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SUBMITTAL OF PRELIMINARY DESIGN PACKAGE (30%) FOR THE ROAD DESIGN - CONTAINS DESIGN CRITERIA, DESIGN CALCULATIONS, TECHNICAL SPECIFICATIONS AND DESIGN DRAWINGS

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Department of Energy
Fernald Environmental Management Project
P. O. Box 538705
Cincinnati, Ohio 45253-8705
(513) 648-3155

JAN 2 6 1996

DOE-0471-96

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - SRF-5J
77 W. Jackson Blvd.
Chicago, IL 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, OH 45402-2911

Dear Mr. Saric and Mr. Schneider:

SUBMITTAL OF PRELIMINARY DESIGN PACKAGE (30%) FOR THE ROAD DESIGN

The U.S. Department of Energy, Fernald Area Office (DOE-FN) is pleased to submit the enclosed Preliminary Design Package (30%) for the Haul Road and Rerouted North Entrance Road. This package includes: Design Criteria, Design Calculations, Technical Specifications and Design Drawings.

If you have any questions, please contact Rod Warner at (513) 648-3156.

Sincerely,

Susan M Petrina for

Johnny Reising
Fernald Remedial Action
Project Manager

FN:Warner

Enclosure: As Stated

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Recycled and Recyclable

cc w/enc:

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Design Criteria Package
for
Haul Road and Rerouted North Entrance Road
Design and Construction

Operable Unit 2
Project Order 158

January 1996
Revision 1

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio
FERMCO Subcontract No. 2-21487

PARSONS

25 Merchant Street
Cincinnati, Ohio 45246

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HAUL ROAD/NORTH ENTRANCE ROAD DESIGN ASSUMPTIONS

The following design assumptions are made in addition to the stated assumptions of the design criteria package for the 30% CFC submittal.

- Contour mapping for the site has been used as the basis for design of the proposed profile and cross sections. Field survey data will be incorporated for the 90% CFC Design submittal.

- Clearance of the existing oxygenation unit and parshall flume will be addressed at the 90% submittal.

- The North end of the North Entrance Road may have a revised alignment to eliminate the reverse curve (less than 100 feet minimum desirable length). This will be determined for the 90% CFC Design submittal.

- Drawings and quantities for Grading and Sediment Control, Intersection Details, Maintenance of Traffic, and Signing & Pavement Marking will be included in the 90% CFC Design submittal.

- The Haul Road's preliminary alignment that was provided by PARSONS will be modified based on field survey data during the final design phase. Proposed construction for the OU4/Vitrification Plant Fernald residue, and the design for the OU1 Remediation, and the excavation for OU2 Lime Sludge Pond may require adjustment to the Haul Road alignment.

- The electronic stationing resulted in uneven stations at the PC and PT points. After the field survey data is received, the alignment will be adjusted to eliminate the uneven stations.

- The horizontal and vertical alignment near the 3rd Street soil and rubble pile will be adjusted after analyzing the field survey data.

- Drainage will be calculated for the 90% CFC design submittal when the survey is complete and the alignment finalized. For this submittal, 2 foot deep ditches with 3 to 1 side slopes are shown and will be adjusted as required for the 90% submittal. The ditches for the proposed cross sections will be designed in conjunction with the drainage. Similarly, earthwork quantities will be calculated for the 90% submittal.

- De Leuw, Cather has been directed to use the Geosyntech's data as a guide and to use our best engineering judgement to set the alignment for the North Entrance Road.

- The alignment of the "existing" North Entrance Road will be determined from aerial photos. It will be adjusted based on the information from the field run survey for the 90% CFC issue.

- The tie-in points where the new roadways meet the existing will be completed after the survey is complete for the 90% CFC submittal.

- The final construction phase of the North Entrance Road is considered to be the primary alignment. Therefore, it appears first when reviewing the plan and profile sheets.

- Drainage for the portion of the Haul Road within the former Production Area will include new catch basins cut into existing storm drains. These new catch basins, along with the existing will provide sufficient positive drainage.

- The Haul Road will be extended from the Production Area fence to approximately 100 feet east of the existing North Entrance Road for the 90% CFC submittal.

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Design Criteria Package
for
Haul Road and Rerouted North Entrance Road
Design and Construction

Operable Unit 2
Project Order 158

January 1996
Revision 1

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio
FERMCO Subcontract No. 2-21487

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Design Criteria Package
for
Haul Road and Rerouted North Entrance Road
Design and Construction

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LIST OF ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADT	Average Daily Traffic
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
ARAR	Applicable or Relevant and Appropriate *Requirements*
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CBR	California Bearing Ratio
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPT	Cone Penetration Testing
CRU	CERCLA/RCRA Unit
DCP	Design Criteria Package
DOE	United States Department of Energy
ESAL	Equivalent Single Axle Load
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FRL	Final Remediation Levels
ft	foot (feet)
H&SP	Health and Safety Plan
in	inch
mph	miles per hour
MUTCD	Manual on Uniform Traffic Control Devices
NFPA	National Fire Protection Agency
NPH	Natural Phenomena Hazard
OBBC	Ohio Basic Building Code
ODOT	Ohio Department of Transportation
OSDF	On-Site Disposal Facility
OU	Operable Unit
PC	Performance Category
PO	Project Order
psf	pounds per square foot
psi	pounds per square inch
RCRA	Resource Conservation and Recovery Act
sec	second

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LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

SSC	System, Structure, and Component
TBC	To Be Considered
UBC	Uniform Building Code
UCRL	University of California Research Laboratory
VPD	Vehicles per Day

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SECTION 1

PROJECT DESCRIPTION

The Fernald Environmental Management Project (FEMP) is a 1,050 acre facility located in southwestern Ohio approximately 18 miles northwest of downtown Cincinnati, Ohio. The FEMP facility contains low-level radioactive, solid, and hazardous wastes. Much of the waste material is to be disposed of in an on-site disposal facility (OSDF) as delineated in the feasibility studies, proposed plans, and Records of Decision. Approximately 2.5 million cubic yards of material will be removed from the FEMP operable units during the remediation activities and will be placed in the OSDF for permanent storage. To accomplish this task, a Haul Road and Rerouted North Entrance Road will be designed and constructed. Figure 1-1 shows the tentative route of the Haul Road and Rerouted North Entrance Road.

This Design Criteria Package (DCP) addresses the issues and concerns for design and construction of the Haul and Rerouted North Entrance roads. The DCP is developed consistent with the functional requirements presented in Subsection 2.1 of this DCP, the Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) requirements provided in Appendix A, and appropriate United States Department of Energy (DOE) orders and United States Environmental Protