T_a)$ should be eight seconds.

URBAN

At-grade urban intersections are made up of a variety of types that cannot be grouped by a class of highway. Factors that influence intersection design are peak-hour traffic volumes, left- and right-turning vehicles, traffic control, turning roadways, auxiliary lanes, pedestrian traffic, and right-of-way limitations. The proximity of commercial and industrial sites may require special ramps or in some cases an interchange. Of primary concern is the intersection geometrics that can be provided to accommodate the high traffic volumes within a generally restricted width of roadway right-of-way.





* Concrete Curb & Gutter 36" Taper Curb height from 6" to 0" for 10' length at ends of curb & gutter sections

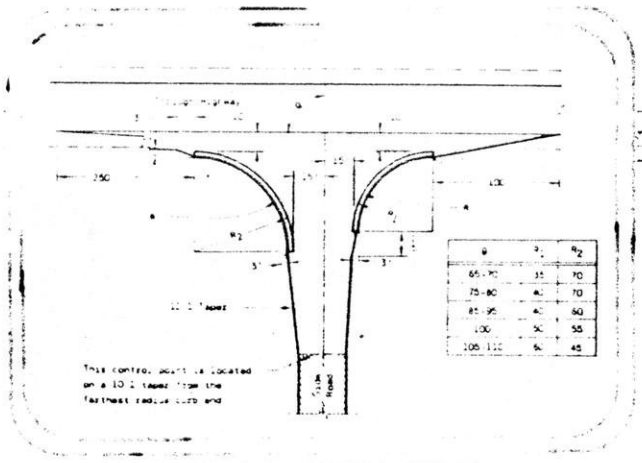
Provide 4:1 or salvaged topsoil & seed to a 1' width at back of curb & gutter sections

TABLES OF DIMENSIONS FOR
VARIABLE SIDE ROAD INTERSECTION ANGLES

Values for angles not shown shall be interpolated

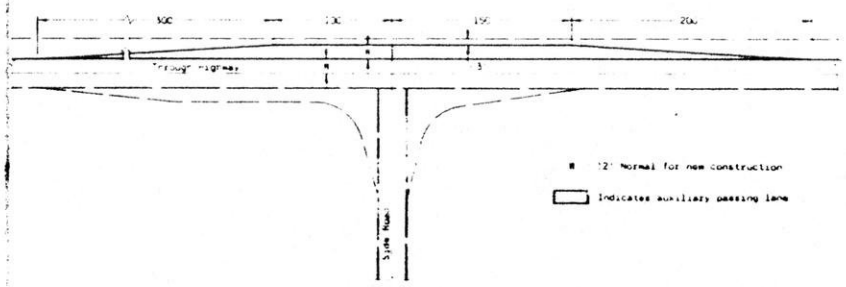
θ	B	x	A	Y	N	P	W	Y
60	41.5	269.9	67.4	29.3	84	144.5	54	40.8
65	39.4	266.5	63.6	25.0	86	141.1	56.4	39.7
70	37.4	264.1	59.1	21.9	88	136.8	56.4	38.2
75	35.7	261.4	55.9	19.5	90	132.7	56.8	37.4
80	34.4	258.9	51.9	17.3	92	128.8	49.1	34.4

TYPE "A" SIDE ROAD INTERSECTION DETAILS



θ	θ_1	θ_2
65-70	35	70
75-80	40	70
85-95	45	60
100	50	55
105-115	55	45

TYPE "B" SIDE ROAD INTERSECTION DETAILS



PASSING LANE DETAIL

GENERAL NOTES

Designs may be used interchangeably in combination or separately for any one complete intersection depending on intersection angle and surfacing of each approach roadway

SIDE ROAD SURFACING NOTE

If the side road is not presently paved, paved pavement shall be placed to the limits shown. In the case where the construction limits are beyond the paving limits, crushed aggregate surfacing shall be placed between the paving limits and construction limits.

If the side road is presently paved, new pavement shall be placed to the limits of design as shown and beyond, if necessary, to meet existing pavement.

If the side road is the construction project, the intersection surfacing shall be the same as for the project.

New Pavement

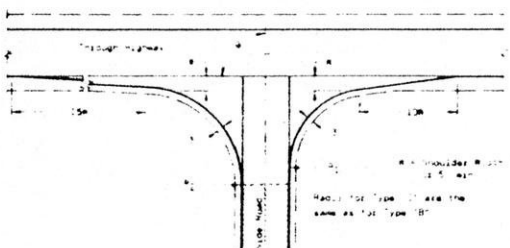
Existing Surface

DESIGN NOTES

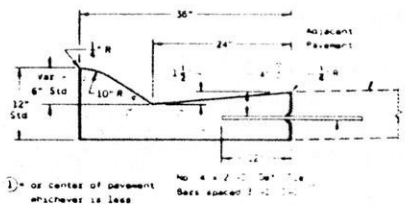
THE DESIGNER SHOULD STRIVE TO AVOID θ INTERSECTION ANGLES OF 65° OR LESS INCLUDING 80° OR MORE.

INTERSECTION DESIGNS WITH CURBING WILL ACCOMODATE THE TURNING PATH OF THE DESIGN VEHICLE. HOWEVER THE RESULTING PAVEMENT WIDTH WILL BE WIDER THAN THE TYPE C INTERSECTION WILL ENCROACH INTO THE OPPOSING TRAFFIC LANE.

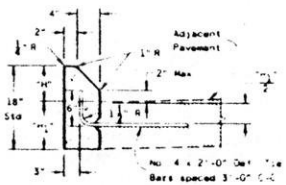
NOTE
DESIGN NOTES WILL NOT APPEAR ON FINAL PLANS.



TYPE C SIDE ROAD INTERSECTION DETAILS



TYPE A (INCLUDING TIE BARS)
TYPE D (EXCLUDING TIE BARS)
CONCRETE CURB & GUTTER 36"



TYPE G (INCLUDING TIE BARS)
TYPE J (EXCLUDING TIE BARS)
CONCRETE CURB

LAYOUT DETAILS FOR AT-GRADE
SIDE ROAD INTERSECTIONS

State of Wisconsin
Department of Transportation

APPROVED 2-5-92

S.D.D. 9 A 1-5

FIGURE IV
K.A.N. 1, 1984
S.D.D. 9 A 1-5

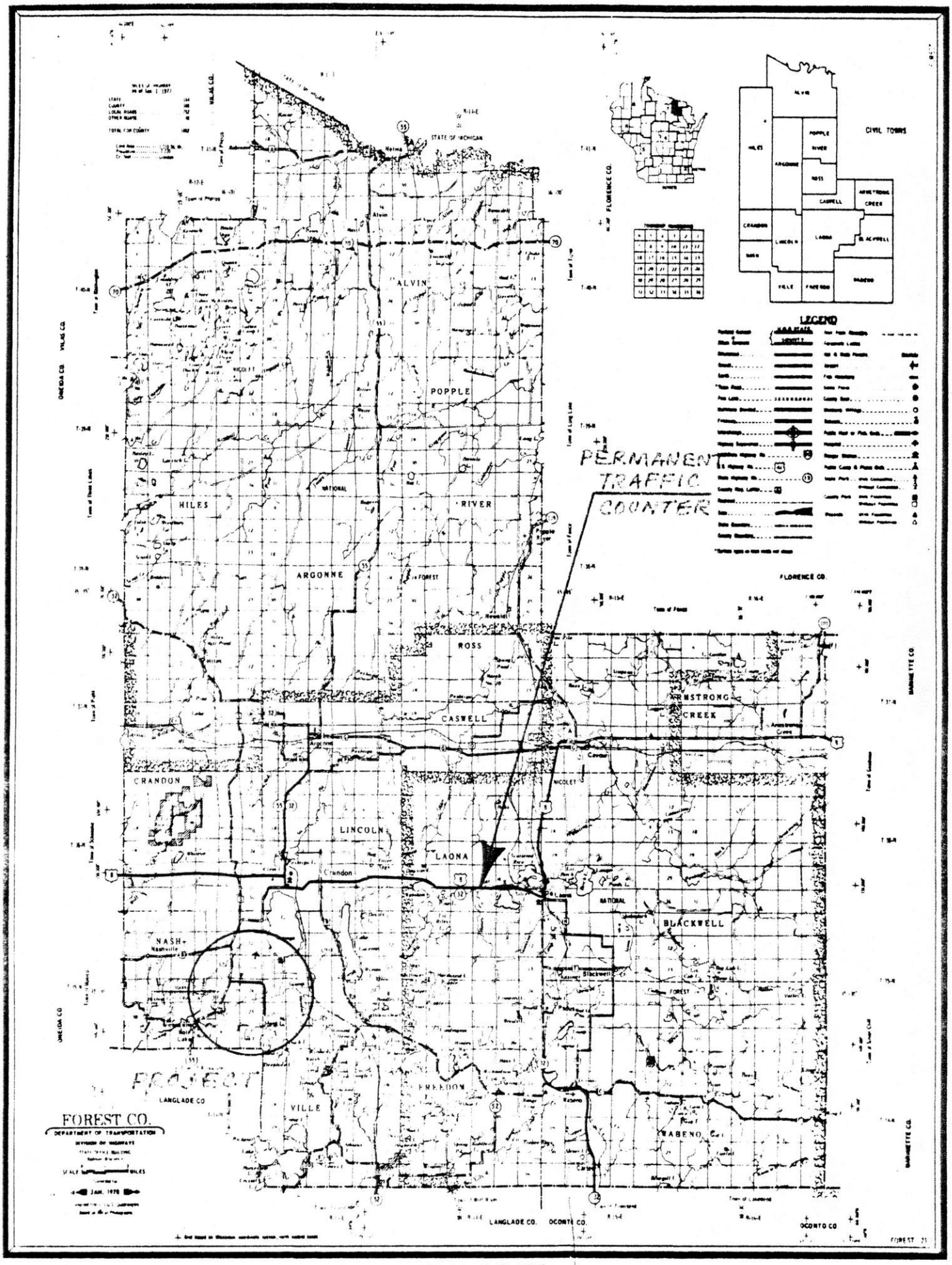

PERMANENT TRAFFIC COUNTER
LEGEND
CIVIL TOWNS
ALVIN
POPPLE
HILES
POPPLE RIVER
ARGONNE
NATIONAL FOREST
ROSS
CASWELL
ARMSTRONG CREEK
CRANDON
LINCOLN
LAONA
NATIONAL FOREST
BLACKWELL
NASH
FREEDOM
VILLE
WABENO
FOREST CO.
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
JAN. 1978
FLORENCE CO.
LANGLADE CO.
OCONTO CO.
ONEIDA CO.
MARINETTE CO.
STATE OF MICHIGAN

FIGURE V

FORM E-T-704-64

STATE HIGHWAY COMMISSION OF WISCONSIN

SHIFT ARRIVAL

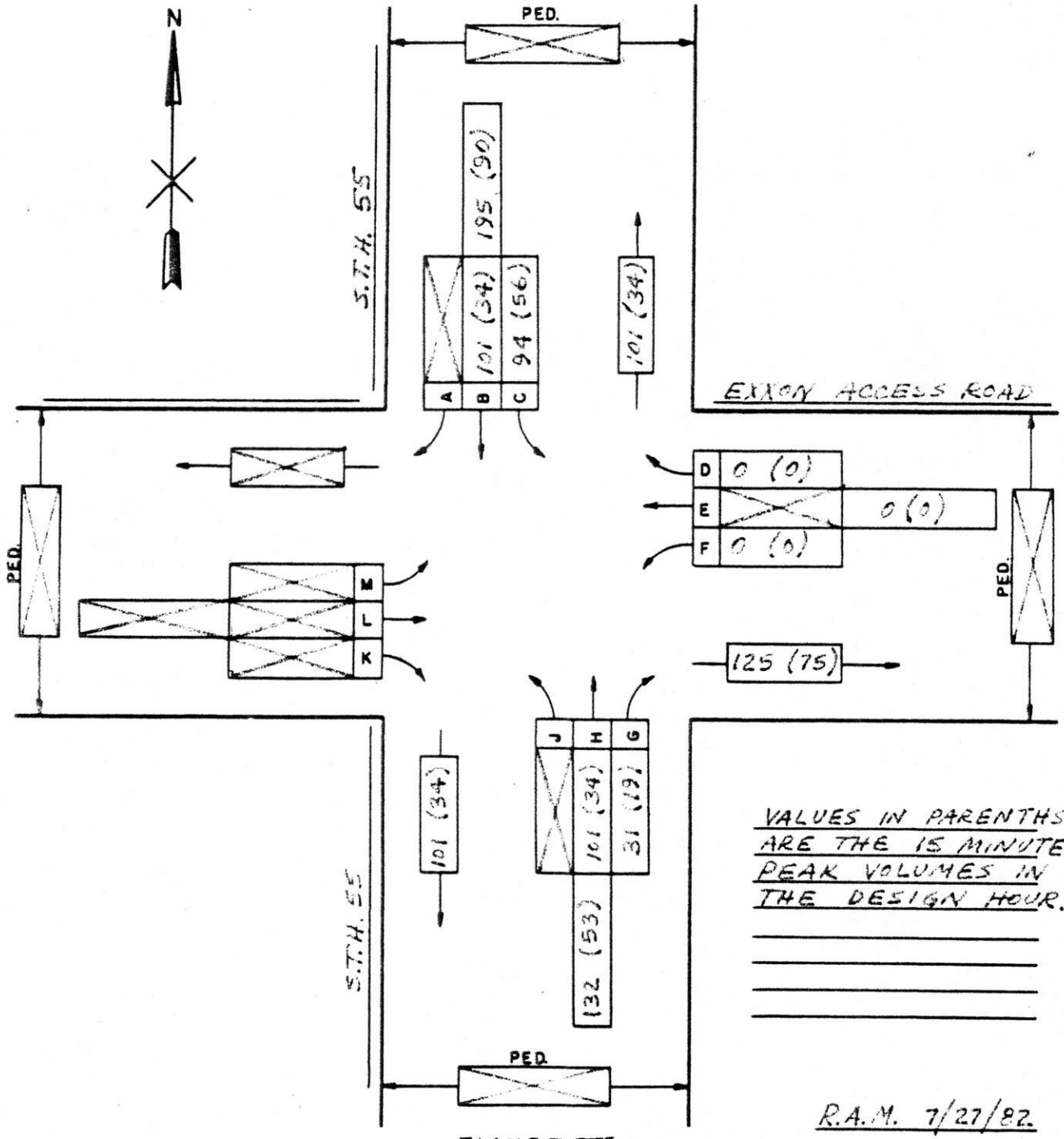
VEHICLE VOLUME PROJECTIONS
GRAPHIC SUMMARY SHEET

DATE DESIGN YR. 2000 DESIGN HOUR TIME 2 PM TO 3 PM SHEET 1 OF 1

LOCATION: DISTRICT 7 COUNTY FOREST RURAL ✓ CITY _____

INTERSECTION S.T.H. 55 AND EXXON ACCESS ROAD

~~WEATHER~~ _____ ~~ROAD CONDITION~~ _____ ~~OBSERVERS~~ _____



VALUES IN PARENTHSES ARE THE 15 MINUTE PEAK VOLUMES IN THE DESIGN HOUR.

R.A.M. 7/27/82.

FIGURE VI

FORM E-T-704-64

SHIFT DEPARTURE

STATE HIGHWAY COMMISSION OF WISCONSIN

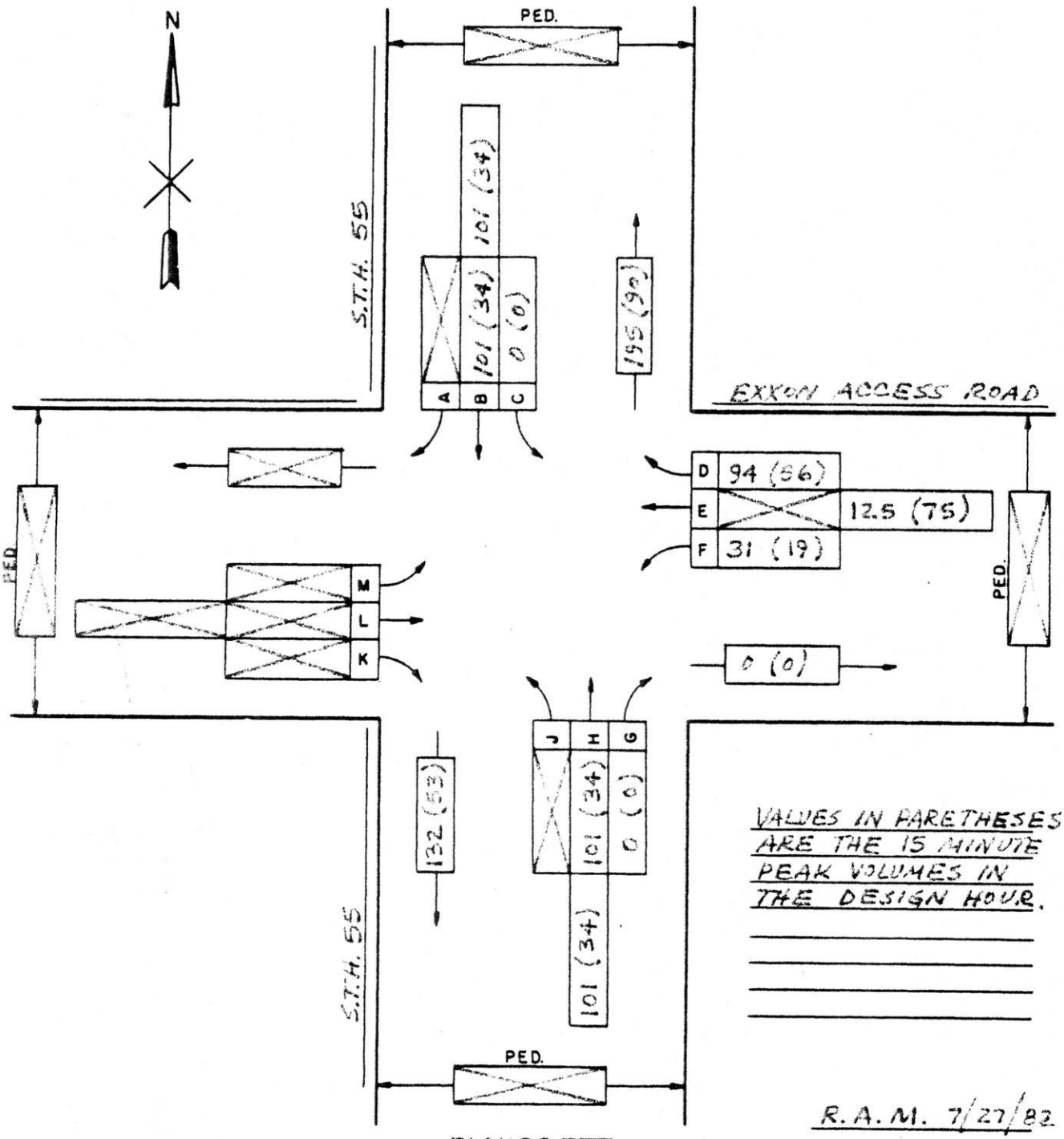
VEHICLE VOLUME PROJECTIONS
GRAPHIC SUMMARY SHEET

DATE DESIGN YR. 2000 [redacted] DESIGN HOUR TIME 3 PM TO 4 PM SHEET 1 OF 1

LOCATION: DISTRICT 7 COUNTY FOREST RURAL [redacted] CITY _____

INTERSECTION S.T.H. [redacted] AND EXXON ACCESS ROAD

WEATHER _____ ROAD CONDITION _____ OBSERVERS _____



VALUES IN PARETHESES ARE THE 15 MINUTE PEAK VOLUMES IN THE DESIGN HOUR.

R.A.M. 7/27/82

FIGURE VII

APPENDIX 8

FLEXIBLE PAVEMENT DESIGN

NOTE: The following flexible pavement design was prepared by Peter R. Wills, P.E. under Contract No. 21704. After review by members of the Geotechnical and Transportation Sections, the design team selected the same pavement structure since soil conditions are basically similar for both alignments and we are revising a portion of the old alignment.

EXXON MINERALS COMPANY

MINE/MILL ACCESS ROAD

CRANDON PROJECT

FLEXIBLE PAVEMENT DESIGN

FOTH & VAN DYKE AND ASSOCIATES, INC.

PETER R. WILLS, P.E.

TRANSPORTATION ENGINEER

BORING NO.	LOCATION OF GRADELINE FILL + (ABOVE)	IN	CUT -(BELOW)	REMARKS	STS (LAB)	CLASSIFICATION FIELD-FOTH & VAN DYKE
1		X				SW
2	4M			Fill		
3		X		Upper Sample	CL. 22 PL. 20.8 ML PI. 1.2	(SM-ML)
		X		Lower Sample	5.2% P-200 SP - SM	(SM-ML)
4					31.7 P-200 SM	(SM-ML)
5	2M			Fill		
6	2M			Fill		Wet-Drainage Pipe at this Location
7			X		31% P-200 SM	SM
8			X		35.2 P-200 SM	(SW-SM) Wet
9			X			SW Trace of Gravel (Wet)
10		X				SW Trace of Gravel (Wet)
11	3M			Fill		SP (Gravel-Cobbles-Gravel)
12		X				
13			X		7.9% P-200 SP-SM	SW Sand-Medium Gravel
14	2.5M			Fill		
15	4M			Fill		Peat Wa. at Surface
16	3M			Fill		Peat Wa. at Surface
17	2.5M			Fill		Peat Wa. at Surface
18		X				SP
19			X		50% P-200 ML	Gravel-Fine Sand-Finer to Silt Deeper SW
20			X			SW Hill North of Swamp Creek
21	Bridge Location					Coarse Gravel Stream Bed
22	4M			Fill		
23	.5M			Fill		SW-Coarse Sand - Gravel
24		X				SW
25	2M			Fill		
26			X			SM Wet Frozen
27			X		LL 30.4 PL 25 ML PI 5.4	(SM-SW) with Silt at Surface

EXXON ACCESS ROAD

(CON TINUED)

BORING NO.	LOCATION OF GRADELINE FILL + (ABOVE)	IN	CUT -(BELOW)	REMARKS	STS (LAB)	CLASSIFICATION FIELD-FOTH & VAN DYKE
28		X				(SW-SM)
29	1.8M			Fill		
30	1.5M			Fill		
31		X				(SW-SP) Wet

Upon review of the field and laboratory results of the soils exploration and location and elevations of the borings in respect to the gradeline that was established, the following soils have been selected as governing the pavement structure design:

Soils of the ML classification (102.1 - 129.0 pct) can be expected to present the worst condition for subgrade.

Boring #

3	ML (Plastic) unit dry wt. 129 pct ML in upper layer - gradeline .3M cut-in ML
4	SM 31.7% P-200 SM in upper layer - gradeline .2M cut-in SM
7	SM 31% P-200 dry wt. 135.2 pct SM throughout - gradeline .9M cut-in SM
8	SM 35.2% P-200 SM in upper layer - gradeline in 1.2M cut-in SW-SM
13	SP-SM 7.9% P-200 (Very clean) SP-SM Upper layers - gradeline in 2M cut-in SW
19	ML 56% P-200 121.5 pct ML in upper layer 0 gradeline in 1.8M cut-in SW
27	ML P.I. = 5.4 Dry Density 102.1 pct ML in upper layer Gradeline in 1.5M cut-in (SM-SW)
24	SP 1.5% P-200 SP in upper layers and at gradeline

Using the value of ML at 102 pct an estimated CBR value of approximately 6 can be expected of these soils whether in the cut or when used to construct fills. With a L.L. of 30.4 P.I. of 5.4 the soil can be further classified as an A-4 soil with a maximum group index of 8 and would also be in a frost group of F-3. Soil support of 4.7.

It is recommended that all cuts and fills be compacted in accordance with Wisconsin Department of Transportation 207.3.6.3 and 207.3.6.4 to 95% of Standard Proctor maximum density based on laboratory procedures.

9/30/81 (RV)

MATERIALS IN CRUSHED AGGREGATE BASE COURSE

Since the nature of the gravel deposits in the area are not known the lower strength coefficient of .10 will be used in the flexible pavement design.

FLEXIBLE PAVEMENT DESIGN

Using Wisconsin DOT design procedures and the traffic data as attached the following section was determined:

3" Bituminous Concrete Pavement
12" Crushed Aggregate Base Course

15" Total Thickness

It is recommended that the surface course be placed in two layers for staged construction.

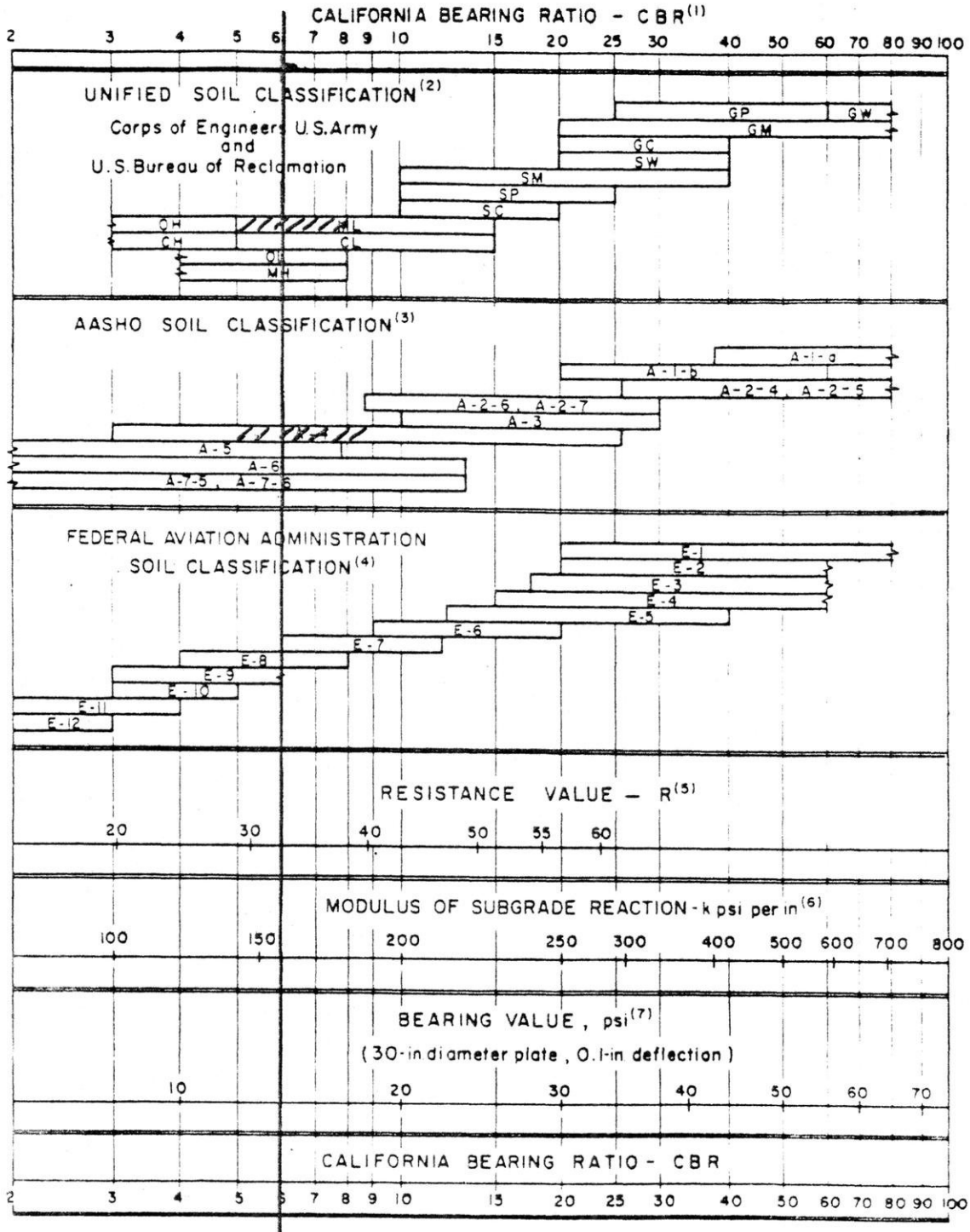
A 2" binder course of Gradation # 2 (3/4") shall be placed initially over the 12" of crushed aggregate base course.

It is further recommended that the crushed aggregate base course be placed in two layers with the lower 6" meeting Gradation # 1 (1½") and the upper 6" lift meet Gradation # 2 (3/4").

At such time that the mine/mill complex is completed, the surface irregularities of the first layer should be corrected and a 1" minimum surface layer of Gradation # 3 (5/8") should be placed with the shoulder aggregates meeting Gradation # 3 (5/8") placed adjacent to the live traffic lanes.

EXXON Access Road

BORING # 3
& #27



(1) For the basic idea, see O. J. Porter, "Foundations for Flexible Pavements," Highway Research Board *Proceedings of the Twenty-second Annual Meeting*, 1942, Vol. 22, pages 100-136.

(2) "Characteristics of Soil Groups Pertaining to Roads and Airfields," Appendix B, *The Unified Soil Classification System*, U.S. Army Corps of Engineers Technical Memorandum 3-357, 1953.

(3) "Classification of Highway Subgrade Materials," Highway Research Board *Proceedings of the Twenty-fifth Annual Meeting*, 1945, Vol. 25, pages 376-392.

(4) *Airport Paving*, U.S. Department of Commerce, Federal Aviation Agency, May 1948, pages 11-16. Estimated using values given in FAA *Design Manual for Airport Pavements*.

(5) F. N. Hveem, "A New Approach for Pavement Design," *Engineering News-Record*, Vol. 141, No. 2, July 8, 1948, pages 134-139. *R* is factor used in California Stabilometer Method of Design.

(6) See T. A. Middlebrooks and G. E. Bertram, "Soil Tests for Design of Runway Pavements," Highway Research Board *Proceedings of the Twenty-second Annual Meeting*, 1942, Vol. 22, page 152. *k* is factor used in Westergaard's analysis for design of concrete pavement.

(7) See item (6), page 184.

Fig. 10. Approximate interrelationships of soil classifications and bearing values.

TABLE 7.4 CHARACTERISTICS PERTINENT

Major Divisions (1)	(2)	Letter (3)	Name (4)	Value as Foundation When Not Subject to Frost Action (5)	Value as Base Directly under Wearing Surface (6)	Potential Frost Action (7)
Coarse-grained soils	Gravel and gravelly soils	GW	Gravel or sandy gravel, well graded	Excellent	Good	None to very slight
		GP	Gravel or sandy gravel, poorly graded	Good to excellent	Poor to fair	None to very slight
		GU	Gravel or sandy gravel, uniformly graded	Good	Poor	None to very slight
		GM	Silty gravel or silty sandy gravel	Good to excellent	Fair to good	Slight to medium
		GC	Clayey gravel or clayey sandy gravel	Good	Poor	Slight to medium
	Sand and sandy soils	SW	Sand or gravelly sand, well graded	Good	Poor	None to very slight
		SP	Sand or gravelly sand, poorly graded	Fair to good	Poor to not suitable	None to very slight
		SU	Sand or gravelly sand, uniformly graded	Fair to good	Not suitable	None to very slight
		SM	Silty sand or silty gravelly sand	Good	Poor	Slight to high
		SC	Clayey sand or clayey gravelly sand	Fair to good	Not suitable	Slight to high
Fine-grained soils	Low compressibility LL < 50	ML	Silts, sandy silts, gravelly silts, or diatomaceous soils	Fair to poor	Not suitable	Medium to very high
		CL	Lean clays, sandy clays, or gravelly clays	Fair to poor	Not suitable	Medium to high
		OL	Organic silts or lean organic clays	Poor	Not suitable	Medium to high
	High compressibility LL > 50	MH	Micaceous clays or diatomaceous soils	Poor	Not suitable	Medium to very high
		CH	Fat clays	Poor to very poor	Not suitable	Medium
		OH	Fat organic clays	Poor to very poor	Not suitable	Medium
Peat and other fibrous organic soils		Pt	Peat, humus, and other	Not suitable	Not suitable	Slight

* From Corps of Engineers.

purposes. This system relies on descriptive names to describe the soil and is based upon the classification of the parent material, slope of weathering, climate, and other environmental factors.

Pedology, in its broadest sense, deals with the soil profile, including the parent material and the A and B horizons. The horizons are

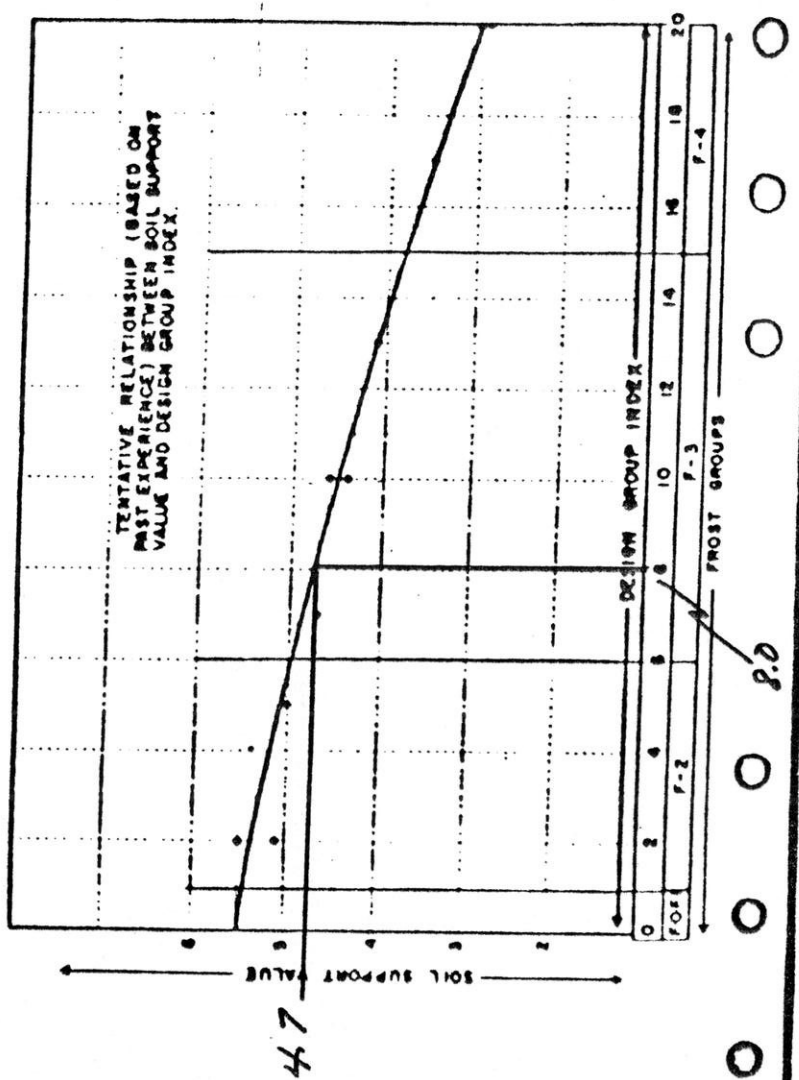
TO ROAD AND RUNWAY FOUNDATIONS*

Compressibility and Expansion (8)	Drainage Characteristics (9)	Compaction Equipment (10)	Unit Dry Weight, pcf (11)	Field CBR (12)	Subgrade Modulus k, pci (13)
Almost none	Excellent	Crawler-type tractor, rubber-tired equipment, steel-wheeled roller	125–140	60–80	300 or more
Almost none	Excellent	Crawler-type tractor, rubber-tired equipment, steel-wheeled roller	120–130	35–60	300 or more
Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	115–125	25–50	300 or more
Very slight	Fair to poor	Rubber-tired equipment, sheepsfoot roller, close control of moisture	130–145	40–80	300 or more
Slight	Poor to practically impervious	Rubber-tired equipment, sheepsfoot roller	120–140	20–40	200–300
Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	110–130	20–40	200–300
Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	105–120	15–25	200–300
Almost none	Excellent	Crawler-type tractor, rubber-tired equipment	100–115	10–20	200–300
Very slight	Fair to poor	Rubber-tired equipment, sheepsfoot roller, close control of moisture	120–135	20–40	200–300
Slight to medium	Poor to practically impervious	Rubber-tired equipment, sheepsfoot roller	105–130	10–20	200–300
Slight to medium	Fair to poor	Rubber-tired equipment, sheepsfoot roller, close control of moisture	100–125	5–15	100–200
Medium	Practically impervious	Rubber-tired equipment, sheepsfoot roller	100–125	5–15	100–200
Medium to high	Poor	Rubber-tired equipment, sheepsfoot roller	90–105	4–8	100–200
High	Fair to poor	Rubber-tired equipment, sheepsfoot roller	80–100	4–8	100–200
High	Practically impervious	Rubber-tired equipment, sheepsfoot roller	90–110	3–5	50–100
High	Practically impervious	Rubber-tired equipment, sheepsfoot roller	80–105	3–5	50–100
Very high	Fair to poor	Compaction not practical			

further grouped into catenas. The catena is composed of three or four soils occurring in a given location. As an example of this, the Miami, Crosby, and Brookston, soils are typical materials that occur in some parts of the Wisconsin Drift area. Miami soils are found on slopes ranging between 16 and 4 per cent. In general, the parent

Exxon Access Road

PLATE IX-1



APPENDIX C

Contents:

Introduction:

Table C-1 consists of a tabulation of the influence of the various factors for each Soils Series as they relate to design and construction. The columns, numbered 1 through 15, are fully explained in Chapter VIII, Sections 8.02 through 8.12.

TABLE 7.2. HIGHWAY RESEARCH BOARD CLASSIFICATION*
(Classification of Highway Subgrade Materials)

General classification	Granular materials (35% or less passing No. 200)			Silt-clay materials (More than 35% passing No. 200)			
Group classification	A-1	A-3	A-2	A-4	A-5	A-6	A-7
Sieve analysis, per cent passing							
No. 10							
No. 40	50 max	51 min					
No. 200	26 max	10 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing No. 40:							
Liquid limit				40 max	41 min	40 max	41 min
Plasticity index	6 max	NP		10 max	10 max	11 min	11 min
Group index			4 max	8 max	12 max	16 max	20 max
General rating as subgrade	Excellent to good			Fair to poor			

(Subgroups)

General classification	Granular materials (35% or less passing No. 200)							Silt-clay materials (more than 35% passing No. 200)			
	A-1		A-3	A-2							
Group classification	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7 A-7-5, A-7-6
Sieve analysis, per cent passing											
No. 10	50 max										
No. 40	30 max	50 max	51 min								
No. 200	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing No. 40:											
Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity index	6 max		NP	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Group index	0		0	0		4 max		8 max	12 max	16 max	20 max
Usual types of significant constituent materials	Stone fragments, gravel, and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General rating as subgrade	Excellent to good							Fair to poor			

* From Highway Research Board.

tent other than air dry, this information should be submitted along with the test results.

HRB OR AASHO SOIL CLASSIFICATION

The Public Roads Administration soil classification system was revised by a Highway Research Board Committee in 1945 (14). Since 1945, it has become known variously as the Highway Research Board, American Association of State Highway Officials, or Modified Bureau of Public Roads system. It will be referred to herein as the HRB system.

This system is the most widely known and used method for classifying soils for highway purposes. The details of this system are shown in Table 7.2 and in Figure 7.5.

Soils are divided into two major groups, granular materials containing 35 per cent or less material passing a No. 200 mesh sieve, and clay and silt-clay materials, containing more than 35 per cent passing a No. 200 mesh sieve. The soil components as recognized by this system are as follows.

Gravel—material passing a 3-inch sieve and retained on a No. 10 sieve.

Coarse sand—material passing a No. 10 sieve and retained on a No. 40 sieve.

Fine sand—material passing a No. 40 sieve and retained on a No. 200 sieve.

Combined silt and clay—material passing the No. 200 sieve.

The Group Index for a soil is obtained by means of equation 7.2.

$$GI = 0.2a + 0.005ac + 0.01bd \qquad (7.2)$$

where a = that portion of the percentage passing No. 200 sieve greater than 35 per cent and not exceeding 75 per cent, expressed as a positive whole number (0 to 40)

b = that portion of the percentage passing No. 200 sieve greater than 15 per cent and not exceeding 55 per cent, expressed as a positive whole number (0 to 40)

c = that portion of the numerical liquid limit greater than 40 and not exceeding 60, expressed as a positive whole number (0 to 20)

d = that portion of the numerical plasticity index greater than 10 and not exceeding 30, expressed as a positive whole number (0 to 20)

Truck Type	18-Kip Equivalent Load Factor
2D	.157
3SU	.336
2S-1	.489
2S-2	.816
3S-2 & Above	.851

Load factors are not given for automobiles and light trucks, as they are insignificant for pavement design purposes.

On minor highways where truck classification data are not available, multiply the total number of trucks in the design lane by a load factor of 0.167 to determine 18-kip equivalent loads. Use five 18-kip equivalent loads per day as a minimum.

SOIL SUPPORT

The soil support value for pavement design is to be determined and subsequently discussed in the soils report.

DESIGN CHARTS

Figures 1 and 2 show the design charts used to determine the design or required Structural Number (SN). These charts have been modified to include a uniform Regional Factor of 3.0, which will cover most of the climatic and environmental conditions encountered in Wisconsin. Use Figure 1 for highways having a serviceability index of 2.5 and Figure 2 for highways having a serviceability index of 2.0 (see Procedure 14-1-1, "Serviceability Index").

MINIMUM LAYER THICKNESSES

Figure 3, "Minimum Layer Thicknesses," provides a guide for minimum layer thicknesses that make up the pavement structure. The minimum values shown are those minimums determined to be practical, taking into account construction and future maintenance considerations.

STRENGTH COEFFICIENTS

Figure 4, "Relative Strength Coefficients for Flexible Pavements," shows strength coefficients for various materials normally used in pavement structures. These coefficients are not absolute but are consistent with minimum strength values that can be expected to be obtained from materials throughout the state.

As indicated in Figure 4, some of the strength coefficients are based on, or estimated on the basis of, AASHTO road test data while the other strength coefficients were determined by assumption.

Districts may modify these strength coefficients when experience and past performance indicate that a pavement structure in question will likely be constructed with materials having strength values different from those shown. Appropriate reasons for modification must be documented in the pavement structure design report.

GMW PE

EXXON ACCESS ROAD

MINIMUM LAYER THICKNESS
(NEW CONSTRUCTION)

LAYER	TYPE		SERVICEABILITY INDEX	
			P_t= 2.0	P_t= 2.5
SURFACE COURSE	BITUMINOUS CONCRETE PAVEMENT	SURFACE	3/4"	1- 1/4"
		BINDER	1- 1/4"	1- 1/4"
	SINGLE AGGREGATE BITUMINOUS SURFACE		1- 1/2"	2"
	BITUMINOUS ROAD MIX SURFACE		1- 1/2"	2"
BASE COURSE	BITUMINOUS		2"	2- 1/2"
	ASPHALT STABILIZED		2- 1/2"	2- 1/2"
	CRUSHED AGGREGATE		5"	6"
SUBBASE COURSE	GRANULAR		6"	6"

GRW AS

RELATIVE STRENGTH COEFFICIENTS FOR FLEXIBLE PAVEMENTS

Pavement Components	Other Requirements	Coefficients a_1	a_2	a_3
Surface Course				
Road mix (low stability)	Marshall stability 500-1,000	0.20	--	--
Plant Mix (high stability)	Marshall stability 2,000	0.44**	--	--
Sand asphalt	Marshall stability 1,000-1,200	0.40	--	--
Base Course				
Sand gravel (uncrushed)	CBR 20-30	--	0.07*	--
Crushed gravel		--	0.10	
Crushed stone	CBR 105-110	--	0.14**	--
Water bound macadam		--	0.15-0.20	--
Lime treated	CBR	--	0.15-0.30	--
Sand asphalt (hot mix)	Marshall stability	--	0.30	--
Bituminous treated (coarse-graded hot mix)	Marshall stability	--	0.34*	--
Cement treated	650 psi 7-day	--	0.23*	--
	400-650 psi 7-day	--	0.20	--
	Less than 400 psi 7-day	--	0.15	--
Subbase				
Sandy gravel	CBR 20-30	--	--	0.11*
Sand or sandy-clay		--	--	See Figure 5

* Estimated on basis of AASHO Road Test data.

** Based on AASHO Test data. All other coefficients determined by assumption based on range of other values in the figure.

GRW P5

EXXON Access Road

SURFACE COURSES

Flexible Pavement

The surface course of a flexible pavement consists of a relatively thin layer of bituminous material placed over a base or a base and subbase course. The purpose of a surface course is to:

1. Resist the abrasive forces of highway traffic.
2. Resist the disintegrating effects of climate.
3. Reduce the amount of surface water penetrating the structure.
4. Provide resistance to deflections in the upper part of the pavement structure.
5. Reduce the shear stresses transmitted to the underlying base course.
6. Provide a skid-resistant and smooth riding surface.

In the design of flexible pavement structures, a full-depth or deep-strength design in which asphalt mixtures are employed for all or most courses above the subgrade is possible. However, these designs have not shown any distinct performance advantages over equivalent bituminous concrete surfaces and crushed aggregate base pavement structures, thus their use is discouraged due to higher cost and certain construction disadvantages.

Other bituminous surfaces such as open-graded friction courses and sprinkle mixes are available for special uses. These would normally be used only where it is desirable to provide a skid-resistant surface greater than what can be obtained from normal bituminous surfaces since costs are higher, especially for open-graded friction courses.

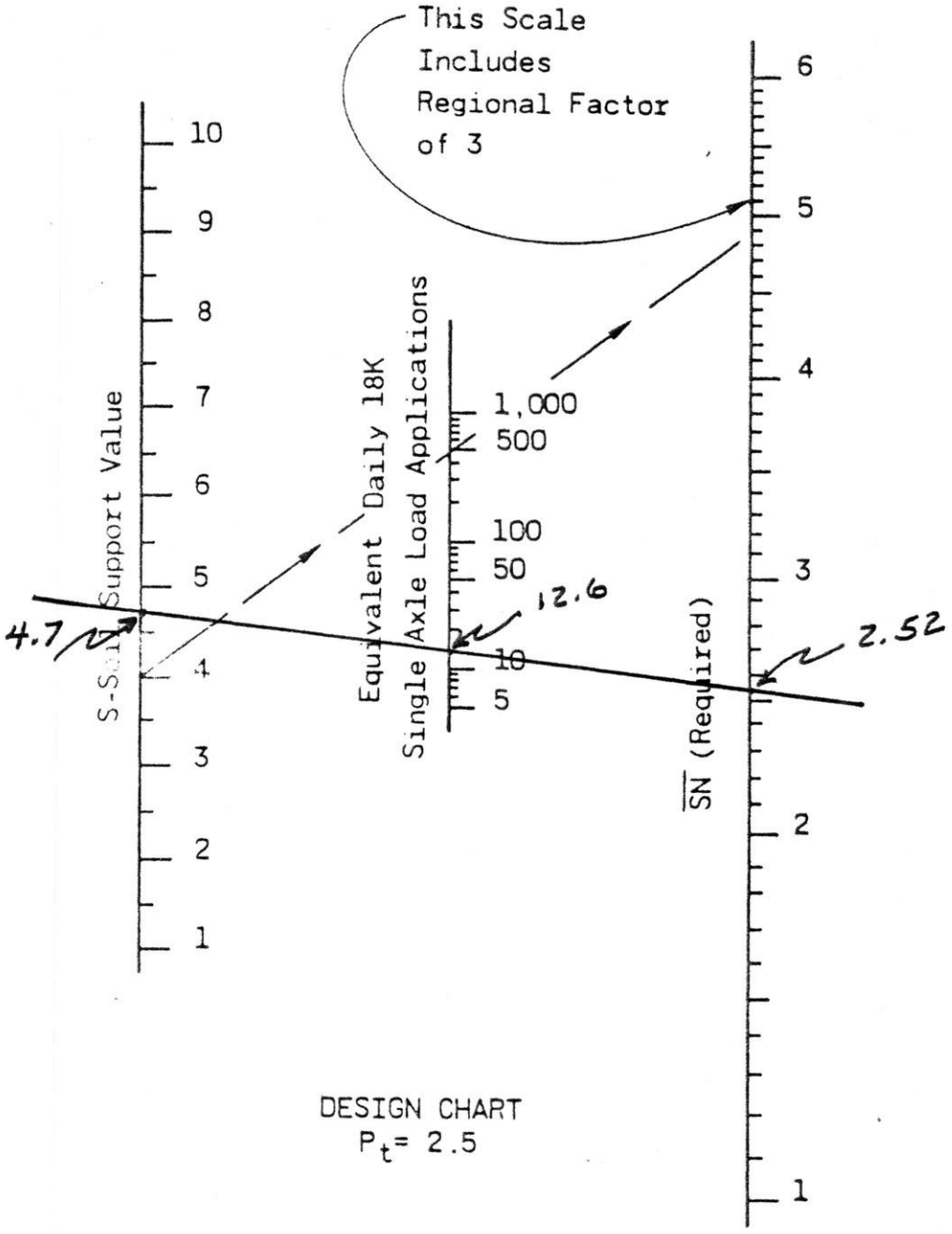
The utilization of stage construction concepts for asphalt pavement structures offers another alternative in flexible pavement design. This allows the pavement structure to be built with sufficient strength to serve expected traffic for a few years. Then, as traffic volumes increase, additional layers of asphalt are added, as needed, to increase the strength of the pavement structure.

* If stage construction is utilized, the portion of the pavement structure placed initially should be equivalent structurally to at least 70 percent of the pavement structure that would be required for a normal 20-year design life. Minimum layer thicknesses shown in Subject 5 must also apply.

The Standard Specifications have been revised to permit a wider penetration range for asphalt cements. As a result of this change, present criteria used to select grades of asphalt cement for bituminous pavements are being reviewed. Updated criteria will be issued upon completion of this review.

Recommended flexible pavement designs consisting of bituminous layers exceeding 5-1/2 inches will require concurrence of the Chief Design Engineer.

GKW PE



DESIGN CHART
P_t= 2.5

GRW PE

FLEXIBLE PAVEMENT STRUCTURE DESIGN

State of Wisconsin Department of Transportation

ED-401 5-71

Project ID	Federal Project	Highway	County	Date
CRANDON		Access Rd	FOREST	7/21/81

Project Name: EXXON MINERALS CO. – MINE/MILL ACCESS ROAD

District: WIS DOT #7

TRAFFIC Traffic Analysis Period: 20 Years

Construction Year ADT	Design Year ADT	Directional Factor (DF)	Lane Distribution Factor (LDF)
802	802	.5	1.0

Design Lane Traffic (DLT) = (Constr. Year ADT + Design Year ADT) / 2 × DF × LDF

$$\frac{802 + 802}{2} \times .5 \times 1.0 = 401$$

LOADING (Use charts "18 Kip Loads for Flexible Pavements" or "18 Kip Loads for County Trunk Highways")

Truck Type	Truck Class % of ADT		DLT	No. of Trucks	18K Loads
2D	.5	×		2.00 × .157	.31
3 SU	.8	×		3.20 × .336	1.08
2S-1	.9	×	401	3.61 × .489	1.77
2S-2	1.0	×		4.01 × .816	3.27
3S-2	1.8	×		7.23 × .851	6.15
	5%			Design Lane Total 18K Loads per Day	12.58

DESIGN – $\overline{SN}$ (Use Flexible Pavement Design Charts for Pt = 2.5 or 2.0)

Serviceability Index	Design Group Index	Frost Index	Soil Support Value	$\overline{SN}$
2.5	8	F-3	4.7	2.52

ALTERNATE DESIGNS - SN

	(Ultimate) (1)		(Stage #1) (2)	
Bituminous Concrete AC 120-150	3.0" × 0.44 =	1.32	2.0" × 0.44 =	.88
Bituminous Road Mix	____" × 0.20 =	____	____" × 0.20 =	____
Bituminous Base Course (Hot Mix)	____" × 0.34 =	____	____" × 0.34 =	____
Bituminous Stabilized Base	____" × ____ =	____	____" × ____ =	____
P.C. Stabilized Base	____" × ____ =	____	____" × ____ =	____
Gravel or Crushed Stone Base	____" × 0.14 =	____	____" × 0.14 =	____
Granular or Subbase	____" × ____ =	____	____" × ____ =	____
CRUSHED GRAVEL	12" × .10	1.20	12" × .10	1.20
	15.0 SN =	2.52	SN =	2.08

Show other alternates on attached sheet

Recommended Alternate: 2.52

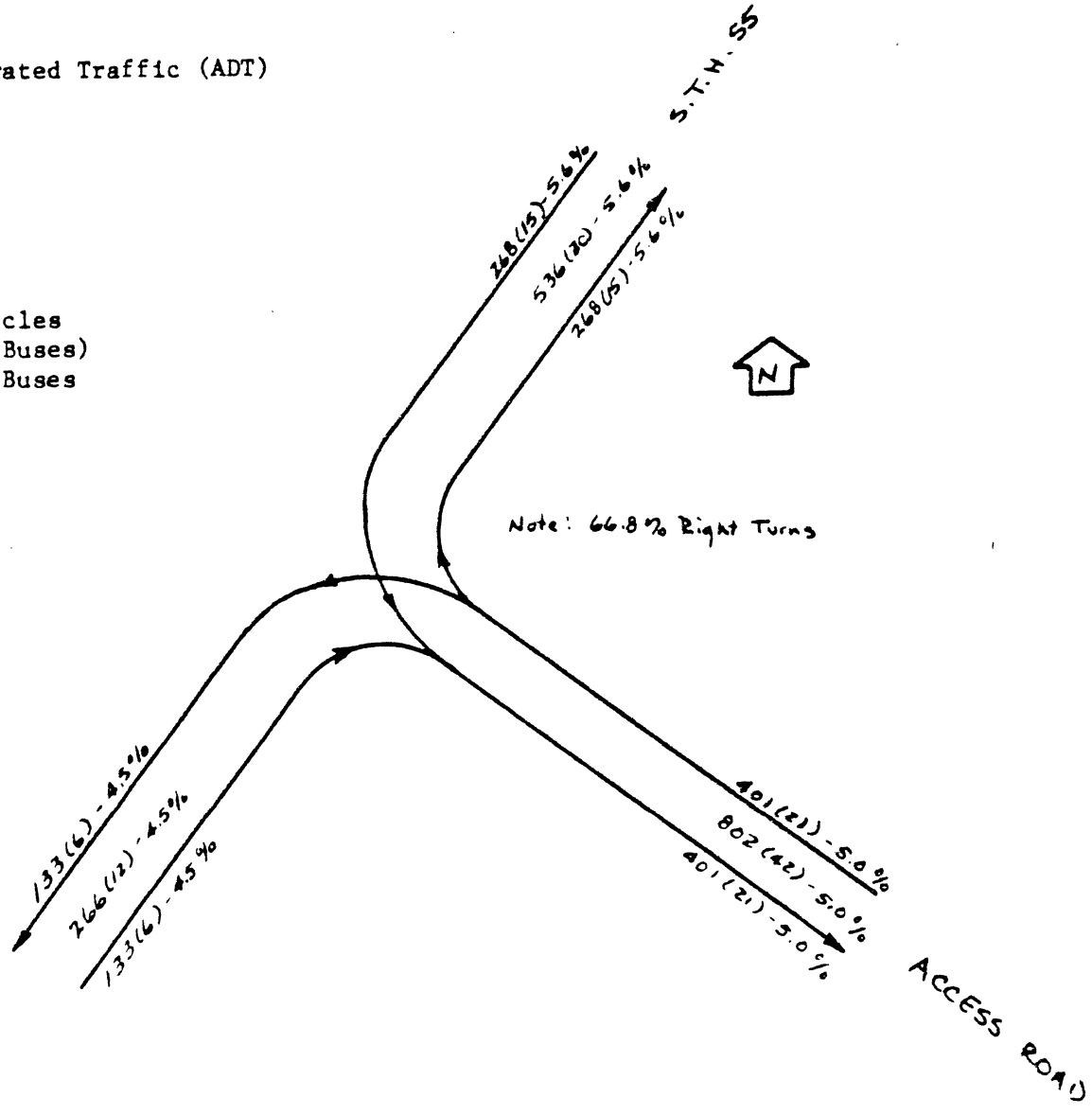
FOR STAGED CONSTRUCTION 70% OF ULTIMATE PAVEMENT STRUCTURE SHOULD BE PLACED INITIALLY 2.52 × .70 = 1.76 STAGE #1 2.08 > 1.76

∴ 2" BINDER COURSE PLACED INITIALLY WITH 1" MIN OVERLAY WHEN MINE/MILL CONSTRUCTION IS COMPLETED.

GKW PE

Site-Generated Traffic (ADT)

Total Vehicles
(Trucks & Buses)
% Truck & Buses



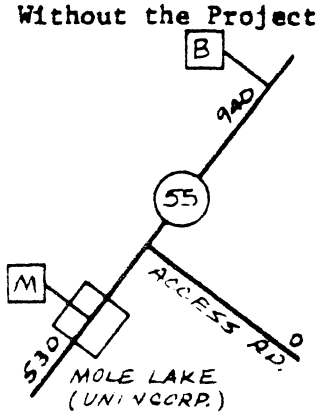
Source: Inman - Foltz

FIGURE I

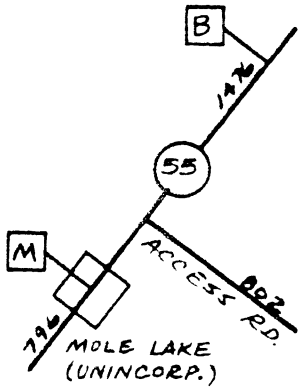
Two-Way Traffic (ADT)

Current Traffic

Without the Project

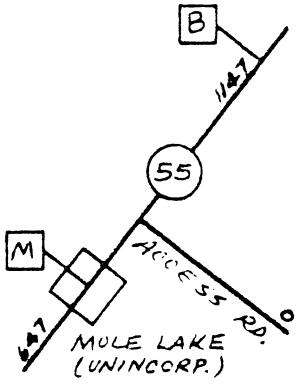


With the Project

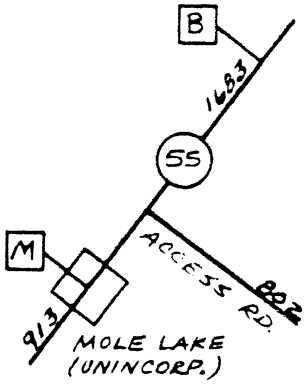


Future Traffic (20 yr.)

Without the Project



With the Project



Projections of future traffic without the project are based on an assumed growth rate of 0.95% per year. This number is derived from other work in a nearby community, but must be regarded as approximate.

The % trucks on S.T.H. 55 is unknown. Based on studies at other locations, this could range from 7.5 to 12.5% of the total traffic.

FIGURE II

APPENDIX 9

COST ESTIMATES

CONTRACT COST ESTIMATE

PROJECT Exxon Minerals Co. - Mine/Mill Access Road
CONTRACT NO. 21615 LOCATION Crandon, Wisconsin
DATE July 20, 1982 BY J. Lacenski

NOTE: Est. does not include (Swamp Creek Bridge)

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM COST	
20103	Clearing	12.12	H.A.	1977.	23,961	00
20106	Grubbing	12.12	H.A.	2966.	35,948	00
20503	Unclassified Excavation	86000	C.M.	2.29	196,940	00
20505	Marsh Excavation	1800	C.M.	2.62	4,716	00
20811	Select Borrow Exc.	2340	C.M.	3.92	9,173	00
30404	Crushed Aggregate Base Course	56700	Metric Ton	3.86	218,862	00
40701	Bituminous Concrete Pavement	7216	M.T.	29.73	214,532	00
52205	Reinf. Conc. Culvert Pipe Class III .609M (24")	132.3	L.M.	75.60	10,002	00
52206	Reinf. Conc. Culvert Pipe Class III .689 (27")	25.3	L.M.	98.67	2,496	00
52229	Reinf. Conc. Culvert Pipe Class IV .609 (24")	41	L.M.	80.00		
52264	Reinf. Conc. Apron Endwalls .609M (24")	12	Each	250.00	3,000	00
52265	Reinf. Conc. Apron Endwalls .689 (27")	2	Each	275.00	550	00

CONTRACT COST ESTIMATE

PROJECT Exxon Minerals Co. - Mine/Mill Access Road
CONTRACT NO. 21615 LOCATION Crandon, Wisconsin
DATE July 20, 1982 BY J. Lacenski

NOTE: Est. does not include (Swamp Creek Bridge)

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM COST	
60170	Concrete Curb & Gutter .914M (36") Type D	46	L.M.	49.29	2,267	00
60601	Rip Rap	414	S.M.	29.89	12,375	00
61406	Anchorages for Steel Plate Beam Guard	6	Each	150.00	900	00
61408	Steel Plate Beam Guard Class A	325	L.M.	39.38	12,798	00
61422	Marker Posts for Right of Way	78	Each	30.00	2,340	00
61601	Woven Wire Fence	2650	L.M.	7.38	19,557	00
61801	Maintenance and Repair of Haul Roads	1	L.S.	5,000	5,000	00
62505	Salvaged Topsoil	76113	S.M.	0.25	19,028	00
62702	Mulching	76113	S.M.	0.18	13,700	00
62802	Erosion Mat	8000	S.M.	1.44		
62810	Erosion Bales	1000	Each	7.60	7,600	00
62902	Fertilizer Type A	2600	K.G.	.55	1,430	00
63002	Seeding	1115	K.G.	22.34	24,909	00

CONTRACT COST ESTIMATE

PROJECT Exxon Minerals Co. - Mine/Mill Access Road
CONTRACT NO. 21615 LOCATION Crandon, Wisconsin
DATE July 20, 1982 BY J. Lacenski

NOTE: Est. does not include (Swamp Creek Bridge)

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	ITEM COST	
63301	Delineator Posts	25	Each	12.96	324	00
63305	Delineators	50	Each	1.53	77	00
63410	Wood Posts .102M x .152M x 3.658M (4"x6"x12')	13	Each	25.00	325	00
63702	Signs, Type II, Reflective	4.7	S.M.	119.00	559	00
64202	Field Office Type "B"	1	L.S.	2,500.	2,500	00
64210	Field Laboratory	1	L.S.	1,500.	1,500	00
64301	Traffic Control	1	L.S.	5,000.	5,000	00
90001	2" Tubular Steel Gate 1.270 x 4.877M (50" x 16')	12	Each	200.00	2,400	00
90003	Settling Basins	2	Each	500	1,000	00
90004	Center Line/No Passing/ Lane Marking	14.1	K.M.	900.00	12,690	00
			SUB-TOTAL		$ 868,500	00
			Plus 15% Contingency		130,000	00
			ESTIMATED COST		$ 998,500	00

EXXON MINERALS COMPANY

Final Cost Estimate

Swamp Creek Structure

70" Prestressed Concrete Girders	635 l.f. @ $90.00	$ 57,150.00
Excavation and Undercut	Lump Sum	1,000.00
Concrete Masonry & Reinforcing	323 c.y. @ $300.00	96,900.00
Steel HP Piles 10"x42 lb/ft.	700 l.f. @ $16.00	11,200.00
Heavy Rip Rap	270 c.y. @ $28.00	7,560.00
Type "F" Steel Railing	258 l.f. @ $50.00	12,900.00
Bearing Pads	Lump Sum	1,000.00
Sub-Total		$ 187,710.00
Plus 10% Contingency		18,770.00
Total Estimated Construction Cost		$ 206,480.00

APPENDIX 10

SPECIFICATIONS

EXXON MINERALS CO.
MINE/MILL ACCESS ROAD
ALTERNATE #2
FOREST COUNTY
CRANDON, WISCONSIN

STANDARD SPECIFICATIONS

1. General. The work under this contract for the construction of Exxon Minerals Co. Mine/Mill Access Road located between S.T.H. 55 and the proposed mine/mill site, Forest County, Wisconsin shall be in accordance with the plans, and shall be executed under the requirements of the State of Wisconsin, Department of Transportation, Division of Highways, Standard Specifications for Road and Bridge Construction, Edition of 1981; the attached special provisions and supplemental instructions.

2. Scope of Work. The work under this contract shall consist of the construction of one bridge structure, installing culverts, grading of earthwork, clearing and grubbing, crushed aggregate base course, bituminous concrete pavement, curb and gutter, fencing, topsoil, fertilizer, seed and mulch, and all the work shown on the plans and included in the proposal and contract.

3. Method of Measurement. All units of measurement shall be by the metric system using standard SI units. The units of measurement for payment shall be by the appropriate metric unit listed with the item.

   For the purposes of clarity key or basic dimensions, such as for right-of-way widths, pavement widths and thickness and roadway dimensions, the metric dimension and unit is shown with the English dimension and unit following in parenthesis.

4. Traffic Control. Traffic control and pavement marking and signing shall be in accordance with the Manual of Uniform Traffic Control Devices Edition of 1978, U.S. Department of Transportation, Federal Highway Administration.

5. Environmental. Construction operations in areas of streams and wetlands shall be in accordance with the State of Wisconsin Department of Natural Resources and the U.S. Department of the Army Corps of Engineers requirements.

6. Standard Details.

   The following indexed standard details shall be considered a part of the plans and shall be included in this contract.

S.D.D.	
8C1-3	Inlets, Type 1 and 2
8E4-2	Sod or Masonry and Sod Ditch Checks
8E5-1	Sodded Backslope Flume and Intercepting Embankment
8E7-1	Erosion Mat
8E8-1	Typical Installations of Erosion Bales

8F1-8	Apron Endwalls for Culvert Pipe and Pipe Arch
8F4-2	Joint Ties for Concrete Pipe
9A1-5	Layout Details for At-Grade Side Road Intersections
12A1-2	Slope Paving-Structures (Concrete Cast in Place)
12A2-2	Slope Paving-Structures (Crushed Aggregate)
12A3-4	Name Plate-Structures
13A1-3	Concrete Pavement Reinforcement
13B5-1	Pavement Marking
14B2a&b	Class "A" Steel Plate Beam Guard
15A1-3	Marker Posts for Right-of-Way
15A2-2	Delineator Posts, Marker Posts and Delineators
15B1-4	Woven Wire Fence
15C1-6	Construction Barricades and Standard Signs
16A1-3	Landmark Reference Monuments

Wherever the term "incidental" is used in the plans or specifications, it shall mean the particular item shall be included in the bid item, but no additional payment shall be made.

7. Work By Others. The Crandon Telephone Company has existing underground telephone cables within the project limits.

   The Wisconsin Public Service has an existing overhead power line along S.T.H. 55 and in addition will be constructing a high voltage power line adjacent to the access road right-of-way.

   Utility companies will relocate their respective lines as required along S.T.H. 55 to provide the necessary clearance.

   It is anticipated there will be a minimal amount of conflict.

8. Mobilization. Shall be considered incidental to the project.

9. Finish Roadway. Shall be considered incidental to the project.

10. Construction Sequence. Bituminous paving of the mine/mill access road may be split into two stages dependent on the construction of the mine/mill site. Stage I would be a 5.1 cm (2") binder course and Stage II a 2.54 cm (1") surface course.

SCHEDULE OF BID ITEMS

Item No.	Item	Unit
20101	Clearing	Sta.
20102	Clearing	I.D.
20103	Clearing	Acre
20104	Grubbing	Sta.
20105	Grubbing	I.D.
20106	Grubbing	Acre
20201	Roadside Clearing	Sta.
20202	Roadside Clearing	Acre
20301 et seq.	Removing Old Culvert, Station _____	L.S.
20330	Removing Old Culverts	Each
20351 et seq.	Removing Old Bridge, Station _____	L.S.
20401	Removing Pavement	S.Y.
20402	Removing Bituminous Surface	S.Y.
20403	Removing Curb	L.F.
20404	Removing Gutter	L.F.
20405	Removing Curb and Gutter	L.F.
20406	Removing Concrete Sidewalk	S.Y.
20407	Removing Lip Curb	L.F.
20408	Removing Masonry	C.Y.
20409	Removing Surface Drains	Each
20410	Removing Railroad Track	L.F.
20411	Removing Guardrail	L.F.
20412	Removing Fence	L.F.
20413	Removing Utility Poles	Each
20414	Removing Manholes	Each
20415	Removing Catch Basins	Each
20416	Removing Inlets	Each
20417	Removing Septic Tanks	Each
20450 et seq.	Removing Underground Tanks, Station _____	L.S.
20460 et seq.	Removing Building, Station _____	L.S.
20470 et seq.	Removing Buildings, Parcel _____	L.S.

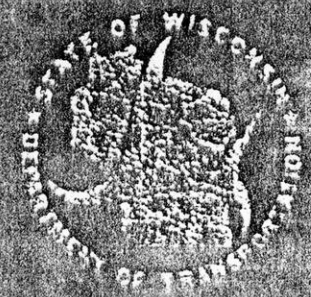
STATE OF WISCONSIN

DEPARTMENT OF TRANSPORTATION

STANDARD SPECIFICATIONS

for

ROAD AND BRIDGE CONSTRUCTION



Edition of 1981

SCHEDULE OF BID ITEMS — Continued

Item No.	Item	Unit
20480	Abandoning Manholes	Each
20481	Abandoning Catch Basins	Each
20482	Abandoning Inlets	Each
20483	Abandoning Wells	Each
20501	Common Excavation	C.Y.
20502	Rock Excavation	C.Y.
20503	Unclassified Excavation	C.Y.
20504	Stone Piles and Stone Fences	C.Y.
20505	Marsh Excavation	C.Y.
20511	Overhaul	Sta. Yd.
20512	Overhaul	Yd. Mi.
20513	Presplitting Rock	L.F.
20610 et seq.	Excavation for Structures, Bridges _____	L.S.
20620 et seq.	Excavation for Structures, Culverts _____	L.S.
20630 et seq.	Excavation for Structures, Retaining Walls _____	L.S.
20640 et seq.	Excavation for Structures, Structural Plate Pipe or Pipe Arches, Station _____	L.S.
20650	Cofferdams	L.S.
20801	Borrow Excavation	C.Y.
20811	Selected Borrow Excavation	C.Y.
20901	Granular Backfill	C.Y.
21101	Preparation of Foundation for Bituminous Paving	L.S.
21102 et seq.	Preparation of Foundation for Bituminous Paving, Project _____	L.S.
21111	Preparation of Foundation for Concrete Pavement	L.S.
21112 et seq.	Preparation of Foundation for Concrete Pavement, Project _____	L.S.
21121	Preparation of Foundation for Concrete Base Course	L.S.
21122 et seq.	Preparation of Foundation for Concrete Base Course, Project _____	L.S.
21201	Granular Subbase Course	C.Y.
21202	Granular Subbase Course	Ton

SCHEDULE OF BID ITEMS — Continued

Item No.	Item	Unit
21220 et seq.	Granular Subbase Course, _____ -Inch	S.Y.
21301	Finishing Roadway	L.S.
21302 et seq.	Finishing Roadway, Project _____	L.S.
21401	Obliterating Old Road	Sta.
30403	Crushed Aggregate Base Course	C.Y.
30404	Crushed Aggregate Base Course	Ton
30412	Producing and Stockpiling Crushed Aggregate Base Course	C.Y.
30413	Producing and Stockpiling Crushed Aggregate Base Course	Ton
30415	Hauling and Placing Crushed Aggregate Base Course	C.Y.
30416	Hauling and Placing Crushed Aggregate Base Course	Ton
30601	Bituminous Base Course	Ton
30606	Bituminous Base Course Widening	Ton
30706	Concrete Base Course, 6-Inch	S.Y.
30707	Concrete Base Course, 7-Inch	S.Y.
30708	Concrete Base Course, 8-Inch	S.Y.
30709	Concrete Base Course, 9-Inch	S.Y.
30726	H.E.S. Concrete Base Course, 6-Inch	S.Y.
30727	H.E.S. Concrete Base Course, 7-Inch	S.Y.
30728	H.E.S. Concrete Base Course, 8-Inch	S.Y.
30729	H.E.S. Concrete Base Course, 9-Inch	S.Y.
30751	Concrete Base Course Widening	S.Y.
30801	Base Patching	S.Y.
40201	Bituminous Material for Prime Coat	Ton
40202	Bituminous Material for Prime Coat	Gal.
40203	Bituminous Material for Tack Coat	Ton
40204	Bituminous Material for Tack Coat	Gal.
40401	Bituminous Road Mix Surface	S.Y.
40402	Bituminous Material for Surface Course	Ton
40403	Bituminous Material for Surface Course	Gal.
40406	Aggregates for Bituminous Road Mix Surface	C.Y.
40407	Aggregates for Bituminous Road Mix Surface	Ton
40410	Producing and Stockpiling Aggregates for Bituminous Road Mix Surface	C.Y.

Item No.	Item	Unit
40411	Producing and Stockpiling Aggregates for Bituminous Road Mix Surface	Ton
40501	Bituminous Material for Plant Mixes	Ton
40502	Bituminous Material for Plant Mixes	Gal.
40607	Single Aggregate Bituminous Pavement	Ton
40610	Producing and Stockpiling Aggregates for Single Aggregate Bituminous Pavement	Ton
40611	Producing and Stockpiling Aggregates for Single Aggregate Bituminous Pavement	C.Y.
40701	Bituminous Concrete Pavement	Ton
40710	Producing and Stockpiling Aggregates for Bituminous Concrete Pavement	Ton
40711	Producing and Stockpiling Aggregates for Bituminous Concrete Pavement	C.Y.
40801	Aggregate for Seal Coat Cover	C.Y.
40802	Aggregate for Seal Coat Cover	Ton
40805	Bituminous Material for Seal Coat	Ton
40806	Bituminous Material for Seal Coat	Gal.
40906	Concrete Pavement, 6-Inch	S.Y.
40907	Concrete Pavement, 7-Inch	S.Y.
40908	Concrete Pavement, 8-Inch	S.Y.
40909	Concrete Pavement, 9-Inch	S.Y.
40910	Concrete Pavement, 10-Inch	S.Y.
40911	Concrete Pavement, 11-inch	S.Y.
40918	H.E.S. Concrete Pavement, 8-Inch	S.Y.
40919	H.E.S. Concrete Pavement, 9-Inch	S.Y.
40920	H.E.S. Concrete Pavement, 10-Inch	S.Y.
40921	H.E.S. Concrete Pavement, 11-Inch	S.Y.
40930	Concrete Widening	S.Y.
40931	Concrete Driveway	S.Y.
40932	Concrete Alley	S.Y.
40933	Concrete Header	S.Y.
40934	Concrete Surface Drains	C.Y.
40935	Concrete Pavement Approach Slab	S.Y.
40940	H.E.S. Concrete Widening	S.Y.
40941	H.E.S. Concrete Driveway	S.Y.
40942	H.E.S. Concrete Alley	S.Y.
40943	H.E.S. Concrete Header	S.Y.

Item No.	Item	Unit
40944	H.E.S. Concrete Surface Drains	C.Y.
40945	H.E.S. Concrete Pavement Approach Slab	S.Y.
40950	Concrete Pavement Reinforcement	S.Y.
40951	Continuous Concrete Pavement Reinforcement	S.Y.
40960	Pavement Terminal Anchors	Each
40970	Pavement Terminal Units	Each
50201	Concrete Masonry, Bridges	C.Y.
50202	H.E.S. Concrete Masonry, Bridges	C.Y.
50211	Concrete Masonry, Seal	C.Y.
50220 et seq.	Preformed Elastomeric Compression Joint Sealer _____ -Inch	L.F.
50230	Protective Surface Treatment	Gal.
50303	Prestressed Girder, I Type, 36-Inch	L.F.
50305	Prestressed Girder, I Type, 45-Inch	L.F.
50307	Prestressed Girder, I Type, 54-Inch	L.F.
50309	Prestressed Girder, I Type, 70-Inch	L.F.
50310	Prestressed Girder, Box Type, 17-Inch	L.F.
50311	Prestressed Girder, Box Type, 21-Inch	L.F.
50312	Prestressed Girder, Box Type, 27-Inch	L.F.
50313	Prestressed Girder, Box Type, 33-Inch	L.F.
50314	Prestressed Girder, Box Type, 39-Inch	L.F.
50316	Prestressed Girder, Box Type, 42-Inch	L.F.
50320	Prestressed Girder, Slab Type, 12-Inch	L.F.
50322	Prestressed Girder, Slab Type, 15-Inch	L.F.
50324	Prestressed Girder, Slab Type, 18-Inch	L.F.
50326	Prestressed Girder, Slab Type, 21-Inch	L.F.
50401	Concrete Masonry, Culverts	C.Y.
50402	H.E.S. Concrete Masonry, Culverts	C.Y.
50405	Concrete Masonry, Retaining Walls	C.Y.
50406	H.E.S. Concrete Masonry, Retaining Walls	C.Y.
50409	Concrete Masonry, Endwalls	C.Y.
50501	Bar Steel Reinforcement, Bridges	Lb.
50502	Bar Steel Reinforcement, Culverts	Lb.
50503	Bar Steel Reinforcement, Retaining Walls	Lb.
50504	High-Strength Bar Steel Reinforcement, Bridges	Lb.
50505	High-Strength Bar Steel Reinforcement, Culverts	Lb.

Item No.	Item	Unit
50506	High-Strength Bar Steel Reinforcement, Retaining Walls	Lb.
50510	Coated High-Strength Bar Steel Reinforcement	Lb.
50601	Structural Carbon Steel	Lb.
50606	High-Strength Structural Steel	Lb.
50610	Steel Castings	Lb.
50611	Carbon Steel Forgings	Lb.
50612	Bronze Castings	Lb.
50614	Lubricated Bronze Plates	Lb.
50615	Sheet Copper	Lb.
50616	Sheet Zinc	Lb.
50621	Bearing Pads	S.F.
50625	Bearing Pads, Elastomeric	S.F.
50702	Treated Lumber and Timber	M.B.M.
50801 et seq.	Untreated Timber Test Piling, Structure _____	L.S.
50810	Untreated Timber Piling, Delivered	L.F.
50813	Untreated Timber Piling, Driven	L.F.
50816	Treated Timber Piling, Delivered	L.F.
50820	Treated Timber Piling, Driven	L.F.
50830 et seq.	Treated Timber Test Piling, Structure _____	L.S.
50840	Preboring, Timber Piling	L.F.
50901	Deck Preparation	S.Y.
50905	Deck Cleaning	S.Y.
50910	Joint Repair	S.Y.
50915	Concrete Surface Repair	S.F.
50920	Full-Depth Deck Repair	S.Y.
50925	Concrete Masonry, Overlay	C.Y.
51020	Preboring, Cast-in-Place Concrete Piling	L.F.
51030	Cast-in-Place Concrete Piling, Delivered and Driven, 10-3/4-Inch	L.F.
51031	Cast-in-Place Concrete Piling, Delivered and Driven, 12-Inch	L.F.
51032	Cast-in-Place Concrete Piling, Delivered and Driven, 14-Inch	L.F.
51033	Cast-in-Place Concrete Piling, Delivered and Driven, 16-Inch	L.F.

Item No.	Item	Unit
51120	Steel Piling, Delivered and Driven, HP 8-Inch 36 Pound	L.F.
51121	Steel Piling, Delivered and Driven, HP 10-Inch 42 Pound	L.F.
51122	Steel Piling, Delivered and Driven, HP 12-Inch 53 Pound	L.F.
51123	Steel Piling, Delivered and Driven, HP 12-Inch 73 Pound	L.F.
51124	Steel Piling, Delivered and Driven, HP 14-Inch 73 Pound	L.F.
51205	Steel Sheet Piling, Delivered	S.F.
51206	Steel Sheet Piling, Driven	S.F.
51320 et seq.	Pipe Railing, Structure _____	L.S.
51330 et seq.	Steel Railing, Structure _____	L.S.
51340 et seq.	Tubular Railing, Type F, Structure _____	L.S.
51350 et seq.	Tubular Railing, Type H, Structure _____	L.S.
51360 et seq.	Tubular Railing, Type J, Structure _____	L.S.
51370	Steel Railing, Type W, Structure _____	L.S.
51401	Floor Drains, Type A	Each
51402	Floor Drains, Type B	Each
51404	Floor Drains, Type G	Each
51405	Floor Drains, Type GC	Each
51406	Floor Drains, Type HC	Each
51410 et seq.	Deck Drains, Structure _____	L.S.
51426	Downspout, 6-Inch	L.F.
51501	Open Steel Grid Floor, 2-Inch	S.F.
51505	Open Steel Grid Floor, 3-Inch	S.F.
51510	Open Steel Grid Floor, 4-Inch	S.F.
51515	Open Steel Grid Floor, 5-Inch	S.F.
51520	Concrete Filled Steel Grid Floor, 2-inch	S.F.
51525	Concrete Filled Steel Grid Floor, 3-Inch	S.F.
51530	Concrete Filled Steel Grid Floor, 4-Inch	S.F.
51535	Concrete Filled Steel Grid Floor, 5-Inch	S.F.

Item No.	Item	Unit
51601	Dampproofing	S.Y.
51602	Membrane Waterproofing, 2-Ply	S.Y.
51603	Membrane Waterproofing, 3-Ply	S.Y.
51701 et seq.	Painting Structure, Structure _____	L.S.
51730 et seq.	Structure Maintenance Painting, Class A, Structure _____	L.S.
51740 et seq.	Structure Maintenance Painting, Class B, Structure _____	L.S.
51801	Mortar Rubble Masonry	C.Y.
52001	Culvert Pipe, Class III, 12-Inch	L.F.
52002	Culvert Pipe, Class III, 15-Inch	L.F.
52003	Culvert Pipe, Class III, 18-Inch	L.F.
52004	Culvert Pipe, Class III, 21-Inch	L.F.
52005	Culvert Pipe, Class III, 24-Inch	L.F.
52007	Culvert Pipe, Class III, 30-Inch	L.F.
52009	Culvert Pipe, Class III, 36-Inch	L.F.
52010	Culvert Pipe, Class III, 42-Inch	L.F.
52011	Culvert Pipe, Class III, 48-Inch	L.F.
52012	Culvert Pipe, Class III, 54-Inch	L.F.
52013	Culvert Pipe, Class III, 60-Inch	L.F.
52015	Culvert Pipe, Class III, 72-Inch	L.F.
52017	Culvert Pipe, Class III, 84-Inch	L.F.
52021	Culvert Pipe, Class IV, 12-Inch	L.F.
52022	Culvert Pipe, Class IV, 15-Inch	L.F.
52023	Culvert Pipe, Class IV, 18-Inch	L.F.
52024	Culvert Pipe, Class IV, 21-inch	L.F.
52025	Culvert Pipe, Class IV, 24-Inch	L.F.
52027	Culvert Pipe, Class IV, 30-Inch	L.F.
52029	Culvert Pipe, Class IV, 36-Inch	L.F.
52030	Culvert Pipe, Class IV, 42-Inch	L.F.
52031	Culvert Pipe, Class IV, 48-Inch	L.F.
52032	Culvert Pipe, Class IV, 54-Inch	L.F.
52033	Culvert Pipe, Class IV, 60-Inch	L.F.
52035	Culvert Pipe, Class IV, 72-Inch	L.F.
52037	Culvert Pipe, Class IV, 84-Inch	L.F.
52041	Culvert Pipe, Class V, 12-Inch	L.F.
52042	Culvert Pipe, Class V, 15-Inch	L.F.

Item No.	Item	Unit
52043	Culvert Pipe, Class V, 18-Inch	L.F.
52044	Culvert Pipe, Class V, 21-Inch	L.F.
52045	Culvert Pipe, Class V, 24-Inch	L.F.
52047	Culvert Pipe, Class V, 30-Inch	L.F.
52049	Culvert Pipe, Class V, 36-Inch	L.F.
52050	Culvert Pipe, Class V, 42-Inch	L.F.
52051	Culvert Pipe, Class V, 48-Inch	L.F.
52052	Culvert Pipe, Class V, 54-Inch	L.F.
52053	Culvert Pipe, Class V, 60-Inch	L.F.
52055	Culvert Pipe, Class V, 72-Inch	L.F.
52056	Culvert Pipe, Class V, 84-Inch	L.F.
52059	Apron Endwalls for Culvert Pipe, 12-Inch	Each
52060	Apron Endwalls for Culvert Pipe, 15-Inch	Each
52061	Apron Endwalls for Culvert Pipe, 18-Inch	Each
52062	Apron Endwalls for Culvert Pipe, 21-Inch	Each
52063	Apron Endwalls for Culvert Pipe, 24-Inch	Each
52065	Apron Endwalls for Culvert Pipe, 30-Inch	Each
52067	Apron Endwalls for Culvert Pipe, 36-Inch	Each
52068	Apron Endwalls for Culvert Pipe, 42-Inch	Each
52069	Apron Endwalls for Culvert Pipe, 48-Inch	Each
52070	Apron Endwalls for Culvert Pipe, 54-Inch	Each
52071	Apron Endwalls for Culvert Pipe, 60-Inch	Each
52072	Apron Endwalls for Culvert Pipe, 72-Inch	Each
52073	Apron Endwalls for Culvert Pipe, 84-Inch	Each
52075	Pipe Cattle Pass	L.F.
52103	Corrugated Steel Culvert Pipe, 12-Inch	L.F.
52104	Corrugated Steel Culvert Pipe, 15-Inch	L.F.
52105	Corrugated Steel Culvert Pipe, 18-Inch	L.F.
52106	Corrugated Steel Culvert Pipe, 21-Inch	L.F.
52107	Corrugated Steel Culvert Pipe, 24-Inch	L.F.
52109	Corrugated Steel Culvert Pipe, 30-Inch	L.F.
52111	Corrugated Steel Culvert Pipe, 36-Inch	L.F.
52112	Corrugated Steel Culvert Pipe, 42-Inch	L.F.
52113	Corrugated Steel Culvert Pipe, 48-Inch	L.F.
52114	Corrugated Steel Culvert Pipe, 54-Inch	L.F.
52115	Corrugated Steel Culvert Pipe, 60-Inch	L.F.
52117	Corrugated Steel Culvert Pipe, 72-Inch	L.F.

Item No.	Item	Unit
52118	Corrugated Steel Culvert Pipe, 84-Inch	L.F.
52119	Corrugated Steel Culvert Pipe, 96-Inch	L.F.
52135	Corrugated Steel Pipe Arch, 17x13-Inch	L.F.
52136	Corrugated Steel Pipe Arch, 21x15-Inch	L.F.
52137	Corrugated Steel Pipe Arch, 24x18-Inch	L.F.
52138	Corrugated Steel Pipe Arch, 28x20-Inch	L.F.
52139	Corrugated Steel Pipe Arch, 35x24-Inch	L.F.
52140	Corrugated Steel Pipe Arch, 42x29-Inch	L.F.
52141	Corrugated Steel Pipe Arch, 49x33-Inch	L.F.
52142	Corrugated Steel Pipe Arch, 57x38-Inch	L.F.
52143	Corrugated Steel Pipe Arch, 64x43-Inch	L.F.
52144	Corrugated Steel Pipe Arch, 71x47-Inch	L.F.
52145	Steel Apron Endwalls for Culvert Pipe, 12-Inch	Each
52146	Steel Apron Endwalls for Culvert Pipe, 15-Inch	Each
52147	Steel Apron Endwalls for Culvert Pipe, 18-Inch	Each
52148	Steel Apron Endwalls for Culvert Pipe, 21-Inch	Each
52149	Steel Apron Endwalls for Culvert Pipe, 24-Inch	Each
52150	Steel Apron Endwalls for Culvert Pipe, 30-Inch	Each
52151	Steel Apron Endwalls for Culvert Pipe, 36-Inch	Each
52152	Steel Apron Endwalls for Culvert Pipe, 42-Inch	Each
52153	Steel Apron Endwalls for Culvert Pipe, 48-Inch	Each
52154	Steel Apron Endwalls for Culvert Pipe, 54-Inch	Each
52155	Steel Apron Endwalls for Culvert Pipe, 60-Inch	Each
52157	Steel Apron Endwalls for Culvert Pipe, 72-Inch	Each
52159	Steel Apron Endwalls for Culvert Pipe, 84-Inch	Each
52161	Steel Apron Endwalls for Pipe Arch, 17x13-Inch	Each

Item No.	Item	Unit
52162	Steel Apron Endwalls for Pipe Arch, 21x15-Inch	Each
52163	Steel Apron Endwalls for Pipe Arch, 24x18-Inch	Each
52164	Steel Apron Endwalls for Pipe Arch, 28x20-Inch	Each
52165	Steel Apron Endwalls for Pipe Arch, 35x24-Inch	Each
52166	Steel Apron Endwalls for Pipe Arch, 42x29-Inch	Each
52167	Steel Apron Endwalls for Pipe Arch, 49x33-Inch	Each
52168	Steel Apron Endwalls for Pipe Arch, 57x38-Inch	Each
52169	Steel Apron Endwalls for Pipe Arch, 64x43-Inch	Each
52170	Steel Apron Endwalls for Pipe Arch, 71x47-Inch	Each
52175	Corrugated Steel Pipe Cattle Pass	L.F.
52201	Reinforced Concrete Culvert Pipe, Class III, 12-Inch	L.F.
52202	Reinforced Concrete Culvert Pipe, Class III, 15-Inch	L.F.
52203	Reinforced Concrete Culvert Pipe, Class III, 18-Inch	L.F.
52204	Reinforced Concrete Culvert Pipe, Class III, 21-Inch	L.F.
52205	Reinforced Concrete Culvert Pipe, Class III, 24-Inch	L.F.
52206	Reinforced Concrete Culvert Pipe, Class III, 27-Inch	L.F.
52207	Reinforced Concrete Culvert Pipe, Class III, 30-Inch	L.F.
52209	Reinforced Concrete Culvert Pipe, Class III, 36-Inch	L.F.
52210	Reinforced Concrete Culvert Pipe, Class III, 42-Inch	L.F.
52211	Reinforced Concrete Culvert Pipe, Class III, 48-Inch	L.F.
52212	Reinforced Concrete Culvert Pipe, Class III, 54-Inch	L.F.

Item No.	Item	Unit
52213	Reinforced Concrete Culvert Pipe, Class III, 60-Inch	L.F.
52214	Reinforced Concrete Culvert Pipe, Class III, 66-Inch	L.F.
52215	Reinforced Concrete Culvert Pipe, Class III, 72-Inch	L.F.
52216	Reinforced Concrete Culvert Pipe, Class III, 78-Inch	L.F.
52217	Reinforced Concrete Culvert Pipe, Class III, 84-Inch	L.F.
52218	Reinforced Concrete Culvert Pipe, Class III, 90-Inch	L.F.
52219	Reinforced Concrete Culvert Pipe, Class III, 96-Inch	L.F.
52220	Reinforced Concrete Culvert Pipe, Class III, 102-Inch	L.F.
52221	Reinforced Concrete Culvert Pipe, Class III, 108-Inch	L.F.
52225	Reinforced Concrete Culvert Pipe, Class IV, 12-Inch	L.F.
52226	Reinforced Concrete Culvert Pipe, Class IV, 15-Inch	L.F.
52227	Reinforced Concrete Culvert Pipe, Class IV, 18-Inch	L.F.
52228	Reinforced Concrete Culvert Pipe, Class IV, 21-Inch	L.F.
52229	Reinforced Concrete Culvert Pipe, Class IV, 24-Inch	L.F.
52230	Reinforced Concrete Culvert Pipe, Class IV, 27-Inch	L.F.
52231	Reinforced Concrete Culvert Pipe, Class IV, 30-Inch	L.F.
52233	Reinforced Concrete Culvert Pipe, Class IV, 36-Inch	L.F.
52234	Reinforced Concrete Culvert Pipe, Class IV, 42-Inch	L.F.
52235	Reinforced Concrete Culvert Pipe, Class IV, 48-Inch	L.F.
52236	Reinforced Concrete Culvert Pipe, Class IV, 54-Inch	L.F.

Item No.	Item	Unit
52237	Reinforced Concrete Culvert Pipe, Class IV, 60-Inch	L.F.
52238	Reinforced Concrete Culvert Pipe, Class IV, 66-Inch	L.F.
52239	Reinforced Concrete Culvert Pipe, Class IV, 72-Inch	L.F.
52240	Reinforced Concrete Culvert Pipe, Class IV, 78-Inch	L.F.
52241	Reinforced Concrete Culvert Pipe, Class IV, 84-Inch	L.F.
52244	Reinforced Concrete Culvert Pipe, Class V, 12-Inch	L.F.
52245	Reinforced Concrete Culvert Pipe, Class V, 15-Inch	L.F.
52246	Reinforced Concrete Culvert Pipe, Class V, 18-Inch	L.F.
52247	Reinforced Concrete Culvert Pipe, Class V, 21-Inch	L.F.
52248	Reinforced Concrete Culvert Pipe, Class V, 24-Inch	L.F.
52249	Reinforced Concrete Culvert Pipe, Class V, 27-Inch	L.F.
52250	Reinforced Concrete Culvert Pipe, Class V, 30-Inch	L.F.
52252	Reinforced Concrete Culvert Pipe, Class V, 36-Inch	L.F.
52253	Reinforced Concrete Culvert Pipe, Class V, 42-Inch	L.F.
52254	Reinforced Concrete Culvert Pipe, Class V, 48-Inch	L.F.
52255	Reinforced Concrete Culvert Pipe, Class V, 54-Inch	L.F.
52256	Reinforced Concrete Culvert Pipe, Class V, 60-Inch	L.F.
52257	Reinforced Concrete Culvert Pipe, Class V, 66-Inch	L.F.
52258	Reinforced Concrete Culvert Pipe, Class V, 72-Inch	L.F.
52259	Reinforced Concrete Culvert Pipe, Class V, 84-Inch	L.F.

SCHEDULE OF BID ITEMS Continued

Item No.	Item	Unit
52260	Reinforced Concrete Apron Endwalls for Culvert Pipe, 12-Inch	Each
52261	Reinforced Concrete Apron Endwalls for Culvert Pipe, 15-Inch	Each
52262	Reinforced Concrete Apron Endwalls for Culvert Pipe, 18-Inch	Each
52263	Reinforced Concrete Apron Endwalls for Culvert Pipe, 21-Inch	Each
52264	Reinforced Concrete Apron Endwalls for Culvert Pipe, 24-Inch	Each
52265	Reinforced Concrete Apron Endwalls for Culvert Pipe, 27-Inch	Each
52266	Reinforced Concrete Apron Endwalls for Culvert Pipe, 30-Inch	Each
52267	Reinforced Concrete Apron Endwalls for Culvert Pipe, 36-Inch	Each
52268	Reinforced Concrete Apron Endwalls for Culvert Pipe, 42-Inch	Each
52269	Reinforced Concrete Apron Endwalls for Culvert Pipe, 48-Inch	Each
52270	Reinforced Concrete Apron Endwalls for Culvert Pipe, 54-Inch	Each
52271	Reinforced Concrete Apron Endwalls for Culvert Pipe, 60-Inch	Each
52272	Reinforced Concrete Apron Endwalls for Culvert Pipe, 66-Inch	Each
52273	Reinforced Concrete Apron Endwalls for Culvert Pipe, 72-Inch	Each
52274	Reinforced Concrete Apron Endwalls for Culvert Pipe, 84-Inch	Each
52275	Reinforced Concrete Pipe Cattle Pass	L.F.
52403	Salvaged Culvert Pipe, 12-Inch	L.F.
52404	Salvaged Culvert Pipe, 15-Inch	L.F.
52405	Salvaged Culvert Pipe, 18-Inch	L.F.
52406	Salvaged Culvert Pipe, 21-Inch	L.F.
52407	Salvaged Culvert Pipe, 24-Inch	L.F.
52408	Salvaged Culvert Pipe, 27-Inch	L.F.
52409	Salvaged Culvert Pipe, 30-Inch	L.F.
52410	Salvaged Culvert Pipe, 33-Inch	L.F.
52411	Salvaged Culvert Pipe, 36-Inch	L.F.

SCHEDULE OF BID ITEMS — Continued

Item No.	Item	Unit
52412	Salvaged Culvert Pipe, 42-Inch	L.F.
52413	Salvaged Culvert Pipe, 48-Inch	L.F.
52414	Salvaged Culvert Pipe, 54-Inch	L.F.
52415	Salvaged Culvert Pipe, 60-Inch	L.F.
52416	Salvaged Culvert Pipe, 66-Inch	L.F.
52417	Salvaged Culvert Pipe, 72-Inch	L.F.
52418	Salvaged Culvert Pipe, 78-Inch	L.F.
52419	Salvaged Culvert Pipe, 84-Inch	L.F.
52420	Salvaged Culvert Pipe, 90-Inch	L.F.
52421	Salvaged Culvert Pipe, 96-Inch	L.F.
52422	Salvaged Culvert Pipe, 102-Inch	L.F.
52423	Salvaged Culvert Pipe, 108-Inch	L.F.
52430	Salvaged Corrugated Steel Pipe Arch, 18x11-Inch	L.F.
52431	Salvaged Corrugated Steel Pipe Arch, 22x13-Inch	L.F.
52432	Salvaged Corrugated Steel Pipe Arch, 25x16-Inch	L.F.
52433	Salvaged Corrugated Steel Pipe Arch, 29x18-Inch	L.F.
52434	Salvaged Corrugated Steel Pipe Arch, 36x22-Inch	L.F.
52435	Salvaged Corrugated Steel Pipe Arch, 43x27-Inch	L.F.
52436	Salvaged Corrugated Steel Pipe Arch, 50x31-Inch	L.F.
52437	Salvaged Corrugated Steel Pipe Arch, 58x36-Inch	L.F.
52438	Salvaged Corrugated Steel Pipe Arch, 65x40-Inch	L.F.
52439	Salvaged Corrugated Steel Pipe Arch, 72x44-Inch	L.F.
52445	Salvaged Pipe Cattle Pass	L.F.
52503	Corrugated Aluminum Culvert Pipe, 12-Inch	L.F.
52504	Corrugated Aluminum Culvert Pipe, 15-Inch	L.F.
52505	Corrugated Aluminum Culvert Pipe, 18-Inch	L.F.
52506	Corrugated Aluminum Culvert Pipe, 21-Inch	L.F.
52507	Corrugated Aluminum Culvert Pipe, 24-Inch	L.F.
52508	Corrugated Aluminum Culvert Pipe, 30-Inch	L.F.

Item No.	Item	Unit
52509	Corrugated Aluminum Culvert Pipe, 36-Inch	L.F.
52510	Corrugated Aluminum Culvert Pipe, 42-Inch	L.F.
52511	Corrugated Aluminum Culvert Pipe, 48-Inch	L.F.
52512	Corrugated Aluminum Culvert Pipe, 54-Inch	L.F.
52513	Corrugated Aluminum Culvert Pipe, 60-Inch	L.F.
52514	Corrugated Aluminum Culvert Pipe, 72-Inch	L.F.
52515	Corrugated Aluminum Culvert Pipe, 84-Inch	L.F.
52550	Metal Apron Endwalls for Aluminum Culvert Pipe, 12-Inch	Each
52551	Metal Apron Endwalls for Aluminum Culvert Pipe, 15-Inch	Each
52552	Metal Apron Endwalls for Aluminum Culvert Pipe, 18-Inch	Each
52553	Metal Apron Endwalls for Aluminum Culvert Pipe, 21-Inch	Each
52554	Metal Apron Endwalls for Aluminum Culvert Pipe, 24-Inch	Each
52555	Metal Apron Endwalls for Aluminum Culvert Pipe, 30-Inch	Each
52556	Metal Apron Endwalls for Aluminum Culvert Pipe, 36-Inch	Each
52557	Metal Apron Endwalls for Aluminum Culvert Pipe, 42-Inch	Each
52558	Metal Apron Endwalls for Aluminum Culvert Pipe, 48-Inch	Each
52559	Metal Apron Endwalls for Aluminum Culvert Pipe, 54-Inch	Each
52560	Metal Apron Endwalls for Aluminum Culvert Pipe, 60-Inch	Each
52561	Metal Apron Endwalls for Aluminum Culvert Pipe, 72-Inch	Each
52562	Metal Apron Endwalls for Aluminum Culvert Pipe, 84-Inch	Each
52701	Structural Plate Pipe, 60-Inch	L.F.
52702	Structural Plate Pipe, 72-Inch	L.F.
52703	Structural Plate Pipe, 84-Inch	L.F.
52704	Structural Plate Pipe, 96-Inch	L.F.
52705	Structural Plate Pipe, 108-Inch	L.F.
52706	Structural Plate Pipe, 120-Inch	L.F.
52707	Structural Plate Pipe, 132-Inch	L.F.

Item No.	Item	Unit
52708	Structural Plate Pipe, 144-Inch	L.F.
52709	Structural Plate Pipe, 156-Inch	L.F.
52710	Structural Plate Pipe, 168-Inch	L.F.
52711	Structural Plate Pipe, 180-Inch	L.F.
52721	Structural Plate Pipe Arch, 6-Ft. Span	L.F.
52722	Structural Plate Pipe Arch, 7-Ft. Span	L.F.
52723	Structural Plate Pipe Arch, 8-Ft. Span	L.F.
52724	Structural Plate Pipe Arch, 9-Ft. Span	L.F.
52725	Structural Plate Pipe Arch, 10-Ft. Span	L.F.
52726	Structural Plate Pipe Arch, 11-Ft. Span	L.F.
52727	Structural Plate Pipe Arch, 12-Ft. Span	L.F.
52728	Structural Plate Pipe Arch, 13-Ft. Span	L.F.
52729	Structural Plate Pipe Arch, 14-Ft. Span	L.F.
52730	Structural Plate Pipe Arch, 15-Ft. Span	L.F.
52731	Structural Plate Pipe Arch, 16-Ft. Span	L.F.
52732	Structural Plate Pipe Arch, 16.5-Ft. Span	L.F.
60101	Concrete Curb, Type A	L.F.
60102	Concrete Curb, Type D	L.F.
60103	Concrete Curb, Type G	L.F.
60104	Concrete Curb, Type J	L.F.
60119	Concrete Curb and Gutter, 18-Inch, Type A	L.F.
60120	Concrete Curb and Gutter, 18-Inch, Type D	L.F.
60123	Concrete Curb and Gutter, 30-Inch, Type A	L.F.
60133	Concrete Curb and Gutter, 30-Inch, Type D	L.F.
60135	Concrete Curb and Gutter, 30-Inch, Type G	L.F.
60136	Concrete Curb and Gutter, 30-Inch, Type J	L.F.
60140	Concrete Curb and Gutter, 30-Inch, Type K	L.F.
60150	Concrete Curb and Gutter, 30-Inch, Type L	L.F.
60160	Concrete Curb and Gutter, 36-Inch, Type A	L.F.
60170	Concrete Curb and Gutter, 36-Inch, Type D	L.F.
60204	Concrete Sidewalk, 4-Inch	S.F.
60205	Concrete Sidewalk, 5-Inch	S.F.
60206	Concrete Sidewalk, 6-Inch	S.F.
60210	Concrete Loading Zone	S.F.
60215	Concrete Steps	S.F.
60224	Concrete Safety Islands	S.F.
60301	Concrete Barrier	L.F.

Item No.	Item	Unit
60404	Slope Paving, Concrete	S.Y.
60405	Slope Paving, Crushed Aggregate	S.Y.
60503	Mortar Rubble Ditch Checks	C.Y.
60504	Concrete Ditch Checks	C.Y.
60601	Riprap	C.Y.
60602	Heavy Riprap	C.Y.
60603	Grouted Riprap	C.Y.
60701	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 6-Inch	L.F.
60702	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 8-Inch	L.F.
60703	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 10-Inch	L.F.
60704	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 12-Inch	L.F.
60705	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 15-Inch	L.F.
60706	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 18-Inch	L.F.
60707	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 21-Inch	L.F.
60708	Nonreinforced Concrete Pipe, Class I, Storm Sewer, 24-Inch	L.F.
60711	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 6-Inch	L.F.
60712	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 8-Inch	L.F.
60713	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 10-Inch	L.F.
60714	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 12-Inch	L.F.
60715	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 15-Inch	L.F.
60716	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 18-Inch	L.F.
60717	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 21-Inch	L.F.
60718	Nonreinforced Concrete Pipe, Class III, Storm Sewer, 24-Inch	L.F.
60733	ABS Composite Pipe Storm Sewer, 8-Inch	L.F.

Item No.	Item	Unit
60734	ABS Composite Pipe Storm Sewer, 10-Inch	L.F.
60735	ABS Composite Pipe Storm Sewer, 12-Inch	L.F.
60736	ABS Composite Pipe Storm Sewer, 15-Inch	L.F.
60801	Reinforced Concrete Pipe, Class II, Storm Sewer, 12-Inch	L.F.
60802	Reinforced Concrete Pipe, Class II, Storm Sewer, 15-Inch	L.F.
60803	Reinforced Concrete Pipe, Class II, Storm Sewer, 18-Inch	L.F.
60804	Reinforced Concrete Pipe, Class II, Storm Sewer, 21-Inch	L.F.
60805	Reinforced Concrete Pipe, Class II, Storm Sewer, 24-Inch	L.F.
60806	Reinforced Concrete Pipe, Class II, Storm Sewer, 27-Inch	L.F.
60807	Reinforced Concrete Pipe, Class II, Storm Sewer, 30-Inch	L.F.
60809	Reinforced Concrete Pipe, Class II, Storm Sewer, 36-Inch	L.F.
60810	Reinforced Concrete Pipe, Class II, Storm Sewer, 42-Inch	L.F.
60811	Reinforced Concrete Pipe, Class II, Storm Sewer, 48-Inch	L.F.
60812	Reinforced Concrete Pipe, Class II, Storm Sewer, 54-Inch	L.F.
60813	Reinforced Concrete Pipe, Class II, Storm Sewer, 60-Inch	L.F.
60814	Reinforced Concrete Pipe, Class II, Storm Sewer, 66-Inch	L.F.
60815	Reinforced Concrete Pipe, Class II, Storm Sewer, 72-Inch	L.F.
60816	Reinforced Concrete Pipe, Class II, Storm Sewer, 78-Inch	L.F.
60817	Reinforced Concrete Pipe, Class II, Storm Sewer, 84-Inch	L.F.
60818	Reinforced Concrete Pipe, Class II, Storm Sewer, 90-Inch	L.F.
60819	Reinforced Concrete Pipe, Class II, Storm Sewer, 96-Inch	L.F.
60820	Reinforced Concrete Pipe, Class II, Storm Sewer, 102-Inch	L.F.

Item No.	Item	Unit
60821	Reinforced Concrete Pipe, Class II, Storm Sewer, 108-Inch	L.F.
60825	Reinforced Concrete Pipe, Class III, Storm Sewer, 12-Inch	L.F.
60826	Reinforced Concrete Pipe, Class III, Storm Sewer, 15-Inch	L.F.
60827	Reinforced Concrete Pipe, Class III, Storm Sewer, 18-Inch	L.F.
60828	Reinforced Concrete Pipe, Class III, Storm Sewer, 21-Inch	L.F.
60829	Reinforced Concrete Pipe, Class III, Storm Sewer, 24-Inch	L.F.
60830	Reinforced Concrete Pipe, Class III, Storm Sewer, 27-Inch	L.F.
60831	Reinforced Concrete Pipe, Class III, Storm Sewer, 30-Inch	L.F.
60833	Reinforced Concrete Pipe, Class III, Storm Sewer, 36-Inch	L.F.
60834	Reinforced Concrete Pipe, Class III, Storm Sewer, 42-Inch	L.F.
60835	Reinforced Concrete Pipe, Class III, Storm Sewer, 48-Inch	L.F.
60836	Reinforced Concrete Pipe, Class III, Storm Sewer, 54-Inch	L.F.
60837	Reinforced Concrete Pipe, Class III, Storm Sewer, 60-Inch	L.F.
60838	Reinforced Concrete Pipe, Class III, Storm Sewer, 66-Inch	L.F.
60839	Reinforced Concrete Pipe, Class III, Storm Sewer, 72-Inch	L.F.
60840	Reinforced Concrete Pipe, Class III, Storm Sewer, 78-Inch	L.F.
60841	Reinforced Concrete Pipe, Class III, Storm Sewer, 84-Inch	L.F.
60842	Reinforced Concrete Pipe, Class III, Storm Sewer, 90-Inch	L.F.
60843	Reinforced Concrete Pipe, Class III, Storm Sewer, 96-Inch	L.F.
60844	Reinforced Concrete Pipe, Class III, Storm Sewer, 102-Inch	L.F.

Item No.	Item	Unit
60845	Reinforced Concrete Pipe, Class III, Storm Sewer, 108-Inch	L.F.
60850	Reinforced Concrete Pipe, Class IV, Storm Sewer, 12-Inch	L.F.
60851	Reinforced Concrete Pipe, Class IV, Storm Sewer, 15-Inch	L.F.
60852	Reinforced Concrete Pipe, Class IV, Storm Sewer, 18-Inch	L.F.
60853	Reinforced Concrete Pipe, Class IV, Storm Sewer, 21-Inch	L.F.
60854	Reinforced Concrete Pipe, Class IV, Storm Sewer, 24-Inch	L.F.
60855	Reinforced Concrete Pipe, Class IV, Storm Sewer, 27-Inch	L.F.
60856	Reinforced Concrete Pipe, Class IV, Storm Sewer, 30-Inch	L.F.
60858	Reinforced Concrete Pipe, Class IV, Storm Sewer, 36-Inch	L.F.
60859	Reinforced Concrete Pipe, Class IV, Storm Sewer, 42-Inch	L.F.
60860	Reinforced Concrete Pipe, Class IV, Storm Sewer, 48-Inch	L.F.
60861	Reinforced Concrete Pipe, Class IV, Storm Sewer, 54-Inch	L.F.
60862	Reinforced Concrete Pipe, Class IV, Storm Sewer, 60-Inch	L.F.
60863	Reinforced Concrete Pipe, Class IV, Storm Sewer, 66-Inch	L.F.
60864	Reinforced Concrete Pipe, Class IV, Storm Sewer, 72-Inch	L.F.
60865	Reinforced Concrete Pipe, Class IV, Storm Sewer, 78-Inch	L.F.
60866	Reinforced Concrete Pipe, Class IV, Storm Sewer, 84-Inch	L.F.
60870	Reinforced Concrete Pipe, Class V, Storm Sewer, 12-Inch	L.F.
60871	Reinforced Concrete Pipe, Class V, Storm Sewer, 15-Inch	L.F.
60872	Reinforced Concrete Pipe, Class V, Storm Sewer, 18-Inch	L.F.

SCHEDULE OF BID ITEMS — Continued

Item No.	Item	Unit
60873	Reinforced Concrete Pipe, Class V, Storm Sewer, 21-Inch	L.F.
60874	Reinforced Concrete Pipe, Class V, Storm Sewer, 24-Inch	L.F.
60875	Reinforced Concrete Pipe, Class V, Storm Sewer, 27-Inch	L.F.
60876	Reinforced Concrete Pipe, Class V, Storm Sewer, 30-Inch	L.F.
60878	Reinforced Concrete Pipe, Class V, Storm Sewer, 36-Inch	L.F.
60879	Reinforced Concrete Pipe, Class V, Storm Sewer, 42-Inch	L.F.
60880	Reinforced Concrete Pipe, Class V, Storm Sewer, 48-Inch	L.F.
60881	Reinforced Concrete Pipe, Class V, Storm Sewer, 54-Inch	L.F.
60882	Reinforced Concrete Pipe, Class V, Storm Sewer, 60-Inch	L.F.
60883	Reinforced Concrete Pipe, Class V, Storm Sewer, 66-Inch	L.F.
60884	Reinforced Concrete Pipe, Class V, Storm Sewer, 72-Inch	L.F.
60921	Relaid Storm Sewer, 6-Inch	L.F.
60922	Relaid Storm Sewer, 8-Inch	L.F.
60923	Relaid Storm Sewer, 10-Inch	L.F.
60924	Relaid Storm Sewer, 12-Inch	L.F.
60925	Relaid Storm Sewer, 15-Inch	L.F.
60926	Relaid Storm Sewer, 18-Inch	L.F.
60927	Relaid Storm Sewer, 21-Inch	L.F.
60928	Relaid Storm Sewer, 24-Inch	L.F.
60930	Relaid Storm Sewer, 30-Inch	L.F.
60932	Relaid Storm Sewer, 36-Inch	L.F.
60933	Relaid Storm Sewer, 42-Inch	L.F.
60934	Relaid Storm Sewer, 48-Inch	L.F.
60936	Relaid Storm Sewer, 60-Inch	L.F.
60938	Relaid Storm Sewer, 72-Inch	L.F.
60940	Relaid Storm Sewer, 84-Inch	L.F.
61101	Catch Basins, Type 1	Each
61102	Catch Basins, Type 2	Each

SCHEDULE OF BID ITEMS — Continued

Item No.	Item	Unit
61103	Catch Basins, Type 3	Each
61105	Catch Basins, Type 5	Each
61110	Manholes, Type 1	Each
61111	Manholes, Type 2	Each
61112	Manholes, Type 3	Each
61113	Manholes, Type 5	Each
61115	Manholes, Type 6	Each
61121	Inlets, Type 1	Each
61122	Inlets, Type 3	Each
61123	Inlets, Type 8	Each
61124	Inlets, Type 9	Each
61125	Inlets, Type 10	Each
61126	Inlets, Type 11	Each
61127	Reconstructing Catch Basins	Each
61128	Reconstructing Manholes	Each
61129	Reconstructing Inlets	Each
61131	Catch Basin Covers, Type A	Each
61132	Catch Basin Covers, Type B	Each
61133	Catch Basin Covers, Type C	Each
61135	Catch Basin Covers, Type F	Each
61137	Catch Basin Covers, Type H	Each
61140	Catch Basin Covers, Type WM	Each
61147	Inlets, Type 2	Each
61151	Manhole Covers, Type J	Each
61152	Manhole Covers, Type K	Each
61153	Manhole Covers, Type L	Each
61154	Manhole Covers, Type M	Each
61161	Inlet Covers, Type A	Each
61162	Inlet Covers, Type B	Each
61163	Inlet Covers, Type C	Each
61165	Inlet Covers, Type F	Each
61167	Inlet Covers, Type H	Each
61170	Inlet Covers, Type MS	Each
61171	Inlet Covers, Type WM	Each
61181	Adjusting Catch Basin Covers	Each
61182	Adjusting Manhole Covers	Each
61183	Adjusting Inlet Covers	Each

Item No.	Item	Unit
61201	Pipe Underdrain, 6-Inch	L.F.
61202	Pipe Underdrain, 8-Inch	L.F.
61203	Pipe Underdrain, 10-Inch	L.F.
61204	Pipe Underdrain, 12-Inch	L.F.
61205	Pipe Underdrain, 15-Inch	L.F.
61206	Pipe Underdrain, 18-Inch	L.F.
61207	Pipe Underdrain, 21-Inch	L.F.
61211	Pipe Underdrain, Unperforated, 6-Inch	L.F.
61212	Pipe Underdrain, Unperforated, 8-Inch	L.F.
61213	Pipe Underdrain, Unperforated, 10-Inch	L.F.
61214	Pipe Underdrain, Unperforated, 12-Inch	L.F.
61215	Pipe Underdrain, Unperforated, 15-Inch	L.F.
61216	Pipe Underdrain, Unperforated, 18-Inch	L.F.
61217	Pipe Underdrain, Unperforated, 21-Inch	L.F.
61220	Pipe Underdrain, Drain Tile, 4-Inch	L.F.
61221	Pipe Underdrain, Drain Tile, 5-Inch	L.F.
61222	Pipe Underdrain, Drain Tile, 6-Inch	L.F.
61223	Pipe Underdrain, Drain Tile, 8-Inch	L.F.
61224	Pipe Underdrain, Drain Tile, 10-Inch	L.F.
61225	Pipe Underdrain, Drain Tile, 12-Inch	L.F.
61226	Pipe Underdrain, Drain Tile, 14-Inch	L.F.
61227	Pipe Underdrain, Drain Tile, 15-Inch	L.F.
61228	Pipe Underdrain, Drain Tile, 16-Inch	L.F.
61229	Pipe Underdrain, Drain Tile, 18-Inch	L.F.
61230	Pipe Underdrain, Drain Tile, 21-Inch	L.F.
61231	Pipe Underdrain, Drain Tile, 24-Inch	L.F.
61232	Pipe Underdrain, Drain Tile, 30-Inch	L.F.
61309	Metallic Conduit, 3/4-Inch	L.F.
61310	Metallic Conduit, 1-Inch	L.F.
61311	Metallic Conduit, 1-1/4-Inch	L.F.
61312	Metallic Conduit, 1-1/2-Inch	L.F.
61313	Metallic Conduit, 2-Inch	L.F.
61314	Metallic Conduit, 2-1/2-Inch	L.F.
61315	Metallic Conduit, 3-Inch	L.F.
61316	Metallic Conduit, 4-Inch	L.F.
61330	Nonmetallic Conduit, 3/4-Inch	L.F.
61331	Nonmetallic Conduit, 1-Inch	L.F.

Item No.	Item	Unit
61332	Nonmetallic Conduit, 1-1/4-Inch	L.F.
61333	Nonmetallic Conduit, 1-1/2-Inch	L.F.
61334	Nonmetallic Conduit, 2-Inch	L.F.
61335	Nonmetallic Conduit, 2-1/2-Inch	L.F.
61336	Nonmetallic Conduit, 3-Inch	L.F.
61337	Nonmetallic Conduit, 4-Inch	L.F.
61403	Cable Guard Fence	L.F.
61405	Anchorages for Cable Guard Fence	Each
61406	Anchorages for Steel Plate Beam Guard	Each
61408	Steel Plate Beam Guard, Class A	L.F.
61409	Steel Plate Beam Guard, Class B	L.F.
61411	Steel Plate Beam Median Guard	L.F.
61415	Salvaged Guard Fence, Cable Type	L.F.
61416	Salvaged Guard Fence, Steel Beam Type	L.F.
61421	Marker Posts	Each
61422	Marker Posts for Right-of-Way	Each
61501	Timber Rail Guard Fence	L.F.
61502	Treated Timber Curb	Each
61503	Timber Guard Posts	Each
61504	Rustic Marker Posts	Each
61510	Wisconsin Historical Marker	L.S.
61511 et seq.	Wisconsin Historical Markers, Project _____	L.S.
61601	Woven Wire Fence	L.F.
61604	Chain Link Fence, Type A, 4 Ft.	L.F.
61605	Chain Link Fence, Type A, 5 Ft.	L.F.
61606	Chain Link Fence, Type A, 6 Ft.	L.F.
61607	Chain Link Fence, Type A, 7 Ft.	L.F.
61608	Chain Link Fence, Type A, 8 Ft.	L.F.
61610	Chain Link Fence, Type B, 4 Ft.	L.F.
61611	Chain Link Fence, Type B, 5 Ft.	L.F.
61612	Chain Link Fence, Type B, 6 Ft.	L.F.
61613	Chain Link Fence, Type B, 7 Ft.	L.F.
61614	Chain Link Fence, Type B, 8 Ft.	L.F.
61620 et seq.	Chain Link Fence, Gates, _____ Feet	Each
61701 et seq.	Hauling _____	C.Y.Mi.

SCHEDULE OF BID ITEMS Continued

Item No.	Item	Unit
61801	Maintenance and Repair of Haul Roads	L.S.
61802 et seq	Maintenance and Repair of Haul Roads, Project _____	L.S.
61910	Mobilization	L.S.
61911 et seq	Mobilization, Project _____	L.S.
62001	Concrete Corrugated Median	S.F.
62101	Landmark Reference Monuments	Each
62110	Landmark Reference Monuments and Covers	Each
62201	Bituminous Concrete Curb	L.F.
62301	Calcium Chloride Surface Treatment	Ton
62401	Water	M. Gal.
62501	Topsoil	S.Y.
62502	Topsoil	C.Y.
62505	Salvaged Topsoil	S.Y.
62602	Peat Humus	S.Y.
62702	Mulching	S.Y.
62703	Mulching	Ton
62802	Erosion Mat	S.Y.
62810	Erosion Bales	Each
62902	Fertilizer, Type A	Cwt.
62905	Fertilizer, Type B	Cwt.
62911	Agricultural Limestone Treatment	Ton
63002	Seeding	Lb.
63101	Sodding	S.Y.
63201 et seq	Trees, (Species and Size)	Each
63261 et seq	Shrubs, (Species and Size)	Each
63281 et seq	Vines, (Species and Size)	Each
63301	Delineator Posts	Each
63305	Delineators	Each
63401	Wood Posts, 4x4-Inchx10-Ft	Each
63402	Wood Posts, 4x4-Inchx12-Ft	Each
63403	Wood Posts, 4x4-Inchx14-Ft	Each
63404	Wood Posts, 4x4-Inchx16-Ft	Each
63405	Wood Posts, 4x4-Inchx18-Ft	Each

SCHEDULE OF BID ITEMS — Continued

Item No.	Item	Unit
63406	Wood Posts, 4x4-Inchx20-Ft.	Each
63407	Wood Posts, 4x4-Inchx22-Ft.	Each
63410	Wood Posts, 4x6-Inchx12-Ft.	Each
63411	Wood Posts, 4x6-Inchx14-Ft.	Each
63412	Wood Posts, 4x6-Inchx16-Ft.	Each
63413	Wood Posts, 4x6-Inchx18-Ft.	Each
63414	Wood Posts, 4x6-Inchx20-Ft.	Each
63415	Wood Posts, 4x6-Inchx22-Ft.	Each
63502	High-Strength Structural Steel, Sign Supports	Lb.
63601	Concrete Masonry, Sign Supports	C.Y.
63605	Bar Steel Reinforcement, Sign Supports	Lb.
63701	Signs, Type I	S.F.
63702	Signs, Type II, Reflective	S.F.
63703	Signs, Type II, Non-Reflective	S.F.
63704	Signs, Type III	S.F.
63705	Signs, Type IV	S.F.
63801	Moving Signs	L.S.
63802 et seq	Moving Signs, Project _____	L.S.
63805	Removing Signs	L.S.
63806 et seq	Removing Signs, Project _____	L.S.
63810	Revising Signs	L.S.
63811 et seq	Revising Signs, Project _____	L.S.
63815	Erecting State-Owned Signs	L.S.
63816 et seq	Erecting State-Owned Signs, Project _____	L.S.
63901	Drill Hole in Earth, 6-Inch	L.F.
63902	Drill Hole in Earth, 8-Inch	L.F.
63903	Drill Hole in Earth, 10-Inch	L.F.
63904	Drill Hole in Earth, 12-Inch	L.F.
63905	Drill Hole in Rock, 4-Inch	L.F.
63906	Drill Hole in Rock, 6-Inch	L.F.
63907	Drill Hole in Rock, 8-Inch	L.F.
63908	Drill Hole in Rock, 10-Inch	L.F.
63909	Drill Hole in Rock, 12-Inch	L.F.
63910	Well Casing Pipe, 4-Inch	L.F.

Item No.	Item	Unit
63911	Well Casing Pipe, 6-Inch	L.F.
63912	Well Casing Pipe, 8-Inch	L.F.
63913	Well Casing Pipe, 10-Inch	L.F.
63914	Well Casing Pipe, 12-Inch	L.F.
63917	Well Screen	L.F.
63920	Portland Cement for Grouting	Sack
63925	Pump and Well Platform	Each
63930	Wayside Well Shelter	Each
63940	Test Pumping	Each
64001	Lighting Units	Each
64011	Underground Cable	L.F.
64021 et seq.	Sign Lighting, Structure _____	L.S.
64127	Sign Bridges, 20-Ft. Span	Each
64128	Sign Bridges, 25-Ft. Span	Each
64129	Sign Bridges, 30-Ft. Span	Each
64130	Sign Bridges, 35-Ft. Span	Each
64131	Sign Bridges, 40-Ft. Span	Each
64132	Sign Bridges, 45-Ft. Span	Each
64133	Sign Bridges, 50-Ft. Span	Each
64134	Sign Bridges, 55-Ft. Span	Each
64135	Sign Bridges, 60-Ft. Span	Each
64136	Sign Bridges, 65-Ft. Span	Each
64137	Sign Bridges, 70-Ft. Span	Each
64138	Sign Bridges, 75-Ft. Span	Each
64139	Sign Bridges, 80-Ft. Span	Each
64140	Sign Bridges, 85-Ft. Span	Each
64142	Sign Bridges, 90-Ft. Span	Each
64143	Sign Bridges, 95-Ft. Span	Each
64144	Sign Bridges, 100-Ft. Span	Each
64145	Sign Bridges, 105-Ft. Span	Each
64146	Sign Bridges, 110-Ft. Span	Each
64147	Sign Bridges, 115-Ft. Span	Each
64148	Sign Bridges, 120-Ft. Span	Each
64160	Single Pole Sign Supports, One Sign	Each
64165	Single Pole Sign Supports, Two Signs	Each
64170	Sign Bridge, Structure _____	L.S.
64201	Field Office, Type A	L.S.

Item No.	Item	Unit
64202	Field Office, Type B	L.S.
64210	Field Laboratory	L.S.
64301	Traffic Control	L.S.
64302 et seq.	Traffic Control, Project _____	L.S.

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

SS No. 1

DIVISION OF HIGHWAYS

November 1981

SUPPLEMENTAL SPECIFICATIONS

Section 101. Definitions and Terms

Section 644. Pavement Markings

These Supplemental specifications amend the provisions of the Standard Specifications, Edition of 1981, and shall be construed to be a part thereof superseding any conflicting provisions therein applicable to the work under the contract.

101 Definition and Terms. The list of abbreviations following the second paragraph of this section is supplemented as follows:

ITE Institute of Transportation Engineers

644 Pavement Markings. This section is created to read as follows:

644.1 Description. This work shall consist of the furnishing and application of reflectorized pavement markings at the locations and in accordance with the design and details indicated, all as shown on the plans and provided by the contract.

Pavement Marking shall consist of the furnishing and application of reflectorized traffic stripes of the specified material, width and color to produce centerlines, no passing zone lines, lane lines and edgelines.

Pavement Marking, Channelizing, shall consist of the furnishing and application of white, solid, reflectorized traffic stripes of the specified material and width to produce channelizing lines.

Pavement Marking, Railroad Crossings, shall consist of the furnishing and application of the required reflectorized symbols, letters and stripes of the specified white material, and yellow centerline and no-passing line when required, of similar material. Each unit shall include an RXR symbol and three transverse stripes.

Pavement Marking, Stop Line, shall consist of the furnishing and application of white, reflectorized stop line of the specified width and material.

Pavement Marking, Crosswalk, shall consist of the furnishing and application of white, reflectorized stripes of the specified width, configuration and material.

Pavement Marking, Arrows, shall consist of the furnishing and application of white, reflectorized arrow markings of the specified configuration and material.

Pavement Marking, Words, shall consist of the furnishing and application of white, reflectorized letters forming the specified words and of the specified material.

Temporary Pavement Marking, Removable Tape, shall consist of furnishing, application and removal of reflectorized removable pavement marking tape to and from pavement surfaces designated to remain in place.

Temporary Pavement Marking, shall consist of furnishing and application of reflectorized pavement markings to designated surfaces.

Removing Pavement Markings shall consist of the removal of painted or plastic traffic stripes or markings, except that the removal of markings applied under the item of Temporary Pavement Marking, Removable Tape, shall be incidental to such item.

644.2 Materials.

644.2.1 General. All materials used in the work shall conform to the requirements specified for the class of material named.

644.2.2 Permanent Pavement Markings.

644.2.2.2 Hot Paint. Hot Paint shall conform to the requirements of one of the following materials.

Rapid dry paint as contained in Chapter II, Paints, Subsections A and B of the ITE Standard referenced in Subsection 644.2.2.1.

Type F traffic paint as contained in AASHTO Specification Designation: M 248.

644.2.2.3 Glass Spheres for Paint. The contractor shall furnish a 50-pound sample of spheres from each shipment when samples are required. Roundness will be tested by a Wald Roundness Tester.

Glass Spheres for use with paints conforming to the requirements of the ITE Standard shall meet the requirements of Chapter II, Properties of Glass Spheres for Reflectorization, of such Standard, except for test procedure for roundness.

Glass spheres for use with paints conforming to AASHTO Designation: M 248 shall meet the requirements of the Specification for Glass Beads used in Traffic Paint, AASHTO Designation: M 247, for Type I beads, except for sample size and test procedure for roundness.

644.2.3.2 Reflectorized Paint. The paint shall not be premixed but should be commercially available paint intended for marking traffic lanes on either concrete or bituminous highways. Reflectorization of the paint shall be by means of glass spheres. The glass spheres shall be commercially available spheres intended for use with pavement marking paint, with a minimum index of refraction of 1.5 and overall roundness of 70 percent. The color of the paint shall be yellow or white, as required on the plans.

644.2.4 Testing and Certification. The contractor shall furnish to the engineer a Certificate of Compliance for temporary pavement marking material, including glass beads, which shall indicate the type of material and batch numbers.

The contractor shall also furnish reports of actual tests for conformance made by the manufacturer or a recognized testing laboratory on samples of permanent marking materials and glass spheres furnished for the work. The manufacturer shall identify on these reports the batch numbers to which the test results apply.

The engineer may also require samples of materials from the contractor.

644.3 Equipment.

644.3.1 Paint Equipment. Equipment used for applying paint shall be approved by the Engineer.

The paint tank or tanks on the marker shall have accurately calibrated dipsticks or other means of measuring the quantity of paint in the tank. An adequate heating system shall be provided when applying Hot Paint which will achieve and maintain required, uniform application temperatures.

644.3.2 Glass Sphere Equipment. Equipment for applying glass spheres shall be approved automatic, mechanical devices unless otherwise permitted by the Engineer.

644.4 Construction Methods.

644.4.1 General. The pavement surface shall be dry and free from frost, as visually determined by the Engineer. Dust, dirt, glaze, gravel, debris or other materials which would prevent proper bonding of the marking to the pavement shall be removed by the contractor prior to application of the marking.

644.4.2 Permanent Pavement Markings.

644.4.2.1 General. Permanent pavement markings shall be placed as shown on the plans and within any specified time limits.

Permanent pavement markings shall comply with the pertinent requirements of Subsection 644.2.2.

644.4.2.2 Painted Markings. The paint shall be applied at the rate recommended by the manufacturer within plus or minus ten percent as determined by quantitative measurements made of the area of line applied per unit volume of material. If no rate is specified by the manufacturer, the paint will be applied at the rate of 16.5 gallons per mile of four-inch continuous stripe (wet film thickness of 15 mils), and glass spheres shall be applied at the rate of six pounds per gallon of paint of the drop-on type and three pounds of glass spheres per gallon of paint of the combination type.

The Engineer will compute the rate of application of paint and spheres. If on any section the computed rate of application is less than 90 percent of the above values, the contractor will at his own cost and expense remark such section. Both the paint and the glass spheres shall be applied at a uniform rate across the full width of the painted line.

The contractor when applying Cold Paint shall place cones or other similar traffic control devices on the wet lines immediately back of the marker at a rate of one cone per 250 feet or closer. When the lines are sufficiently dry to preclude any pick-up under traffic, the cones shall be promptly removed.

On highways open to traffic, the marker shall be preceded by a truck and followed by another truck to warn of the newly placed lines. Each of these trucks shall be equipped with a Slow Moving Vehicle emblem, one or more flashing or revolving yellow lights showing to the front and rear, and signs to advise traffic of the wet line. On one-way roadways, all work shall be done with the marker and other trucks operated in the direction of traffic on the roadway being painted.

644.4.2.5 Miscellaneous. The locations for Pavement Marking; Railroad Crossings, Stop Line, Crosswalk, Arrows or Words shall be laid out in the field by the Engineer at the time such markings are to be placed.

The construction methods used for these items of work shall conform to the pertinent foregoing requirements and to the following:

The finished markers shall be uniform and have well-defined edges and ends. They shall be straight and without waviness, or smoothly curved as required by the plans.

Railroad crossings designated for marking and located on highways without centerline pavement marking shall have the centerline and no passing zone marked in conformance with the plans. The cost of marking the centerline shall be considered incidental to this item and no further payment will be made.

644.5 Proving Period. A 90 day proving period shall apply to all permanent plastic markings placed during each calendar month. The proving period shall commence on the last day of each month. During this period the engineer will make such observations as are necessary to determine failure of the material. Should the termination of the 90 day proving period fall within the months of December, January, or February, the Engineer may extend the proving period a minimum number of days necessary for changes in weather and/or road conditions to permit adequate observation of the markings in place.

If more than ten percent of any 2,000-foot section of marking, except miscellaneous marking, fails during the proving period for any reason, except for loss due to abrasion at private entrances or within intersections, that section shall be repaired or replaced at the contractor's expense prior to final acceptance. For this purpose, each edge line, lane line or each combination of center and no-passing lines shall constitute a separate section of marking, measuring the marking through a 2,000-foot length of highway. All gore markings or turning lane markings at a single interchange or intersection shall constitute a separate section, regardless of length.

Failure of the material will be rated on the basis of the percentage of material remaining on the pavement at the end of the proving period. Percentage of the material remaining on the pavement will be the percentage of the area of the stripe in which the substrate is not exposed.

Each miscellaneous marking including channelizing lines, stop lines, crosswalks, railroad crossings, arrows and words will be evaluated for failure as a unit. Any such markings determined by the engineer to have failed shall be repaired or replaced at the contractor's expense.

644.6 Method of Measurement. The items of Pavement Marking; and Pavement Marking, Channelizing of the specified materials; Pavement Marking, Stop Line; and Pavement Marking, Crosswalk of the specified materials and widths; Temporary Pavement Marking, Removable Tape; and Temporary Pavement Marking shall each be measured by the linear foot of line in place and accepted in accordance with the contract.

Removing Pavement Markings shall be measured by the linear foot of line removed in accordance with the contract, except that the removal of markings placed under the item of Temporary Pavement Marking, Removable Tape will not be measured for payment.

The quantity of solid line to be paid for shall be the summation of the linear feet of such line measured end to end of the line. The quantity of intermittent line to be paid for shall be the summation of the linear feet of such line derived by multiplying the nominal length of individual markings of such line by the number of markings in the intermittent line end to end.

The items of Pavement Marking, Railroad Crossings; Pavement Marking, Arrows, and Pavement Marking, Words, of the specified material or number shall each be measured by the unit in place and accepted in accordance with the contract.

644.7 Basis of Payment. The item of Pavement Marking (Material); Pavement Marking, Channelizing (Material); Pavement Marking, Stop Line (Material-Size); Pavement Marking, Crosswalk (Material-Size); Temporary Pavement Marking, Removable Tape; Temporary Pavement Marking; or Removing Pavement Markings, as the case may be, measured as provided above, will each be paid for at the contract unit price per linear foot, which price shall be payment in full for furnishing, applying and protecting all materials, including reflectorization; for removing as required; and for all labor, tools, equipment and incidentals necessary to complete the work in accordance with the contract.

The item of Pavement Marking, Railroad Crossings (Material); Pavement Marking, Arrows (Materials-Number); or Pavement Marking, Words (Material) as the case may be, measured as provided above, will each be paid for at the contract unit price, which price shall be payment in full for furnishing, applying and protecting all materials, including reflectorization; and for all labor, tools, equipment and incidentals necessary to complete the work in accordance with the contract.

EXXON ACCESS ROAD

SPECIAL PROVISIONS AND SUPPLEMENTAL INSTRUCTIONS

Bid Item No. 20103 - Clearing H.A.

- All areas within the R/W shall be cleared.

Bid Item No. 20106 - Grubbing H.A.

- All areas within the R/W shall be grubbed.

Bid Item No. 20503 - Unclassified Excavation C.M.

- Topsoil shall be stripped in all areas of cuts and fills and stockpiled.
- Ditches shall be constructed first.
- No overhaul will be paid for.
- Foundation preparation is incidental.
- Special compaction in accordance with Para. 207.3.6.3 and Para. 207.3.6.4 shall be required.
- No timber, brush or vegetation shall be placed in embankments or buried within the construction limits.
- Removal of any unsuitable material found in the subgrade shall be replaced with suitable material found within the right-of-way and shall be paid as unclassified excavation.

Bid Item No. 20505 - Marsh Excavation C.M.

- In accordance with Section 207.3.3.
- Marsh excavation shall be disposed of along the adjacent fill slopes to flatten the existing slopes and in suitable berms as designated by the Engineer.

Bid Item No. 20811 - Select Borrow Excavation C.M.

- In accordance with Section 208.
- Material shall have a maximum 15% P200 of that portion passing #4.
- Fertilizing and seeding of material source site will be incidental.
- Measurement and payment will be for material in place.
- Special compaction in accordance with Para. 207.3.6.3 shall be required.

Bid Item No. 30404 - Crushed Aggregate Base Course M.T.

- Foundation preparation is incidental.
- The method of measurement and payment shall be M.T. in place.
- Material shall be crushed gravel base course and meet Gradation No. 1-1st 6" lift, No. 2-2nd 6" lift, No. 3-shoulder gravel.
- The Contractor shall identify his source of crushed aggregate base course, in writing, with his bid.
- Special compaction in accordance with Para. 207.3.6.3 shall be required.

Bid Item No. 40701 - Bituminous Concrete Pavement M.T.

- Shall meet Gradation #2 for 2" binder course for initial Stage I.

- Shall meet Gradation #3 for 1" surface course to be placed after construction is completed on the mine/mill complex.

- Shall be 120-150 A.C.

Bid Item No. 52205 - Reinforced Concrete Culvert Pipe Class III .61 (24") L.M.

- Shall be in accordance with Section 520 and 522.

Bid Item No. 52206 - Reinforced Concrete Culvert Pipe Class III .68 (27") L.M.

- Shall be in accordance with Section 520 and 522.

Bid Item No. 52264 - Reinforced Concrete Apron Endwalls for Culvert Pipe .61 (24") Ea.

- Shall be in accordance with Section 520 and 522.

Bid Item No. 52265 - Reinforced Concrete Apron Endwalls for Culvert Pipe .68 (27") Ea.

- Shall be in accordance with Section 520 and 522.

Bid Item No. 60104 - Concrete Curb, Type J L.M.

- Shall be in accordance with Section 601.

- Foundation preparation for bituminous safety island shall be included under this pay item.

Bid Item No. 60170 - Concrete Curb & Gutter, .914M (36"), Type D L.M.

- Shall be in accordance with Section 601.

Bid Item No. 60601 - Rip Rap S.M.

- Shall be in accordance with Section 606.

- Payment shall be by square meter for the surface area in place for a minimum depth of .30 meter.

Bid Item No. 61406 - Anchorages for Steel Plate Beam Guard Ea.

- Shall be in accordance with Section 601 and 614.

Bid Item No. 61408 - Steel Plate Beam Guard, Class A L.M.

- Shall be in accordance with Section 614.

Bid Item No. 61422 - Marker Posts for Right-of-Way Ea.

- Shall be in accordance with Section 614.

Bid Item No. 61601 - Woven Wire Fence L.M.

- Shall be in accordance with Section 616.

Bid Item No. 61801 - Maintenance and Repair of Haul Roads L.S.

- All routes used as haul roads; private roads, town roads, county roads, other than those on the S.T.H. system, shall be included in this item.

Bid Item No. 62505 - Salvaged Topsoil S.M.

- Placed to a minimum depth of .10 (4") in all disturbed areas as directed by the Engineer.

Bid Item No. 62702 - Mulching S.M.

- Shall be in accordance with Section 627.

Bid Item No. 62802 - Erosion Mat S.M.

- Shall be in accordance with Section 628.

Bid Item No. 62810 - Erosion Bales Ea.

- Shall be in accordance with Section 628.

Bid Item No. 62902 - Fertilizer Type A KG

- Shall be in accordance with Section 629.

Bid Item No. 63002 - Seeding KG

- Seed Mix No. 2 & 3, shall be used throughout the project. Seed Mix No. 5 shall only be used as directed by the Engineer.
- The Contractor shall assure a satisfactory catch of seed to one year after the date of seeding.

Bid Item No. 63301 - Delineator Posts Ea.

- Shall be in accordance with Section 633.

Bid Item No. 63305 - Delineators Ea.

- Shall be the 7.6 cm x 10.1 cm (3"x4") rectangular reflector and in accordance with Section 633.

Bid Item No. 63410 - Wood Posts Ea.

- Shall be in accordance with Section 634.

Bid Item No. 63702 - Signs, Type II, Reflective S.M.

- Shall be in accordance with Section 637.

Bid Item No. 64202 - Field Office, Type B L.S.

- To be located as directed by the Engineer, and all phone toll charges to be included.

Bid Item No. 64210 - Field Laboratory L.S.

- To be located as directed by the Engineer.

Bid Item No. 64301 - Traffic Control L.S.

- Shall be in accordance with Section 643 and the manual on Uniform Traffic Control Devices.

Bid Item No. 90001 - 2" Tubular Steel Gate Ea.

- To include furnishing the gate, all hardware and mountings, end posts, concrete and installing to make a complete and operable unit.
- This item shall be in accordance to the details as shown on the special detail sheet.
- Measurement and payment will be per each unit complete and operable in place.
- Basis of payment shall be full compensation for constructing, assembling, painting, hauling, erecting; and for all labor, tools, equipment, services and incidentals necessary to complete the work.

Bid Item No. 90003 - Settling Basins Ea.

- To include furnishing rip rap, .61 m (24") CMCP with endwall, grading, constructing and compacting earth basin and berm, placing of rip rap, in locations as designated by the Engineer.
- This item shall be in accordance to the details as shown on the special detail sheet.
- Measurement and payment shall be per each complete and in place.
- Basis of payment shall be full compensation for furnishing all materials, grading, constructing, compacting; and for all labor, tools, equipment, services and incidentals necessary to complete the work.

Bid Item No. 90004 - Pavement Marking Km

- Shall be in accordance with Section 644 of the Wisconsin D.O.T. Supplemental Specifications for Pavement Marking.
- Exact location of passing/no passing zones will be located by the Engineer in the field.
- Paint shall be hot paint type.
- Measurement and payment shall be in accordance with Sub-sections 644.6 and 644.7 of the Supplemental Specifications.

APPENDIX 11

STANDARD DETAIL DRAWINGS

Originator	Procedure
CHIEF DESIGN ENGINEER	16-5-1

Chapter	16	STANDARD DETAIL DRAWINGS
Section	5	INDEX TO STANDARD DETAIL DRAWINGS
Subject	1	LIST

SDD Number	Title
	DRAINAGE
	CATCH BASINS AND COVERS
8A5-3a & b	Catch Basin, Manhole, and Inlet Covers
8A6-2	Catch Basins, Types 1 and 2
8A7-2	Catch Basins, Types 3 and 5
	MANHOLES
8B6-2	Manholes, Type 1
8B7-2	Manholes, Types 2 and 3
8B8-2	Manholes, Types 5 and 6
	INLETS
8C1-3	Inlets, Types 1 and 2
8C2-3	Inlets, Type 3
8C5-1	Inlets, Types 8, 9, 10, and 11
	CURB AND GUTTER, AND SURFACE DRAINS
8D1-6	Concrete Curb, Concrete Curb and Gutter and Pavement Ties
8D2-1	Concrete Surface Drains, Flume Type
8D3-1	Surface Drain, Drop Inlet Type
8D4-1	Concrete Surface Drain
8D6-6	Curb Ramps
8D13-1	Slotted Corrugated Metal Pipe Surface Drains
8M1-5	Concrete Gutter, Curb and Gutter and Pavement Ties
8M2-2	Inlets, Catch Basins, and Inlet Covers
8M3-2	Manholes, Manhole and Inlet Covers
8M4-2	Inlets and Inlet Covers
	EROSION CONTROL DEVICES
8E1-3	Mortar Rubble Masonry Endwalls for Circular Pipe and Mortar Rubble Masonry Endwalls for Pipe Arches
8E4-2	Sod or Masonry and Sod Ditch Checks
8E5-1	Sodded Backslope Flume and Intercepting Embankment
8E6-3	Concrete Masonry Endwalls (Circular Pipe and Pipe Arches)
8E7-1	Erosion Mat
8E8-1	Typical Installations of Erosion Bales

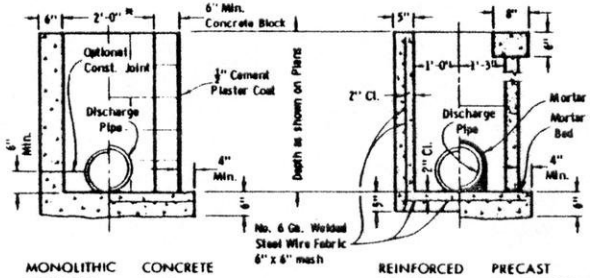
SDD Number	Title
	DRAINAGE (CONTINUED)
	PIPE AND CULVERT
8F1-9	Apron Endwalls for Culvert Pipe and Pipe Arches
8F3-3	Details for Pipe Cattle Pass, Concrete Endwalls, and Steps
8F4-2	Joint Ties for Concrete Pipe
	INTERSECTION DESIGN
	GEOMETRIC LAYOUTS
9A1-5	Layout Details for At-Grade Side Road Intersections
	TRAFFIC SIGNALS
9B2-2	Metal, Fiber, and PVC Conduit
9B3-3	Traffic Signal, Counter, and Pull Box Details
9B4-4	Details for the Installation of Traffic Signal and Traffic Counter Detector Loop Wires in Pavement in Place
9B5-1	Traffic Control Devices for Two Lane Bridges
	GEOMETRIC DESIGN
	MEDIANS
11A1-2	Maintenance Crossover for Freeways
	STRUCTURES
	SLOPE PAVING
12A1-2	Slope Paving-Structures (Concrete Cast in Place)
12A2-2	Slope Paving-Structures (Crushed Aggregate)
12A3-4	Name Plate-Structures
	PAVEMENT DESIGN
	REINFORCEMENT
13A1-3	Concrete Pavement Reinforcement
13A2-2	Continuously Reinforced Concrete Pavement
	APPROACH DETAILS
13B1-2	Pavement Details for Railroad Approach
13B2-3	Concrete Pavement Approach Slab
13B3-3	Pavement Marking Details for Railroad-Highway Grade Crossings
13B5-2	Pavement Marking
	JOINTS
13C1-5	Concrete Pavement Longitudinal Joints
13C2-5	Transverse Joints in Reinforced Concrete Pavement
13C3-2	Non-Reinforced Concrete Pavement (20' Skewed Transverse Joints with Poured Type Sealer)
13C4-5	Non-Reinforced Concrete Pavement (20' Normal Transverse Joint with Poured Type Sealer)
13C5-2	Non-Reinforced Concrete Pavement (Random Spaced & Skewed Transverse Joints with Poured Type Sealer)
13C6-2	Non-Reinforced Concrete Pavement (20' Skewed Transverse Joints with Compression Type Seals)

SDD Number	Title
	JOINTS (CONTINUED)
13C7-2	Non-Reinforced Concrete Pavement (20' Normal Transverse Joints with Compression Type Seals)
13C8-2	Non-Reinforced Concrete Pavement (Random Spaced and Skewed Transverse Joints with Compression Type Seals)
	INCIDENTAL DESIGN
	PRESERVATION DETAILS
14A1-3	Tree Preservation Details
	VEHICLE BARRIER SYSTEMS
14B1-2a & b	Cable Guard Fence
14B2-5a, b, & c	Class "A" Steel Plate Beam Guard (three sheets)
14B3-1	Class "B" Steel Plate Beam Guard
14B4-1	Raised Median at Underpasses
14B5-1	Precast Concrete Barrier
14B6-1	Cast-in-Place Concrete Barrier
14B7-4a	Temporary Precast Concrete Barrier
-4b	Precast Concrete Barrier End Section and Portable Crash Cushion
14B10-1	Class "A" Steel Plate Beam Median Guard
	RECREATIONAL FACILITIES
14C1-2	Timber Rail Guard Fence, Curb and Guard Post, and Marker Post
14C2-2	Historical Marker Construction
14C3-2	Roadside Picnic Table
14C4-4a, b & c	Toilet Building (Waysides) (three sheets)
14C5-1	Charcoal Grill and Incinerator
14C6-5	Wayside Well Shelter and Pump and Well Platform
	R/W AND ACCESS CONTROL
	MARKER POSTS
15A1-3	Marker Posts for Right-of-Way
15A2-2	Delineator Posts, Marker Posts, and Delineators
	FENCING
15B1-4	Woven Wire Fence
15B2-5	Chain Link Fence (Type A)
15B3-5	Chain Link Fence (Type B)
15B4-3	Screen Fence for Junkyards
15B5-2	Wood Gate Frame for Screen Fence for Junkyards
15B6-1	Steel and Aluminum Panels for Screen Fencing Projects
15B7-2	Screen Fence with Horizontal Metal Panels
15B8-1	Steel Angle Gate Frame for Metal Screen Fence with Horizontal Panels
	BARRICADES
15C1-7	Construction Barricades and Standard Signs
	SURVEYING
	MONUMENTS
16A1-3	Landmark Reference Monuments

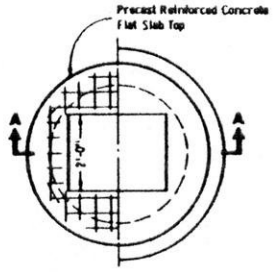
* * * * * * * * * * * * * *

DESIGN NOTE
USE TYPE A, B, C OR J COVERS ON TYPE 1 INLETS.
(SQUARE FRAME MAY ONLY BE USED ON SQUARE STRUCTURES. ROUND FRAME MAY BE USED ON ROUND OR SQUARE STRUCTURES.)

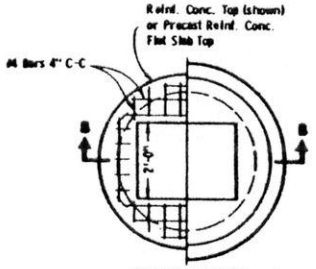
* Selection of Square or Circular Design will be based on the pipe sizes and the Inlet Cover being utilized.



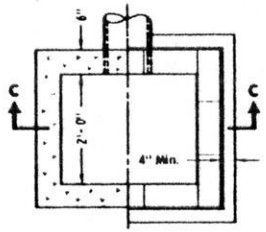
INLETS TYPE 1



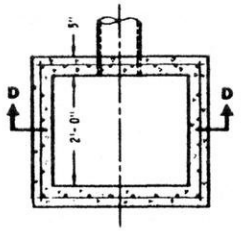
PLAN VIEW



PLAN VIEW

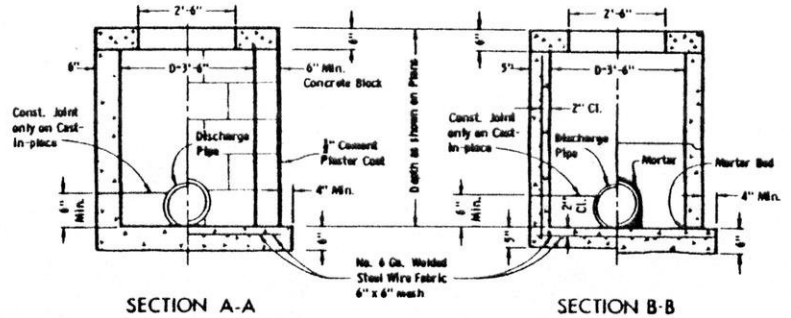


PLAN VIEW



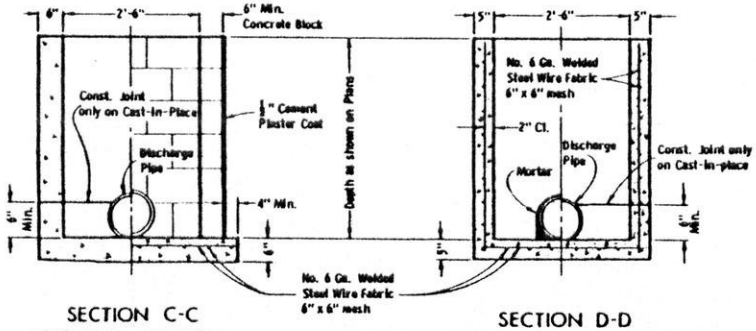
PLAN VIEW

DESIGN NOTE
USE ONLY TYPE BN COVER ON TYPE 2 INLET.



SECTION A-A
MONOLITHIC CONCRETE
CONCRETE BLOCK

SECTION B-B
REINFORCED CONCRETE
PRECAST REINFORCED CONCRETE



SECTION C-C
MONOLITHIC CONCRETE
CONCRETE BLOCK

SECTION D-D
PRECAST REINFORCED CONCRETE
REINFORCED CONCRETE

INLETS TYPE 2

GENERAL NOTES

Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

Detailed drawings for proposed alternate designs for underground drainage structures shall be submitted to the Engineer for approval providing that such alternate designs make provision for equivalent capacity and strength.

Square Precast Inlet units shall conform to the pertinent requirements of AASHTO Designation M 199.

All drainage structures are designated on the plans as "Manholes 1 - C", "Catch Basins 1 - B", "Inlets 1 - H", etc. The first digit designates the masonry portion of the structure, and the following letter designates the type of cover to be used to comprise the complete unit.

Precast Reinforced Bases shall be placed on a bed of material at least 6 inches in depth, which meets the requirements for Granular Backfill. This bedding shall be compacted and provide uniform support for the entire area of the base.

Precast Reinforced Concrete Flat Slab Tops may be used on the structures. The Tops shall be installed on a bed of mortar.

All bar steel reinforced reinforcement shall be embedded 2 inches clear unless otherwise shown or noted.

Precast Reinforced Concrete Risers may be placed with tongue up or down.

NOTE
DESIGN NOTES WILL NOT APPEAR IN CONTRACT PLANS.

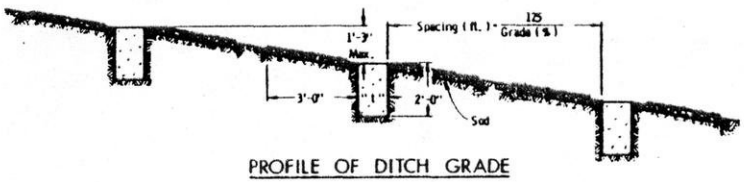
INLETS TYPE 1 & 2

State of Wisconsin
Department of Transportation
Division of Highways

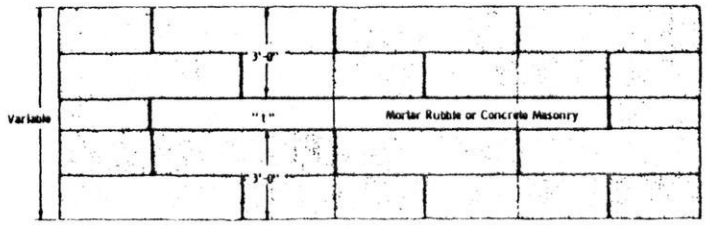
RECOMMENDED FOR APPROVAL
10-16-75 DATE — Chief of Facilities Development

APPROVED
10-16-75 DATE — Engineering Policy Section

S.D.D. 8C1-3

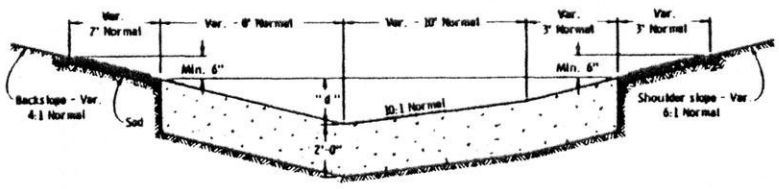


PROFILE OF DITCH GRADE

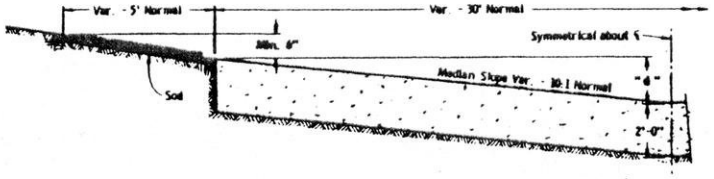


PLAN VIEW SHOWING
MASONRY AND SOD

"t" - Masonry thickness shall be 0'-9" for concrete and 1'-0" for mortar rubble.



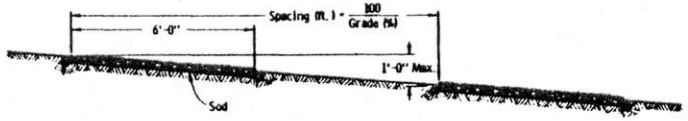
SIDE DITCH CROSS SECTION



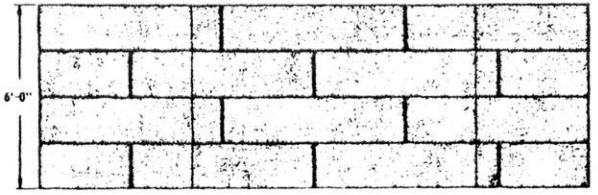
MEDIAN DITCH CROSS SECTION

"d" - The minimum depth of the masonry portion of the ditch checks shall be equal to the maximum depth of flow. The normal "d" will be 1'-6".

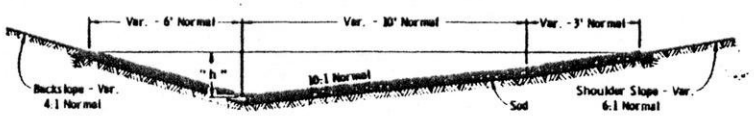
MASONRY AND SOD DITCH CHECKS



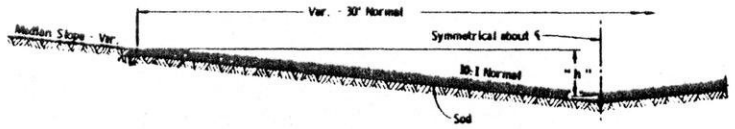
PROFILE OF DITCH GRADE



PLAN VIEW SHOWING SOD



SIDE DITCH CROSS SECTION



MEDIAN DITCH CROSS SECTION

"h" - The minimum height of ditch to be sodded shall be equal to the maximum depth of flow plus 6". The normal "h" will be 1'-6".

SOD DITCH CHECKS

GENERAL NOTES

Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

Alternate designs for ditch checks, of the material or combination of materials shown hereon, may be used upon written permission of the Engineer.

Sod strips for ditch checks may be placed either transversely or longitudinally to the direction of water flow.

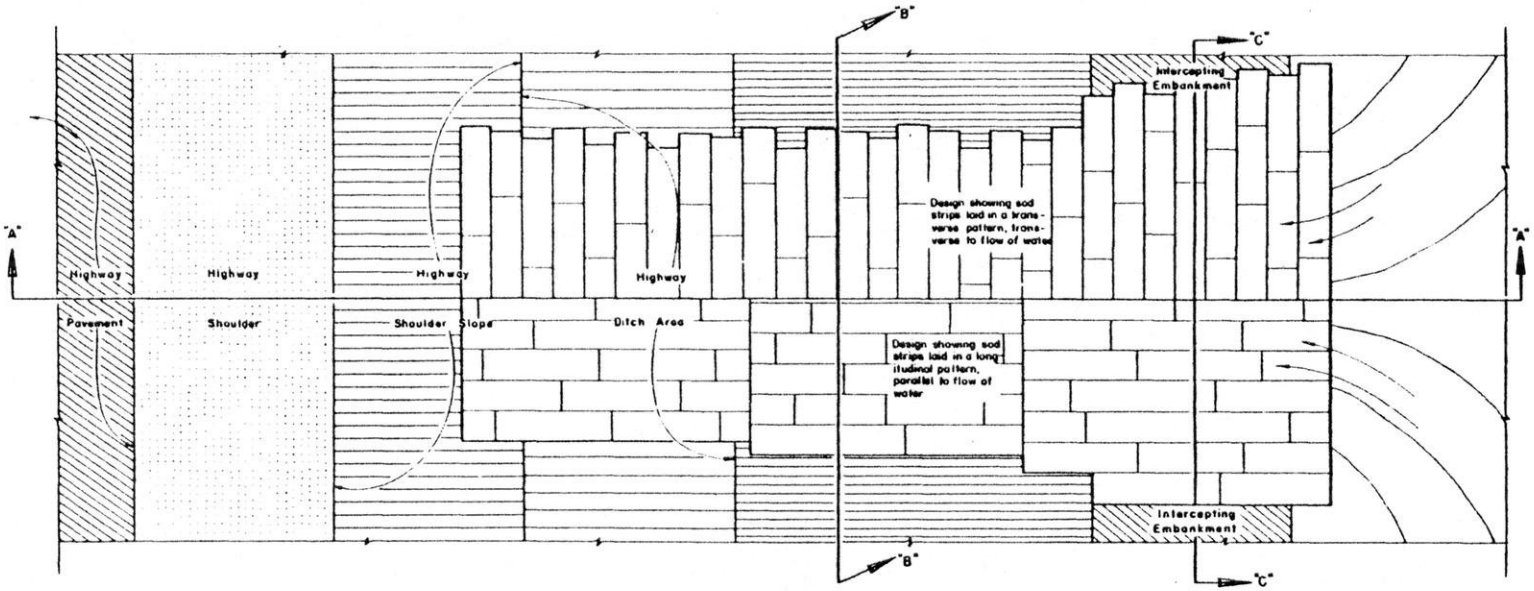
SOD OR MASONRY AND SOD DITCH CHECKS

State of Wisconsin
Department of Transportation
Division of Highways

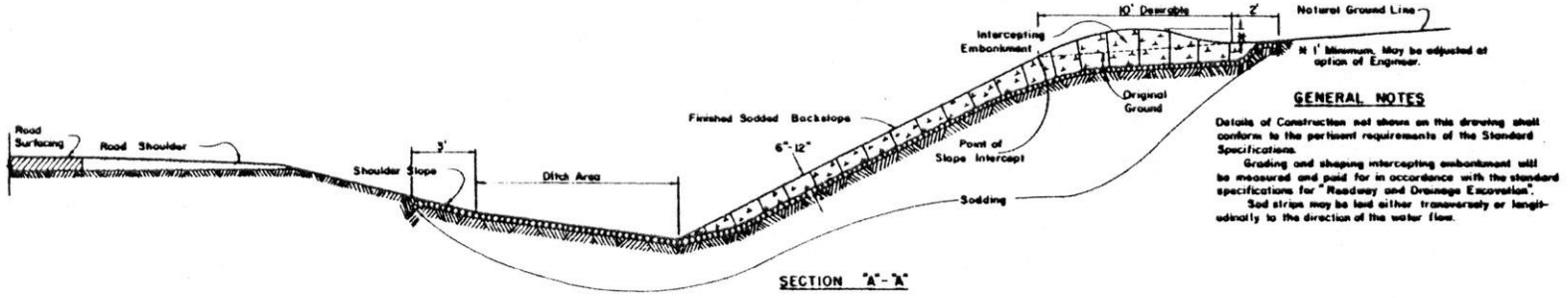
RECOMMENDED FOR APPROVAL
9/7/71 — ACTING CHIEF BUREAU ENGINEER

APPROVED
9/7/71 — STATE HIGHWAY ENGINEER

S.D.D. 8E4-2



PLAN VIEW OF SODDED BACKSLOPE FLUME



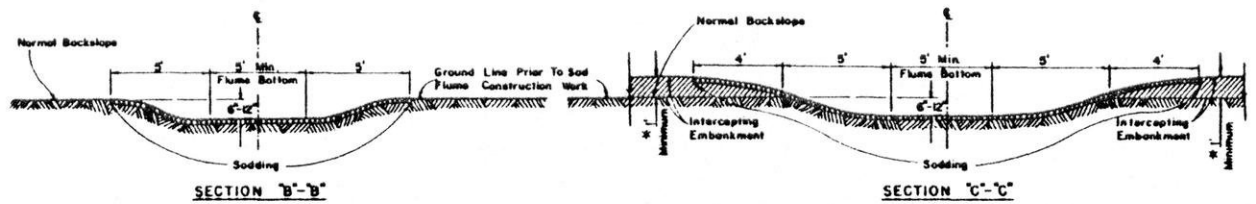
SECTION "A"-"A"

GENERAL NOTES

Details of Construction not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications.

Grading and shaping intercepting embankment will be measured and paid for in accordance with the standard specifications for "Roadway and Drainage Excavation".

Sod strips may be laid either transversely or longitudinally to the direction of the water flow.



SECTION "B"-"B"

SECTION "C"-"C"

NOTE: Dimensions shown may be adjusted at the option of the Engineer to fit local conditions.

SODDED BACKSLOPE FLUME & INTERCEPTING EMBANKMENT

STATE HIGHWAY COMMISSION OF WISCONSIN

RECOMMENDED FOR APPROVAL:

2-5-63
DATE

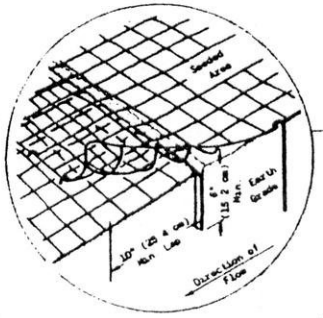
J. L. Pitt
ENGINEER OF DESIGN

APPROVED:

2/6/63
DATE

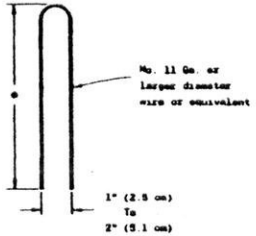
C. L. Burton
STATE HIGHWAY ENGINEER

S.D.D. 8E5-1



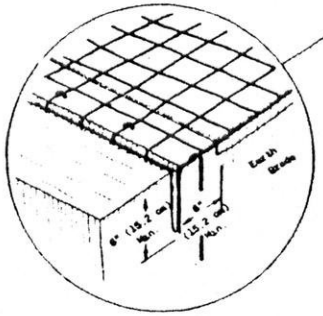
JUNCTION SLOT
(SEED ONLY)

JUNCTION SLOT
(SOD ONLY)

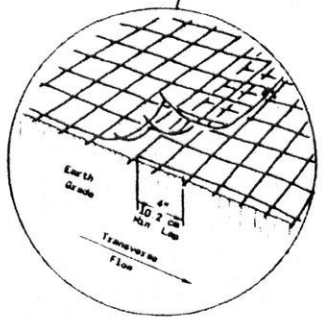


DETAIL OF TYPICAL STAPLE

* 6" (15.2 cm) Min for fine soils
12" (30.5 cm) Min for loose soils
8" (20.3 cm) Min where both sod and mats are being used.



ANCHOR SLOT
AT BEGINNING AND END OF EROSION MAT
(SEED AND SOD)



LAP JOINT
(SEED AND SOD)

GENERAL NOTES

Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

Variations in the dimensions or materials shown hereon shall be permitted if they provide equivalent protection and material strength and if prior approval of the Engineer is obtained.

Lap Joints shall not be placed in the bottom of V-shaped ditches.

Junction Slots on adjacent strips of Matting shall be staggered a minimum of 4 feet (1.219 m) apart.

Edges of the Erosion Mat shall be impressed in the soil.

Erosion Mat shall be measured and payed for in accordance with the Standard Specifications.

EROSION MAT OVER SOD

a. Only Jute Fabric will be permitted over sod.

b. Road Stakes for Sod may be omitted by the Engineer if the existing slope and soil conditions so warrant.

c. The width of Erosion Mat shall always equal the Sod width.

d. Sod strips may be placed either longitudinally or transversely to the flow line of the Ditch.

EROSION MAT OVER SEEDING

Junction or Anchor Slots shall be at minimum intervals of 100 feet (30.48 m) on grades up to and including 3 percent, and 50 feet (15.24 m) on grades exceeding 3 percent.

METHOD OF DIMENSIONING

1'-0" (30.5 cm)

1'-0" (30.5 cm)

BASED: 1 in. = EXACTLY 25.4 mm

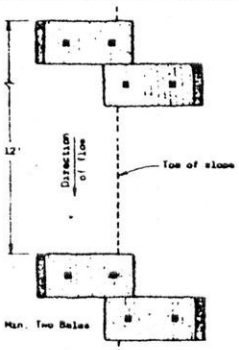
EROSION MAT

State of Wisconsin
Department of Transportation
Division of Highways

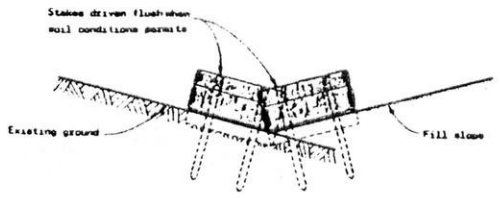
RECOMMENDED FOR APPROVAL
12-3-73
DATE
Chief of Bureau

APPROVED
1-15-74
DATE
Engineering Director

S.D.D. 8E7-1

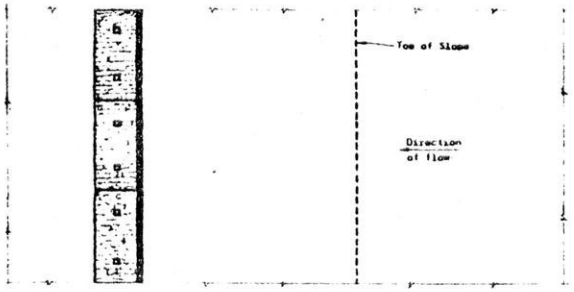


PLAN VIEW

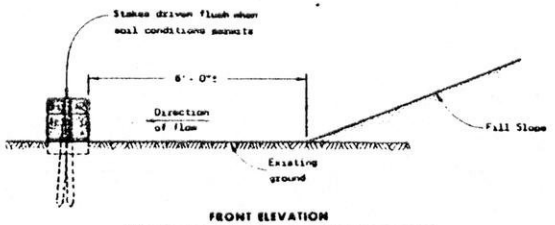


FRONT ELEVATION

WHEN EXISTING GROUND SLOPES TOWARD FILL SLOPE



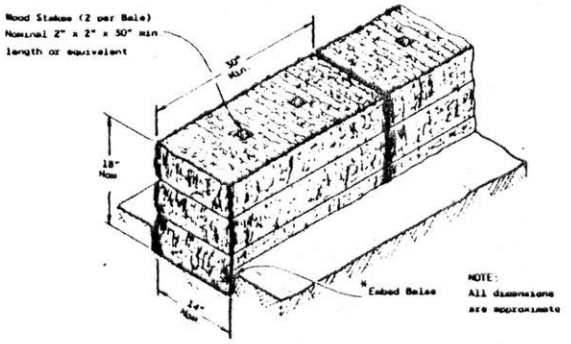
PLAN VIEW



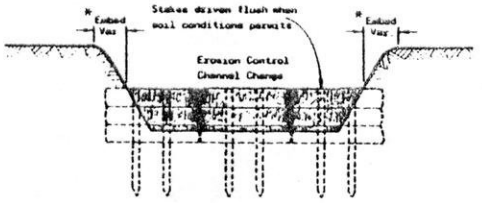
FRONT ELEVATION

EROSION BALES AT TOE OF SLOPE

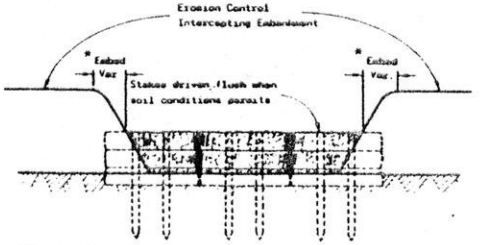
WHEN EXISTING GROUND SLOPES AWAY FROM FILL SLOPE



DETAIL OF EROSION BALE INSTALLATION

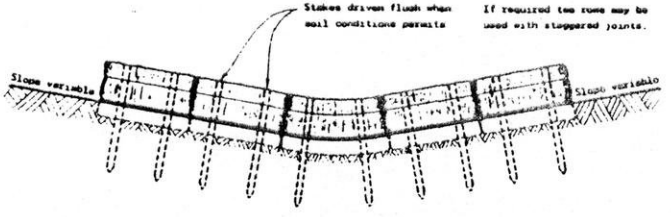


EROSION CONTROL CHANNEL CHANGE



EROSION CONTROL INTERCEPTING EMBANKMENT

PLAN VIEW



FRONT ELEVATION

EROSION BALES ACROSS DITCH BOTTOM

GENERAL NOTES

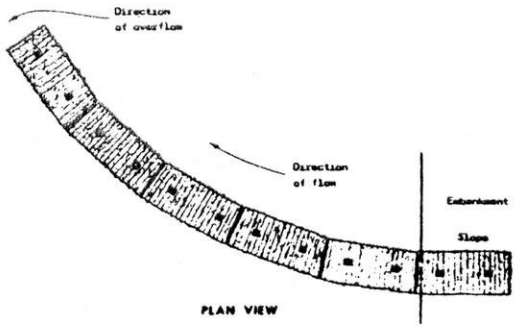
Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

Bales shall be placed end to end or overlapping at right angles to the direction of flow and far enough up the sides of the ditch to prevent eroding around ends.

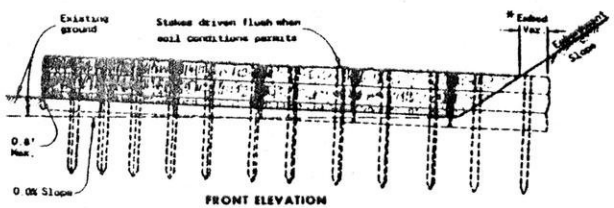
Bales shall be placed with twine or tie wires parallel to the ground.

Stakes to be battered in opposite directions.

* As determined by the Engineer.



PLAN VIEW



FRONT ELEVATION

EROSION BALES AT TOE OF SLOPE

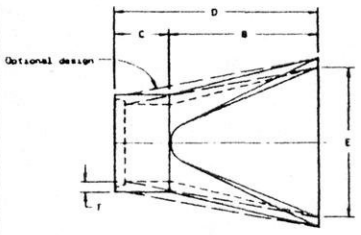
TYPICAL INSTALLATIONS OF EROSION BALES

State of Wisconsin
Department of Transportation
Division of Highways

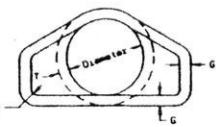
RECOMMENDED FOR APPROVAL
10/14/75 DATE — CHIEF OF TRAFFIC DEVELOPMENT

APPROVED
10/16/75 DATE — STATE HIGHWAY ENGINEER

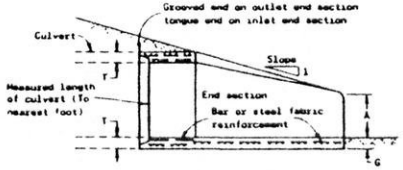
S.D.D. 8E8-1



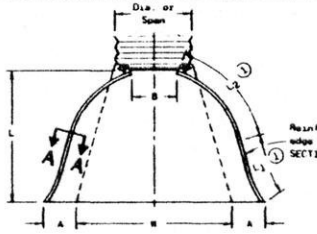
PLAN



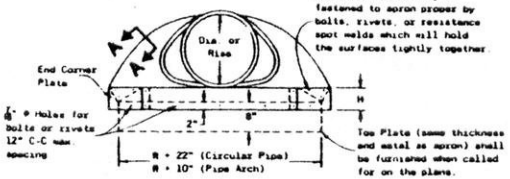
END VIEW



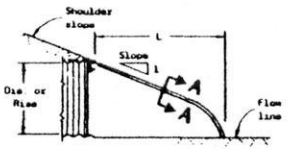
LONGITUDINAL SECTION



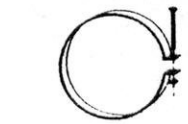
PLAN



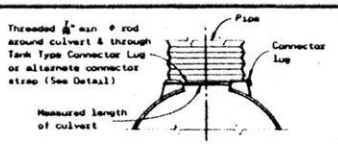
END VIEW



SIDE ELEVATION

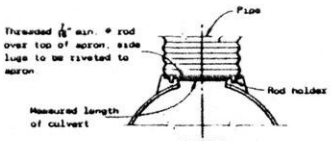


Alternate for Type 1 Connection
END SECTION CONNECTOR STRAP



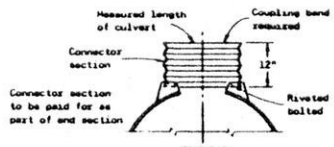
TYPE 1

For 12" thru 24" only (Circular pipe)



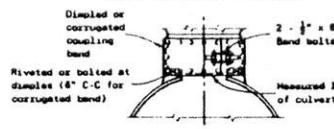
TYPE 2

For 30" & 36" only (Circular pipe)
For 17"x13" thru 57"x38" only (Pipe arch)



TYPE 3

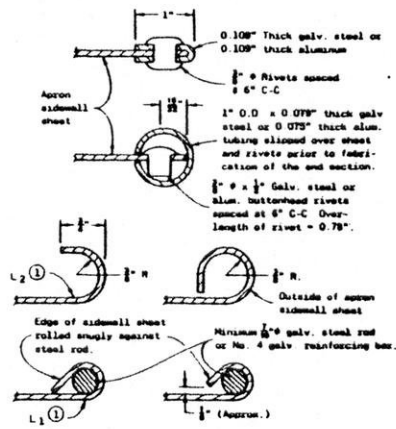
For 42" thru 84" only (Circular pipe)
For 64"x43" & 71"x47" (Pipe arch)



TYPE 6

Alternate for:
All sizes corrugated circular pipe & pipe arches

NOTE Dimpled band fits over outside of endwall, and corrugated band fits inside endwall. Dimpled band may be used with helically corrugated pipe



SECTION A-A

GENERAL NOTES

Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

Variations of the dimensions and designs shown hereon will be permitted providing equivalent capacity and structural integrity are attained, and prior approval of the Engineer is obtained.

Concrete culvert endwalls may not be used with galvanized steel or aluminum culvert pipe or vice versa.

Galvanized steel or aluminum endwalls shall normally be installed on culvert pipe of the same metal. The use of galvanized steel endwalls on aluminum pipes is permitted, provided the two metals at the joint interface are kept separated by a suitable insulating material approximately ⅛" thick or greater. Such material would be an asphalt impregnated fabric, a sheet plastic, a rubber gasket or other non-degradable material of substantial strength.

When two or more pipe arches with apron endwalls are to be laid adjacent to each other, they shall be separated by the following amount:

PIPES Total width of apron endwall less the diameter of pipe plus 6 inches

PIPE ARCHES Total width of apron endwall less the span dimension of the pipe arch plus 6 inches.

① A combination of steel rod rolled into edge sidewall (L_1), and 180° roll on edge of sidewall (L_2) is permitted for metal apron endwalls up to 60" diameter for circular pipe, and 71" x 52" for pipe arches.

CONNECTION DETAILS

CIRCULAR PIPE

For circumferentially corrugated pipe use Endwall Connection Details 1, 2, 3 or 5 as applicable

For helically corrugated pipe use Endwall Connection Details 1, 2 or 5.

For helically corrugated pipes with two circumferential corrugations at each end use Endwall Connection Details 1, 2 or 3

PIPE ARCH

Use Endwall Connection Details 2, 3 or 5 as applicable.

PIPE DIA (in.)	APPROX WEIGHT PER SECTION	DIMENSIONS (inches) T	A	B	C	D	E	G	APPROX SLOPE
12	550	2	4	24	48	72	24	2	3 to 1
15	740	2½	6	27	48	73	30	2½	
18	990	2½	9	27	48	73	36	2½	
21	1,280	2½	9	36	37½	73½	42	2½	
24	1,520	3	9½	43½	30	73½	48	3	
27	1,930	3½	10½	49½	24	73½	54	3½	
30	2,190	3½	12	54	19½	73½	60	3½	
36	4,100	4	15	63	34½	97½	72	4	
42	5,380	4½	21	63	35	98	78	4½	
48	6,550	5	24	72	26	98	84	5	3 to 1
54	8,040	5½	27	65	* 53½ - 55	* ** 90½ - 100	90	5	2½ to 1
60	8,730	6	* ** 30 - 35	80	39	99	96	5	2 to 1
66	10,630	6½	* ** 24 - 30	* ** 72 - 78	* ** 21 - 27		102	5½	
72	12,520	7	* ** 24 - 36	78	21		108	6	
78	14,430	7½	* ** 24 - 36	78	21	99	114	6½	2 to 1
84	18,160	8	36	90½	21	111½	120	6½	1½ to 1

* Minimum ** Maximum

REINFORCED CONCRETE APRON ENDWALLS

PIPE DIA (in.)	MIN THICKNESS (inches) STEEL	ALUM	DIMENSIONS (inches) A ±1"	B MAX	H ±1"	L ±1½	L1 ①	L2 ①	W ±2"	APPROX SLOPE
12	0.064	0.060	6	6	8	21	12	17½	24	2½ to 1
15			7	8		26	14	21½	30	
18			8	10		31	15	28½	36	
21		0.060	9	12		36	18	29½	42	
24	0.064	0.075	10	13	6	41	18	37½	48	
30	0.079	0.075	12	16	8	51	18	52½	60	
36	0.079	0.105	14	19	9	60	24	59½	72	
42	0.109	0.105	16	22	11	69	24	76½	84	2½ to 1
48		0.135	18	27	12	78	24	81	90	2½ to 1
54		0.135		30		84	30	85½	102	2 to 1
60		0.164		33		87	–	–	114	1½ to 1
66				36		87	–	–	120	1½ to 1
72				39		87	–	–	126	1½ to 1
78				42		87	–	–	132	1½ to 1
84	0.109	0.164	18	45	12	87	–	–	138	1½ to 1

NOTE All splices to be lap riveted or bolted.

METAL APRON ENDWALLS FOR CIRCULAR PIPE

PIPE-ARCH DIMENSIONS (inches) SPAN	RISE	MIN THICK (inches) STEEL	ALUM	DIMENSIONS (inches) A ±1"	B MAX	H ±1"	L ±1½	L1 ①	L2 ①	W ±2"	APPROX SLOPE
17	13	0.064	0.060	7	9	6	18	14	16	30	2½ to 1
21	15		0.060	7	10		23	14	19½	36	
24	18		0.060	8	12		28	18	21½	42	
28	20	0.064	0.075	9	14		32	18	27½	48	
35	24	0.079	0.075	10	16	6	39	18	37½	60	
42	29	0.079	0.105	12	18	8	46	24	45½	75	
49	33	0.109	0.105	13	21	9	53		54½	85	
57	38		0.135	18	26	12	63		68	90	2½ to 1
64	43		0.135		30		70	24	72½	102	2½ to 1
71	47		0.164		33		77	30	82½	114	2½ to 1
77	52		0.164		36		77	–	–	126	2 to 1
83	57	0.109	0.164	18	39	12	77	–	–	138	2 to 1

NOTE All splices to be lap riveted or bolted.

METAL APRON ENDWALLS FOR PIPE ARCHES

APRON ENDWALLS FOR CULVERT PIPE AND PIPE ARCHES

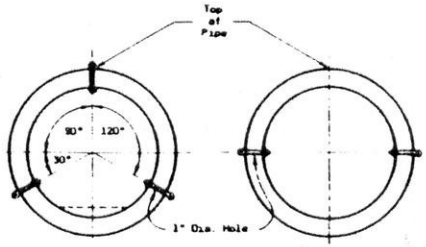
State of Wisconsin
Department of Transportation

APPROVED 2-15-82 DATE

CHIEF BRIDGE ENGINEER

S.D.D. 8 F 1-9

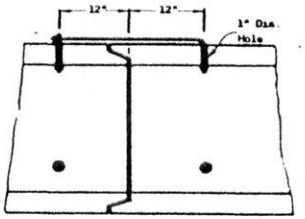
S.D.D. 8 F 1-9



3 CONNECTIONS FOR PIPES OVER 36" OR CATTLE PASS

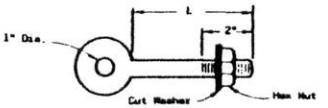
2 CONNECTIONS FOR PIPES 36" AND SMALLER

TRANSVERSE SECTION



EYE BOLT AND TIE ROD ASSEMBLY ALT. #2

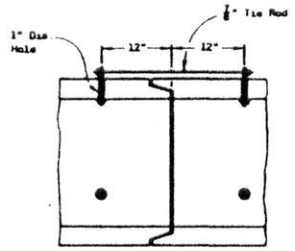
LONGITUDINAL SECTION



⅞" EYE BOLT

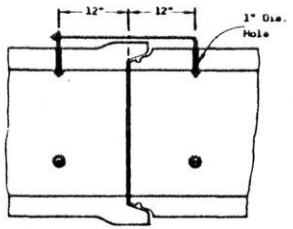
EYE BOLT DIMENSION TABLE

Pipe Size	Length	
	Tongue & Groove Pipe	Modified Bell Pipe
18" to 24"	4½"	8½"
30"	5"	7"
36"	5½"	7"
42"	6"	
48"	6½"	
60"	7½"	
72"	8½"	



EYE BOLT AND TIE ROD ASSEMBLY ALT. #1

LONGITUDINAL SECTION



MODIFIED BELL
EYE BOLT AND TIE ROD ASSEMBLY ALT. #2

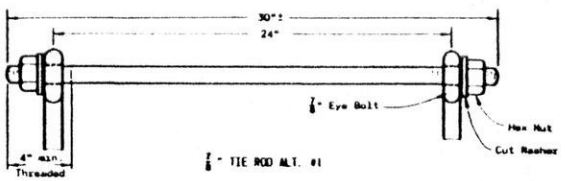
LONGITUDINAL SECTION

GENERAL NOTES

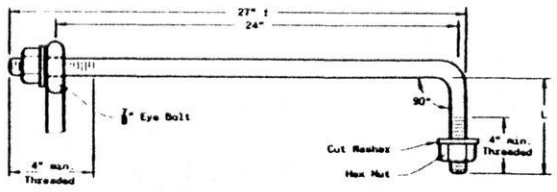
Concrete culvert pipe shall be tied together in the manner illustrated by this detail at locations designated on the plan or directed by the Engineer.

Materials, fabrication and work necessary to tie culvert pipe as indicated by this detail will be considered incidental to Culvert pipe or Reinforced Concrete Culvert pipe.

Detailed drawings for proposed alternate designs for Joint Ties shall be submitted to the Engineer for approval.



⅞" TIE ROD ALT. #1



⅞" TIE ROD ALT. #2

JOINT TIES FOR CONCRETE PIPE

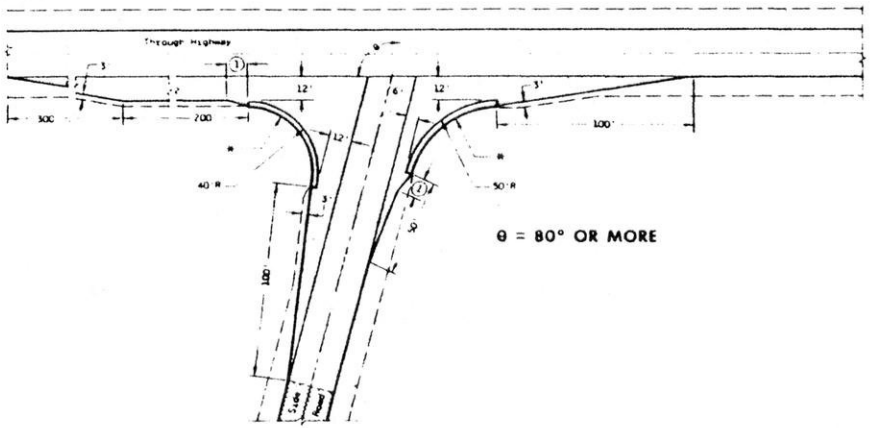
State of Wisconsin
Department of Transportation
Division of Transportation Facilities

APPROVED 12-26-78 DATE

CHIEF DESIGN ENGINEER

S.D.D. 8F4-2

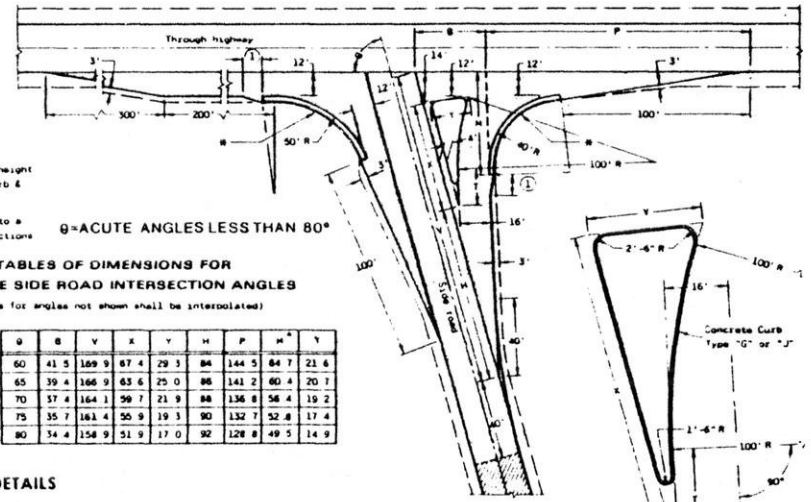
S.D.D. 8F4-2



* Concrete Curb & Gutter 36" Taper curb height 0" to 6" in 10'-0" length at ends of curb & gutter sections

Provide sod or salvaged topsoil & seed to a 3'-0" width in back of curb & gutter sections

1) 10' Typical

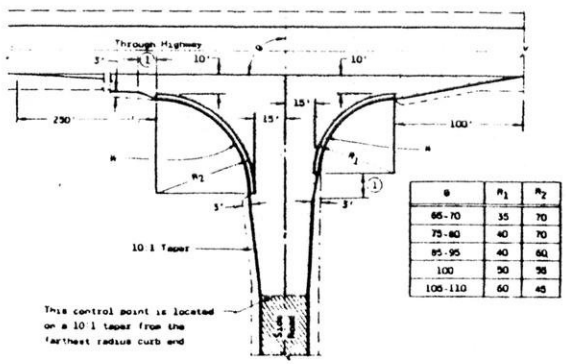


TABLES OF DIMENSIONS FOR VARIABLE SIDE ROAD INTERSECTION ANGLES

(Values for angles not shown shall be interpolated)

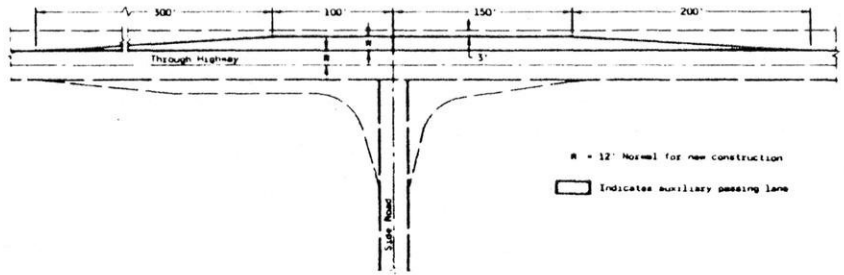
θ	B	Y	X	Y	H	P	M*	T
60	41 5	169 9	67 4	29 3	84	144 5	84 7	21 6
65	39 4	166 9	63 6	25 0	86	141 2	80 4	20 7
70	37 4	164 1	59 7	21 9	88	136 8	56 4	19 2
75	35 7	161 4	55 9	19 3	90	132 7	52 8	17 4
80	34 4	158 9	51 9	17 0	92	128 8	49 5	14 9

TYPE "A" SIDE ROAD INTERSECTION DETAILS

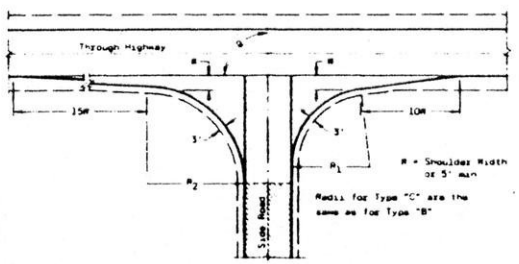


θ	R_1	R_2
66-70	35	70
75-80	40	70
85-95	40	80
100	50	98
105-110	60	45

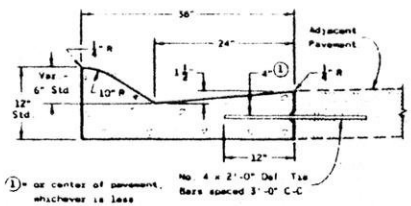
TYPE "B" SIDE ROAD INTERSECTION DETAILS



PASSING LANE DETAIL

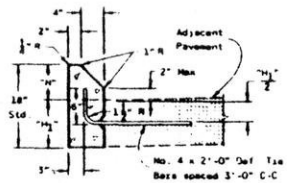


TYPE "C" SIDE ROAD INTERSECTION DETAILS



TYPE "A" (INCLUDING TIE BARS) TYPE "D" (EXCLUDING TIE BARS)

CONCRETE CURB & GUTTER 36"



TYPE "G" (INCLUDING TIE BARS) TYPE "J" (EXCLUDING TIE BARS)

CONCRETE CURB

GENERAL NOTES

Designs may be used interchangeably in combination or separately for any one complete intersection depending upon intersection angle and surfacing of each approach roadway

SIDE ROAD SURFACING NOTE

If the side road is not presently paved, pavement shall be placed to the limits shown. In the case where the construction limits are beyond the paving limits, crushed aggregate surfacing shall be placed between the paving limits and construction limits

If the side road is presently paved, new pavement shall be placed to the limits of design as shown and beyond, if necessary, to meet existing pavement

If the side road is the construction project, the intersection surfacing shall be the same as for the project.

New Pavement

Existing Surface

DESIGN NOTES

THE DESIGNER SHOULD STRIVE TO AVOID θ INTERSECTION ANGLES OF 65° OR LESS AND 115° OR MORE

INTERSECTION DESIGNS ON THIS DRAWING WILL ACCOMODATE THE TURNING PATHS OF THE WB-50 DESIGN VEHICLE HOWEVER THE WB-50 VEHICLE TURNING RIGHT INTO OR FROM THE TYPE "C" INTERSECTION WILL ENCROACH INTO THE OPPOSING TRAFFIC LANE

NOTE:
DESIGN NOTES WILL NOT APPEAR ON CONTRACT PLANS

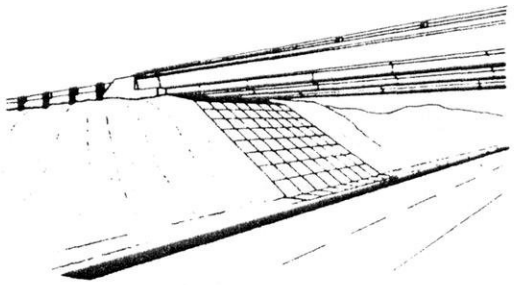
LAYOUT DETAILS FOR AT-GRADE SIDE ROAD INTERSECTIONS

State of Wisconsin
Department of Transportation

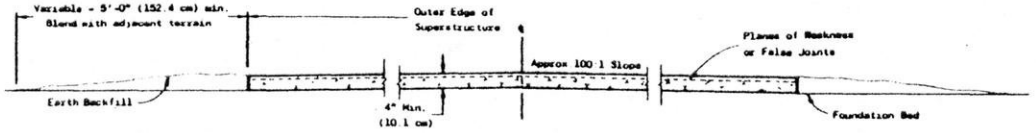
APPROVED 12-15-00

S.D.D. 9 A 1-5

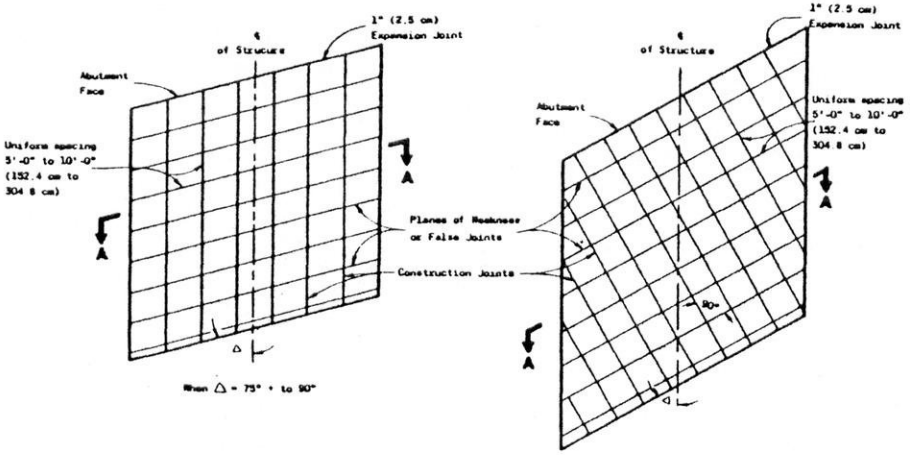
S.D.D. 9 A 1-5



SLOPE PAVING UNDER STRUCTURES



SECTION A - A

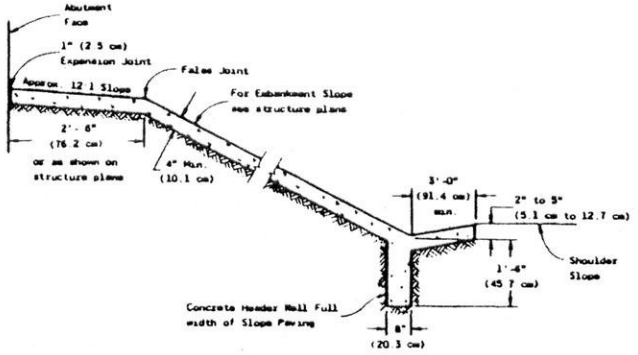


Sketches Showing Planes of Weakness Construction Joint Designs for

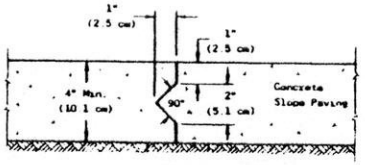
SKEWED TYPE INSTALLATIONS

GENERAL NOTES

Details of construction not shown hereon shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.



TYPICAL RURAL SECTION
HIGHWAY GRADE SEPARATION



CONSTRUCTION JOINT

METHOD OF DIMENSIONING

1'-0" (30.5 cm)

1'-0" (30.5 cm)

BASIS: 1 in. = EXACTLY 25.4 mm

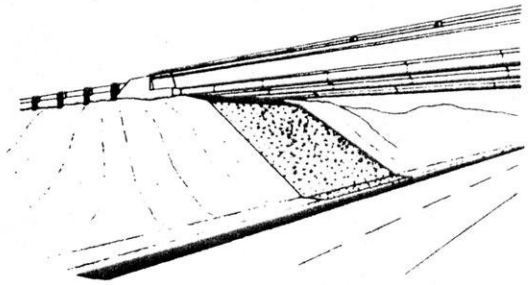
SLOPE PAVING - STRUCTURES
(CONCRETE CAST-IN-PLACE)

State of Wisconsin
Department of Transportation
Division of Highways

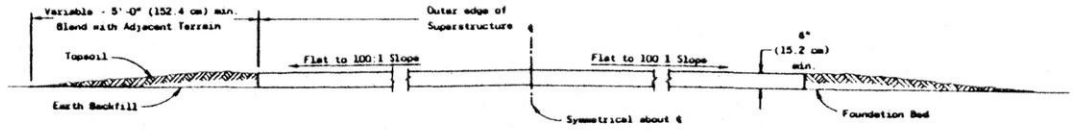
RECOMMENDED FOR APPROVAL
6-6-75
DATE
CHIEF OF FACILITIES DEVELOPMENT

APPROVED
6-6-75
DATE
STATE HIGHWAY ENGINEER

S.D.D. 12A1-2



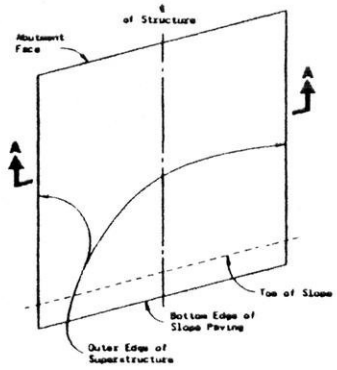
SLOPE PAVING UNDER STRUCTURES



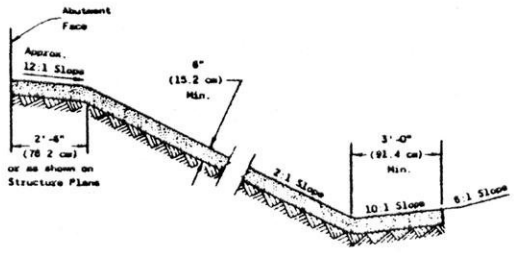
SECTION A - A

GENERAL NOTES

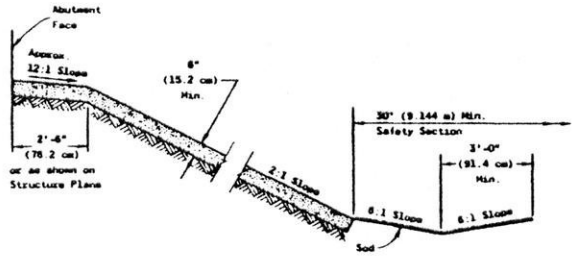
Details of construction not shown hereon shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.



PLAN VIEW



2 LANE STANDARD CROSS SECTION



2 LANE ALTERNATE I

METHOD OF DIMENSIONING

1'-0" (30.5 cm)

1'-0" (30.5 cm)

ONE INCH = EXACTLY 25.4 mm

TYPICAL RURAL SECTION
HIGHWAY GRADE SEPARATION

SLOPE PAVING - STRUCTURES
(CRUSHED AGGREGATE)

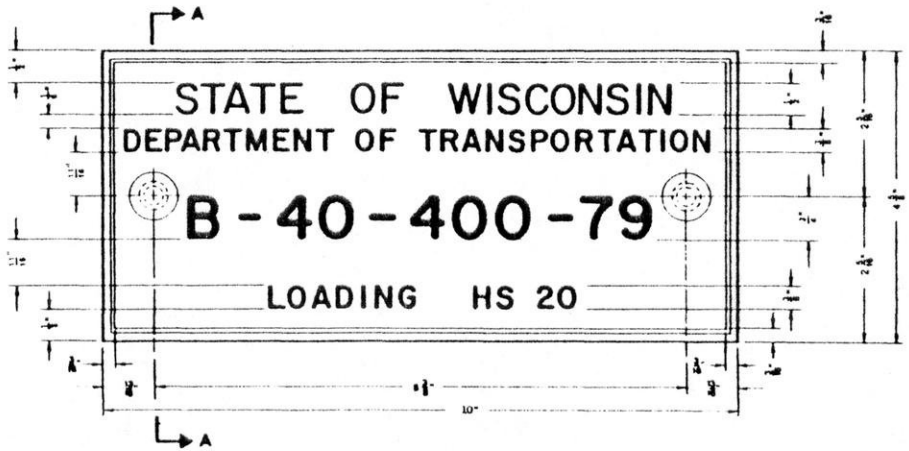
State of Wisconsin
Department of Transportation
Division of Highways

6-6-75
DATE

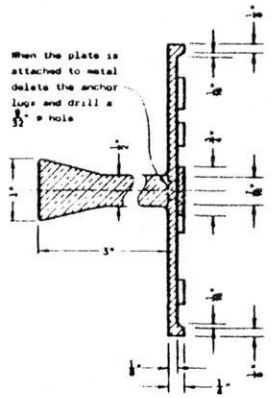
Chief of Facilities Development

6-6-75
DATE

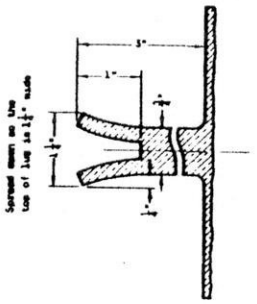
S.D.D. 12A2-2



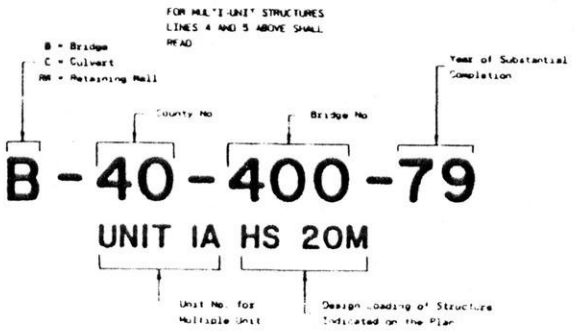
TYPICAL NAME PLATE
(BRIDGES, CULVERTS, AND RETAINING WALLS)



SECTION A-A



ALTERNATE LUG



NUMBERING AND LOADING DESIGNATION
MULTI-UNIT STRUCTURES

GENERAL NOTES

Name Plates to be installed on Bridges Culverts, and Retaining Walls shall conform to the requirements of Section 506.2.4 of the Standard Specifications.

The Bridge Number and Design Loading shown on this drawing are examples only. See Construction Plans for individual numbering and design loading.

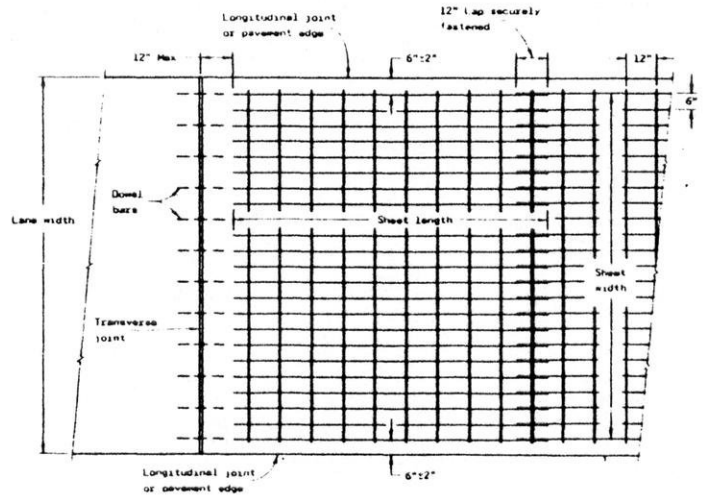
NAME PLATE
(STRUCTURES)

State of Wisconsin
Department of Transportation
Division of Transportation Facilities

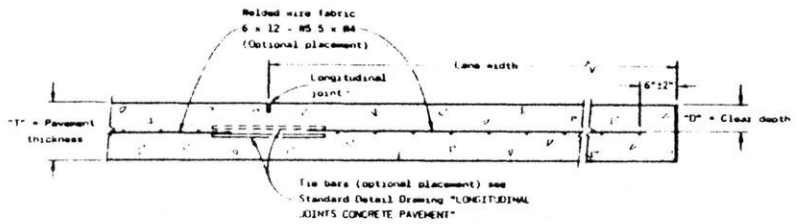
APPROVED 9-27-79

S.D.D. 12 A 3-4

S.D.D. 12 A 3-4



PLAN VIEW



CROSS SECTION

WELDED STEEL WIRE FABRIC

Pavement Thickness "T"	"D"
8"	2½" - 4"
9"	2½" - 4½"
10"	3" - 5"

GENERAL NOTES

Details of construction not shown on this drawing shall conform to Standard Specifications and Special Provisions

FABRIC SPECIFICATIONS

Wire spacing and size = 6" x 12", W5.5 x W4

Weight per 100 sq. ft. = 55 pounds (approx.)

Fabric shall be shipped to the job site in flat sheets.

CONCRETE PAVEMENT REINFORCEMENT

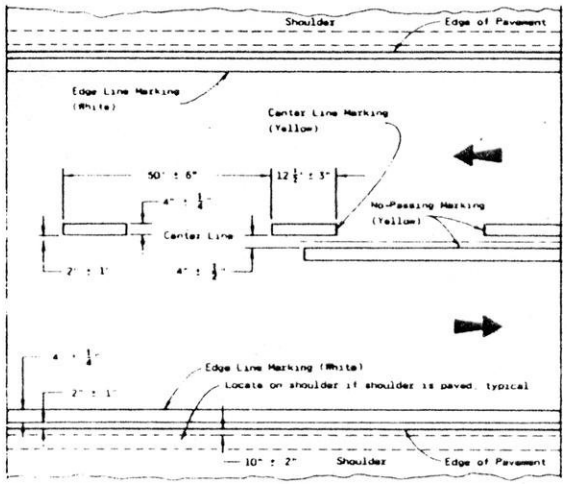
State of Wisconsin
Department of Transportation
Division of Highways

APPROVED 12-5-77 DATE

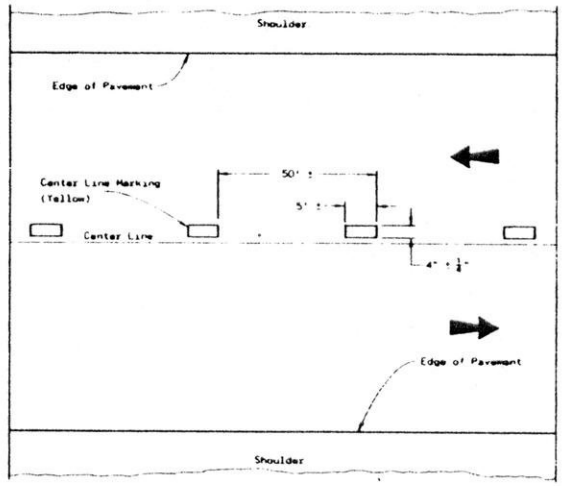
APPROVED 12-6-77 DATE

S.D.D. 13A1-3

S.D.D. 13A1-3

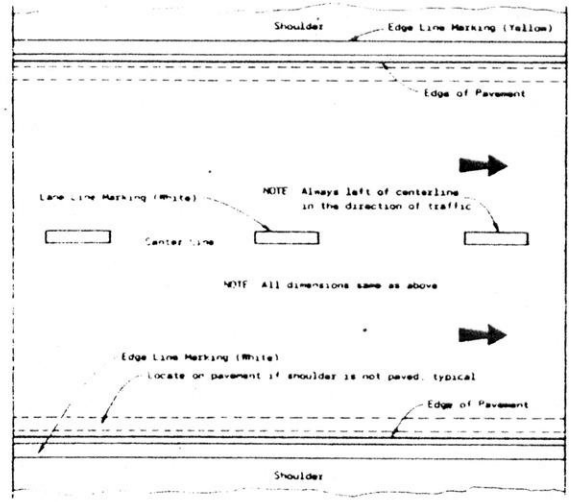


PERMANENT MARKING

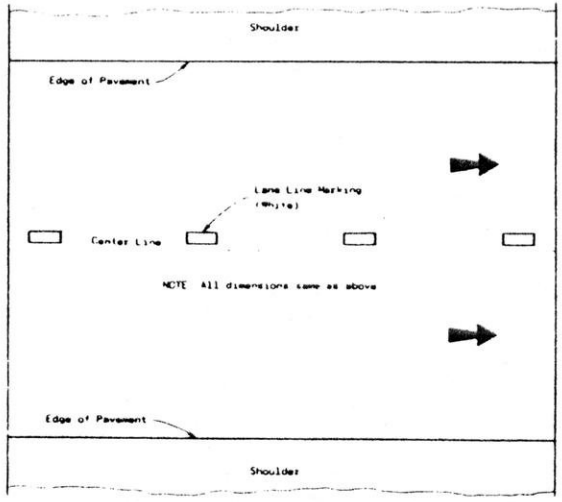


TEMPORARY MARKING

PAVEMENT MARKING - TWO WAY TRAFFIC

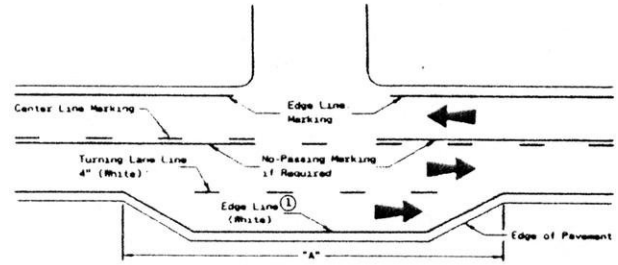


PERMANENT MARKING



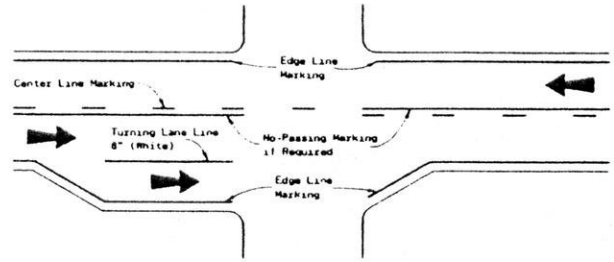
TEMPORARY MARKING

PAVEMENT MARKING - ONE WAY TRAFFIC



PASSING LANE MARKING

① When distance "A" is less than 750 feet, omit edge line and turning lane marking



RIGHT TURN LANE MARKING

GENERAL NOTES

Details of construction not shown on this drawing shall conform to Standard Specifications and Special Provisions.

Where pavement marking tape is used, which would underlie the permanent markings, it shall be removed immediately prior to permanent painting. Other temporary markings shall be removed when required by the plans or Special Provisions.

PAVEMENT MARKING

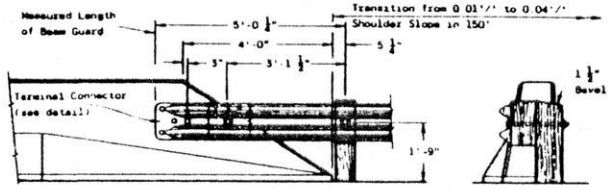
State of Wisconsin
Department of Transportation

APPROVED 2/13/81 DATE

CHIEF DESIGN ENGINEER

S.D.D. 13 B 5-2

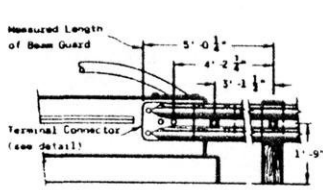
S.D.D. 13 B 5-2



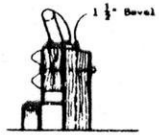
FRONT VIEW

END VIEW

SLOPED FACE PARAPET

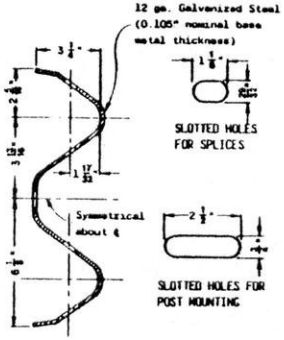


FRONT VIEW



END VIEW

VERTICAL FACE PARAPET



SECTION THRU RAIL ELEMENT

GENERAL NOTES

Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

The type of anchorage and the exact location of the beginning and end of each beam guard installation shall be as shown on the plans or as directed by the Engineer.

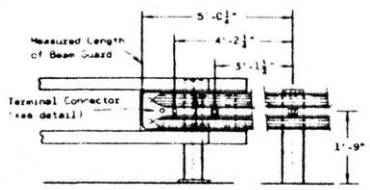
Shoulder widening to accomodate the anchored end of the beam guard shall be accomplished at a rate of widening not to exceed 5 to 1.

Standard Anchorages - Upon approval of the Engineer, the 6 foot offset may be reduced to nothing where existing conditions will not permit the desirable offset. However, when no offset greater than or equal to 3 feet can be provided, the minimum length of guardrail in advance of an obstacle (obstacle to anchor) shall be 150 feet.

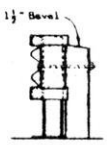
The "Post Footing Details at Piers" shall be used when beam guard posts are over structure footings and less than 3 feet 6 inches of earth is provided over the top of the footing.

(1) The minimum clearance from the front face of beam guard to obstacle shall be 4 feet unless otherwise shown on contract plans. When clearance is less than 4 feet, post spacing shall be reduced to 3 feet - 1 1/2" C-C.

(2) This section shall include at least one 12'-6" Rail Element and a Terminal Connector when required for structure mounting.



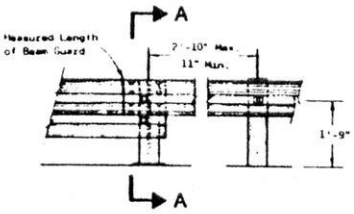
FRONT VIEW



END VIEW

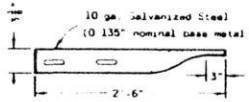
RAILING TYPE "F"

SECTION A-A

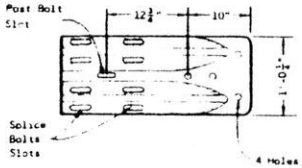


FRONT VIEW

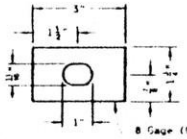
RAILING TYPE "W"



STRUCTURE MOUNTING DETAILS



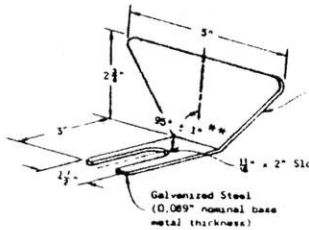
TERMINAL CONNECTOR



8 Gage (0.165" nominal base metal thickness) galvanized

RECTANGULAR PLATE WASHER

(Shall be omitted at selected locations when Type 1 Anchorages are used. See "ANCHOR OFFSETS" Sheet 5c)



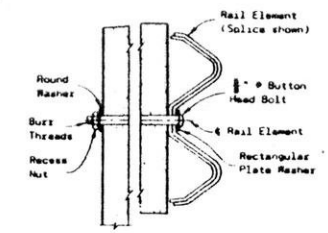
REFLECTOR SPACING

	Beam Guard Length	Reflector Spacing	No. Surfaces Reflectorized	Min. No. Reflectors
One Way Traffic	< 200'	50' C-C	1	3
	> 200'	100' C-C	1	
Two Way Traffic	< 200' *	25' C-C	1 *	6
	> 200' *	50' C-C	1 *	
Two Way Traffic	< 200'	50' C-C	2 * *	3
	> 200'	100' C-C	2 * *	

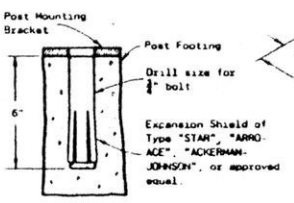
* Every other reflector reversed for 2-way visibility. Contractor may furnish two-sided reflectors in lieu of one-sided reflectors.

** Angle of bend to be 90° ± 1° for two-sided reflectors.

REFLECTOR DETAIL

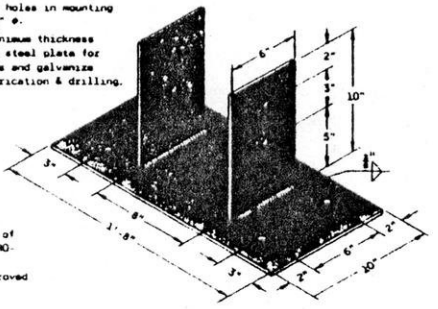


BUTTON HEAD BOLT DETAIL

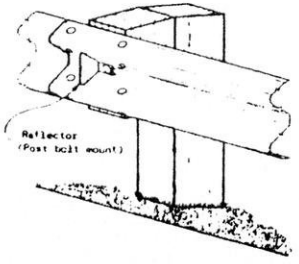


EXPANSION SHIELD DETAIL

NOTE:
Drill all holes in mounting bracket ⅞" ⌀.
Use ⅜" minimum thickness ASTM A 36 steel plate for all pieces and galvanize after fabrication & drilling.

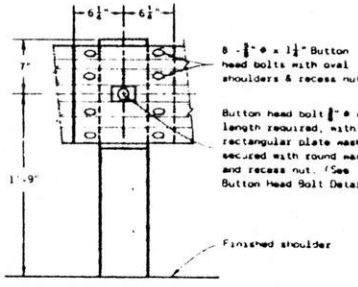


POST MOUNTING BRACKET



TYPICAL INSTALLATION

POST FOOTING DETAIL AT PIERS



RAIL ELEMENT SPLICING AND POST MOUNTING DETAIL

NOTE
THIS STANDARD DETAIL DRAWING HAS THREE SHEETS. SHEET 5c IS REQUIRED ONLY WHEN TYPE 1 OR TYPE 2 ANCHORAGES ARE SPECIFIED.

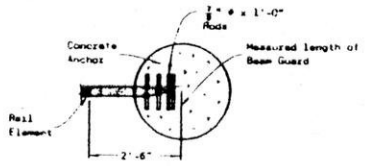
CLASS "A"
STEEL PLATE BEAM GUARD

State of Wisconsin
Department of Transportation

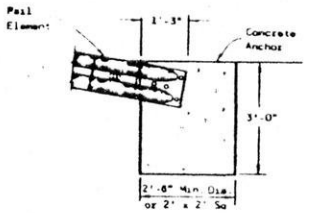
APPROVED 11-13-81 DATE
CHIEF DESIGN ENGINEER

S.D.D. 14 B 2-5a

S.D.D. 14 B 2-5a



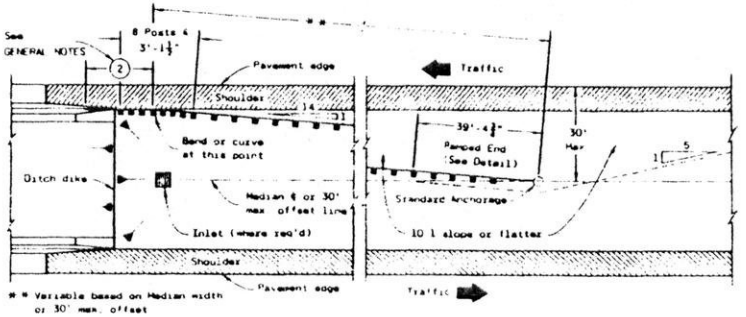
PLAN VIEW IN SECTION



FRONT VIEW IN SECTION

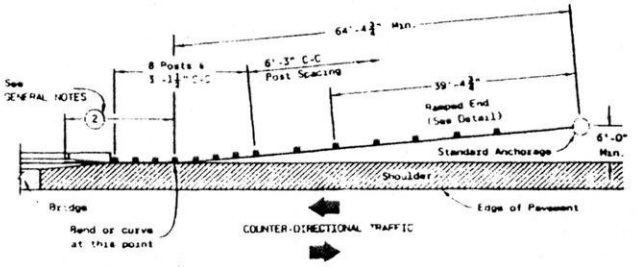
STANDARD ANCHORAGE DETAIL

(Standard Specification Item "Anchorage for Steel Plate Beam Guard")



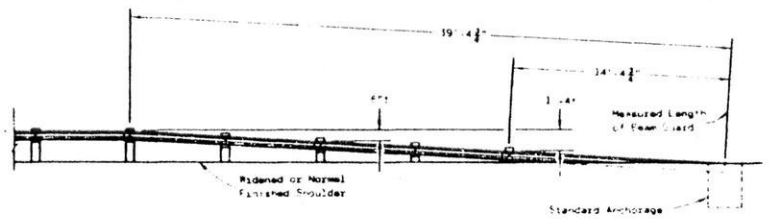
PLAN VIEW

TYPICAL MEDIAN INSTALLATION AT STRUCTURES



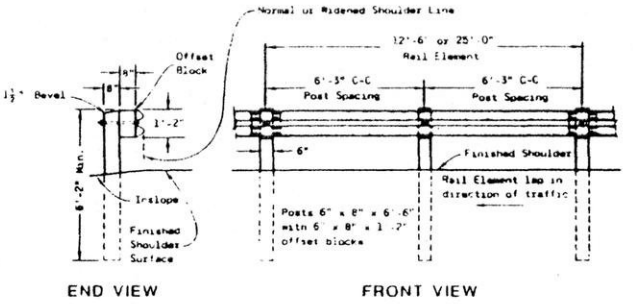
PLAN VIEW

TYPICAL INSTALLATION AT FULL WIDTH STRUCTURES



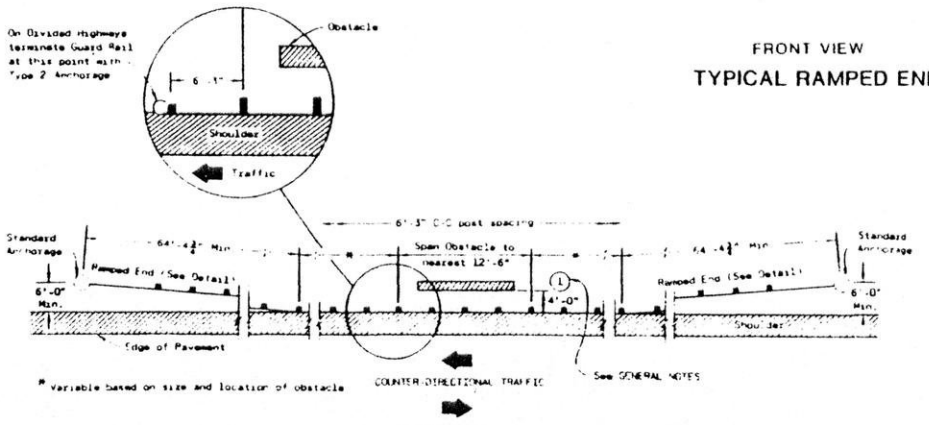
FRONT VIEW

TYPICAL RAMPED END



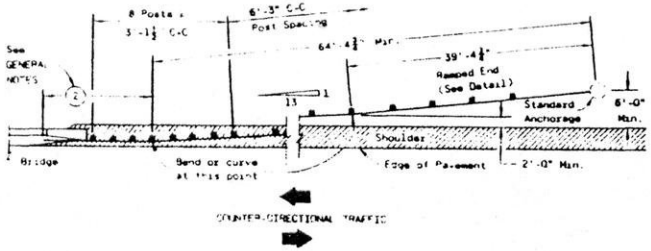
END VIEW FRONT VIEW

TYPICAL STEEL PLATE BEAM GUARD INSTALLATION



PLAN VIEW

TYPICAL INSTALLATION AT OBSTACLES



PLAN VIEW

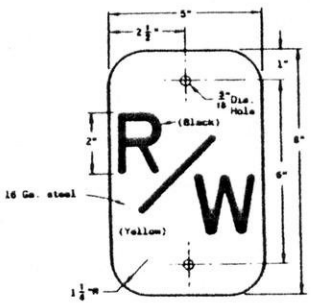
TYPICAL INSTALLATION AT NARROW STRUCTURES

CLASS "A" STEEL PLATE BEAM GUARD

State of Wisconsin
Department of Transportation

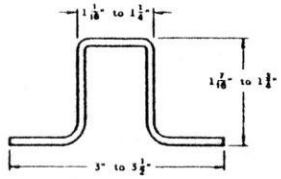
S.D.D. 14 B 2-5b

S.D.D. 14 B 2-5b

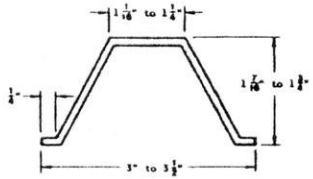


RIGHT OF WAY MARKER

(Letters to be raised $\frac{1}{16}$" Min.)

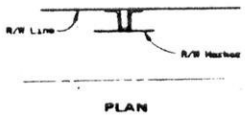


SECTION A-A

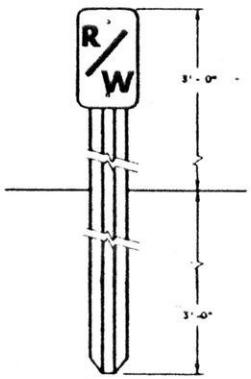


ALTERNATE SECTION A-A

(Minimum weight 2.0 lbs. per ft.)



PLAN

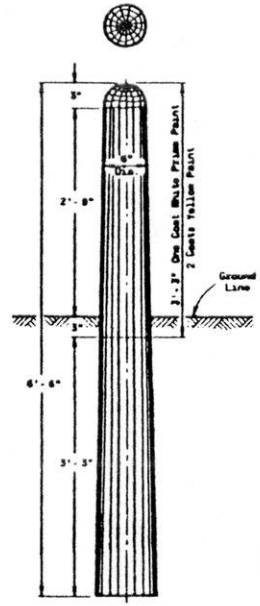


ELEVATION

STEEL MARKER POST
FOR RIGHT OF WAY

ELEVATION

STEEL MARKER POST
FOR RIGHT OF WAY



ELEVATION

WOOD MARKER POST
FOR RIGHT OF WAY

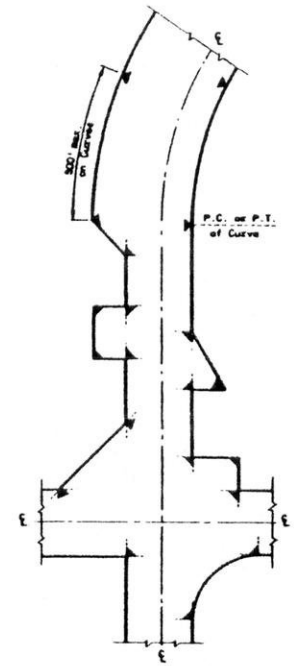


DIAGRAM SHOWING
TYPICAL LOCATIONS
OF MARKER POSTS
FOR RIGHT OF WAY

GENERAL NOTES

Details of construction not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

MARKER POST FOR RIGHT OF WAY

Right of Way Marker Posts may be either wood or steel and shall be erected in advance of grading operations. Posts shall normally be placed at the outer limits of the highway Right of Way, but entirely within the Right of Way, and shall be so placed that the outer edge of the posts shall be tangent to the Right of Way line or lines extended. The exact location of all Right of Way posts will be staked in the field by the Engineer. Location and spacing of Marker Posts shall be as shown elsewhere on the plan or as directed by the Engineer.

MARKER POSTS FOR RIGHT OF WAY

State of Wisconsin
Department of Transportation
Division of Highways

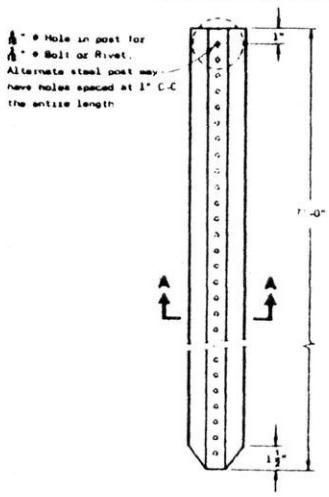
RECOMMENDED FOR APPROVAL

10-3-74 — Chief of Facilities Development

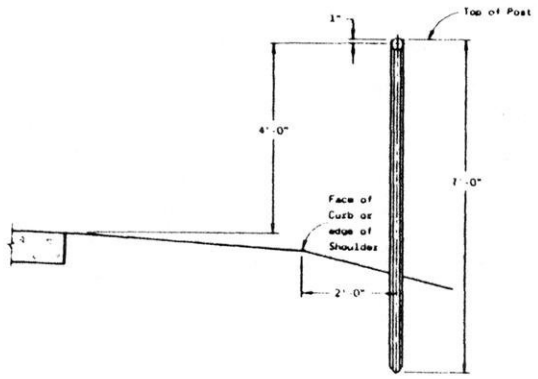
APPROVED

10-14-74 — Highway Engineer

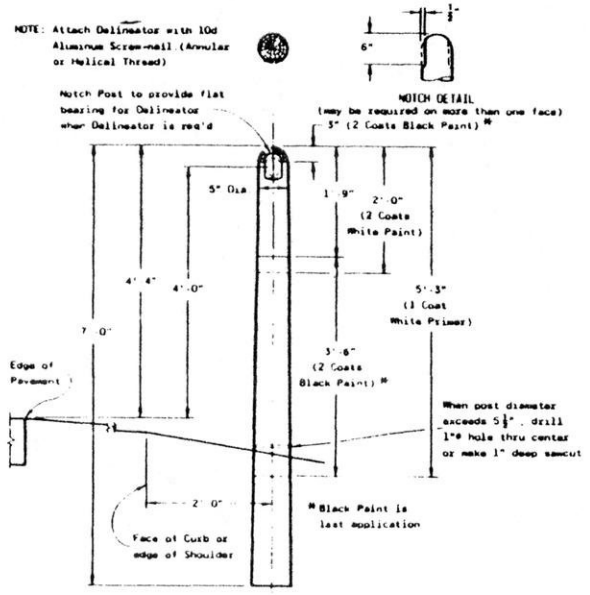
S.D.D. 15 A1-3



DELINEATOR POST



TYPICAL INSTALLATION OF DELINEATOR POSTS



MARKER POST

DESIGN NOTES

THIS DRAWING APPLIES WHEN DELINEATORS ARE LOCATED ON TWO-LANE, TWO-WAY ROADWAYS.

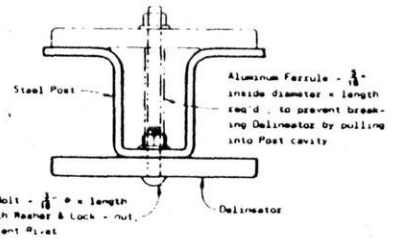
FOR GUIDANCE IN APPLICATION, PLACEMENT AND SPACING OF DELINEATORS, REFER TO PART III, SECTIONS 30-4 AND 30-5 AND FIGURE 3-2D OF THE CURRENT WISCONSIN MANUAL OF TRAFFIC CONTROL DEVICES (WMTCD).

SUGGESTED MAXIMUM SPACING FOR HIGHWAY DELINEATORS ON HORIZONTAL CURVES IS SHOWN IN TABLE III-1, P. 214 OF THE CURRENT WMTCD. THE FORMULA USED TO COMPUTE SPACING OF DELINEATORS ON HORIZONTAL CURVES IS $S=3\sqrt{R-50}$ WHERE R IS THE CURVE RADIUS IN FEET. MINIMUM SPACING SHALL BE 20 FEET.

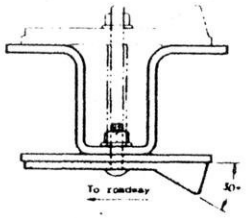
DELINEATOR POSTS OR MARKER POSTS ALONG HORIZONTAL CURVES SHOULD HAVE DELINEATOR UNITS MOUNTED BACK TO BACK TO PROVIDE DELINEATION FOR BOTH DIRECTIONS OF TRAFFIC. DELINEATORS SHOULD ONLY BE USED ON THE OUTSIDE OF CURVES. AS A GENERAL GUIDELINE, DELINEATION IS WARRANTED FOR CURVES OF 5 DEGREES OR GREATER HAVING A CENTRAL ANGLE OF 20 DEGREES OR GREATER.

MARKER POSTS WITH DELINEATORS SHALL BE USED WHERE THERE IS A NEED FOR DELINEATION DURING PERIODS OF DAYLIGHT AS WELL AS DARKNESS AND WHERE THE SECTIONS TO BE DELINEATED ARE OCCASIONAL OR INTERMITTANT. SECTIONS OF ROADWAY HAVING SHARP CURVATURE, HIGH FILLS OR OTHER ROADSIDE OBSTACLES OR HAZARDS WHERE TRAFFIC BARRIERS ARE NOT WARRANTED SHOULD BE DELINEATED IN THIS WAY.

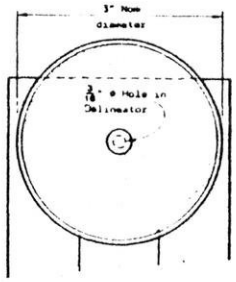
DELINEATORS ON DELINEATOR POSTS SHOULD BE USED IN SITUATIONS REQUIRING CONTINUOUS DELINEATION, AS ON FREEWAYS, WHERE SHARP CURVATURE OR OTHER ROADSIDE HAZARD IS NOT THE REASON FOR DELINEATION AND DAYTIME DELINEATION THEREFORE NOT ESSENTIAL.



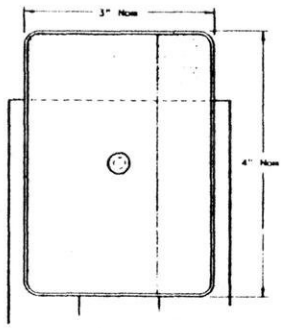
PLAN VIEW



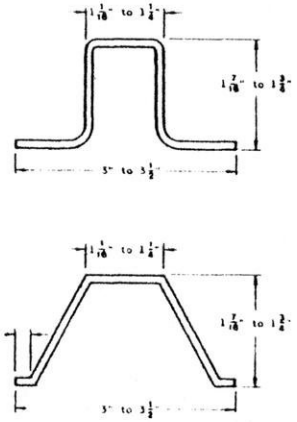
PLAN VIEW



FRONT ELEVATION
3" CIRCULAR TYPE



FRONT ELEVATION
3" X 4" RECTANGULAR TYPE



SECTION A-A
(Minimum weight 2.0 lbs. per ft.)

MOUNTING DETAILS FOR DELINEATORS

GENERAL NOTES

Details of construction not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

The rectangular delineator shall consist of an acrylic plastic wide angle reflex reflector housed in a material such as acrylonitrile butadiene styrene and shall be permanently sealed against dust, water and vapor and will not warp, crack or corrode under field conditions.

Detailed requirements for delineators not shown on this drawing shall conform to Section 633 of the Standard Specifications and the current "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES". The reflectors in the delineators shall be clear.

When the cross sectional area of the Marker Post measured at the ground line exceeds 24 square inches (5 1/2 inch diameter) the post shall be weakened near the ground line by either drilling a 1 inch diameter hole transversely through the center of the post or by making a transverse saw cut to a depth of approximately 1 inch on the side of the post facing traffic.

NOTE
DESIGN NOTES WILL NOT APPEAR ON CONTRACT PLANS.

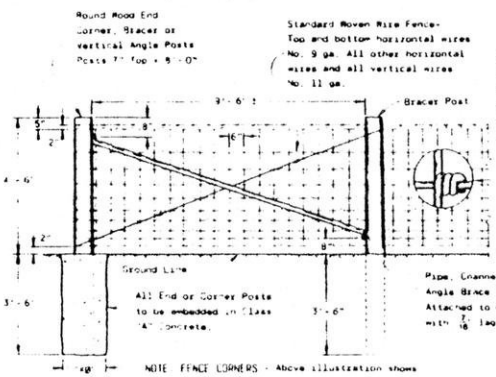
DELINEATOR POSTS
MARKER POSTS AND DELINEATORS

State of Wisconsin
Department of Transportation
Division of Transportation Facilities

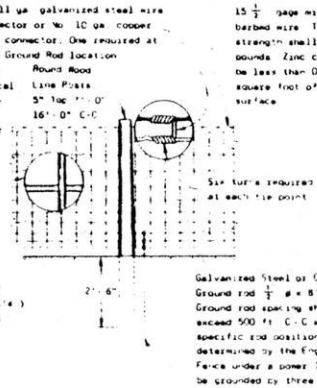
APPROVED 5-2-79
CHIEF DESIGN ENGINEER

S.D.D. 15 A2-2

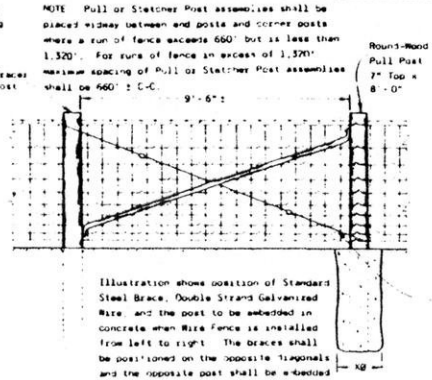
S.D.D. 15 A2-2



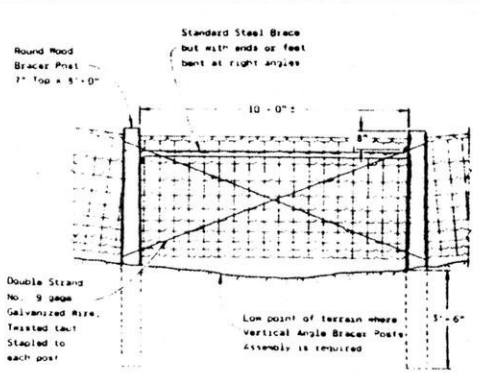
END OR CORNER POSTS ASSEMBLY



LINE FENCE RUCTIC 4

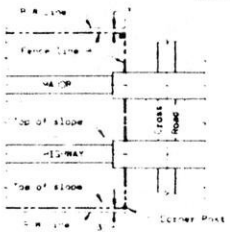


PULL OR STRETCHER POSTS - ASSEMBLY



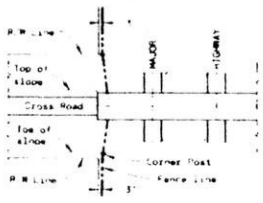
VERTICAL ANGLE BRACER POSTS ASSEMBLY

GENERAL ROADSIDE VIEW OF WOVEN WIRE FENCE



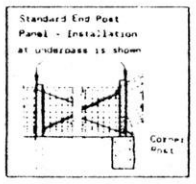
PLAN VIEW

FENCE LOCATION AT STRUCTURES MAJOR HIGHWAY OVERPASS

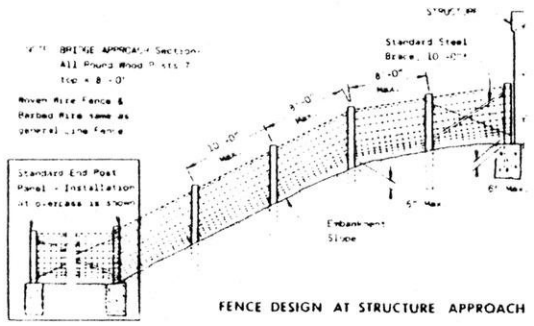


PLAN VIEW

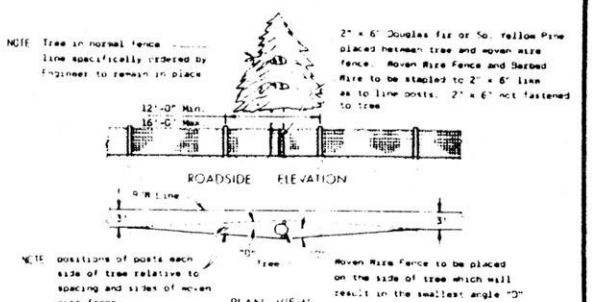
FENCE LOCATION AT STRUCTURES MAJOR HIGHWAY UNDERPASS



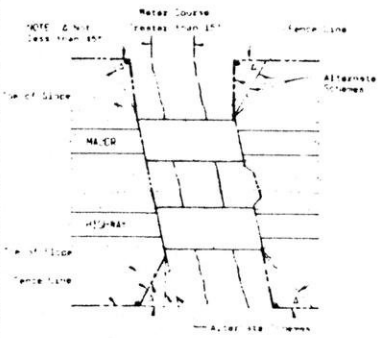
ALTERNATE FENCE DESIGN AT STRUCTURE



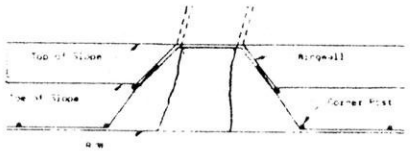
FENCE DESIGN AT STRUCTURE APPROACH

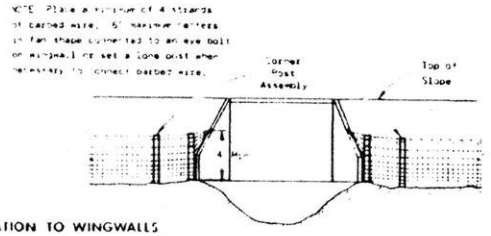


FENCE DESIGN AT TREES REMAINING IN NORMAL FENCE LINE

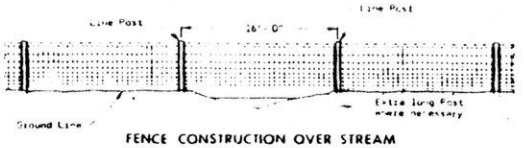


FENCE LOCATION DETAILS STREAM COURSE CROSSING OF GREATER THAN 15ft IN WIDTH



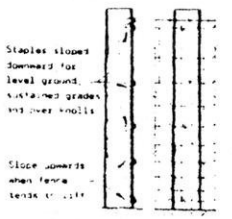


FENCE INSTALLATION TO WINGWALLS



FENCE CONSTRUCTION OVER STREAM COURSES OF 15ft OR LESS IN WIDTH

Sketch showing arrangement of Staples for mounting Woven Wire Fence & Barbed Wire to line posts. Staple arrangement shall be the same for all other posts except that they shall be driven tight to posts



FENCE MOUNTING DETAIL

GENERAL NOTES

Details of construction not shown hereon shall conform to the pertinent requirements of the standard specifications and the applicable special provisions

"d2" = Diameter of post plus 12"

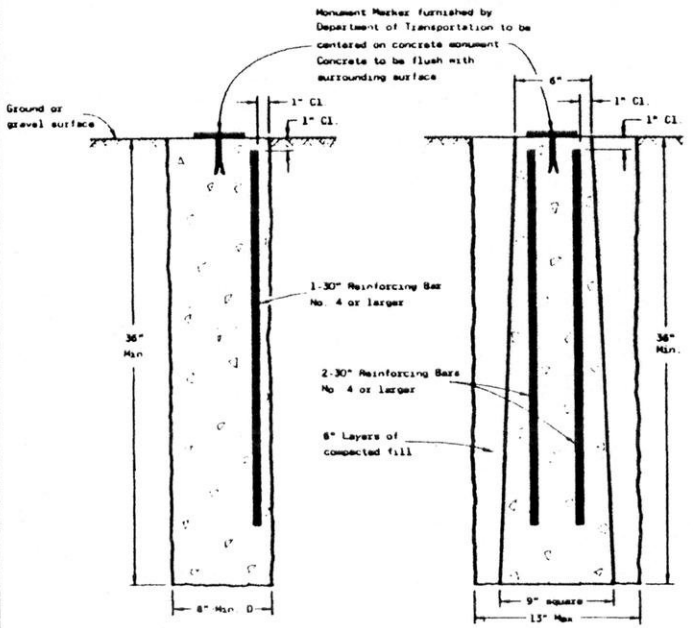
WOVEN WIRE FENCE

State of Wisconsin
Department of Transportation
Division of Transportation Facilities

APPROVED 9-24-79

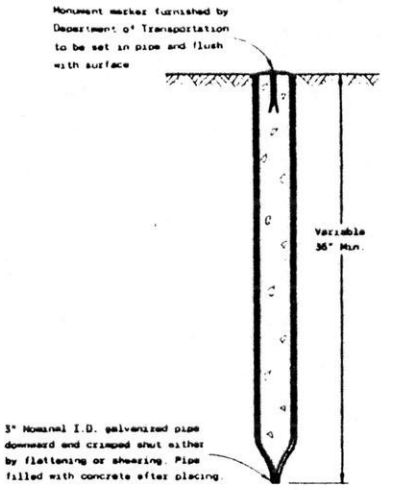
S.D.D. 15 B 1-4

S.D.D. 15 B 1-4



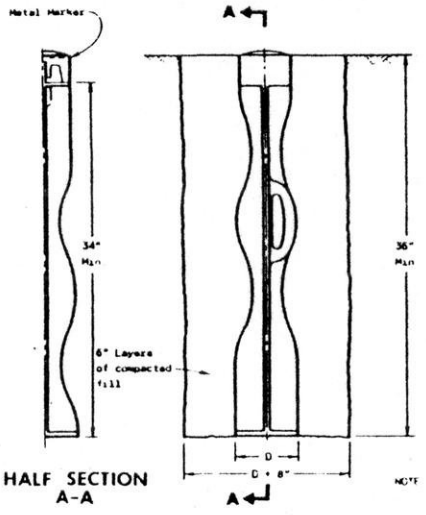
CAST-IN-PLACE CONCRETE MONUMENT | **PRECAST CONCRETE MONUMENT**

TYPE A



TYPE B

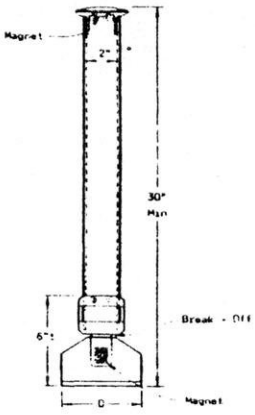
NOT TO BE USED IN PAVEMENT STRUCTURE



HALF SECTION A-A

TYPE C

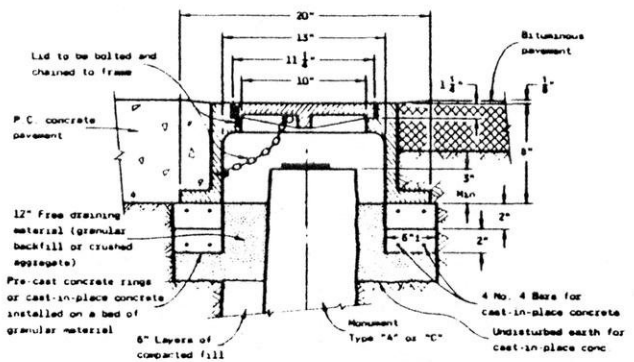
NOTE D - 5" minimum diameter or width base. Circular shape is not required.



TYPE D

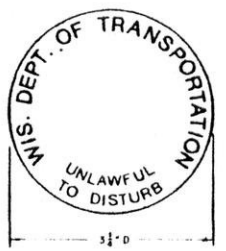
METAL MONUMENTS

(Includes Marker)

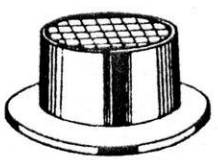


DETAIL OF MONUMENT COVER

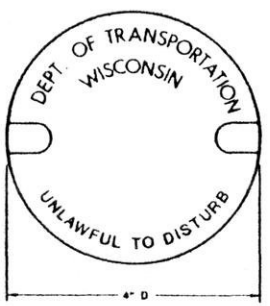
INSTALLATION IN PAVEMENT OVER A MONUMENT



TOP LEGEND FOR TYPES "A", "B", & "D"



(Approximate weight - 95 lbs.)



TOP LEGEND FOR TYPE "C"

GENERAL NOTES

Details of construction, materials and workmanship not shown on this drawing shall conform to the pertinent requirements of the Standard Specifications and the applicable Special Provisions.

Detailed drawings of proposed alternate designs for Metal Monuments or Monument Covers shall be submitted to the Engineer for approval.

The installed Metal Monument must be easily detected with a dip needle. Inert permanent magnets shall be attached near the top and bottom of those Monuments constructed of a metal alloy which is not attractive to a dip needle.

Type A, Type C and Type D Monuments are equal alternates unless otherwise specified on the plan or by special provision.

When Landmark Reference Monument and Cover is specified, contractor shall furnish and install Monument and Monument Cover in conformance with details on this drawing and pertinent requirements of Section 611 of the Standard Specifications.

The Monument Cover shall be a "Non-Rocking" type. Adjustment of the Cover to grade may be accomplished by the use of mortar and brick, or by either pre-cast or cast-in-place Reinforced Concrete Grade Rings.

Monuments shall be located and placed at the direction of the Engineer.

LANDMARK REFERENCE MONUMENTS

State of Wisconsin
Department of Transportation

APPROVED 9-18-80 DATE

SHEET DESIGN ENGINEER

S.D.D. 16 A 1-3

S.D.D. 16 A 1-3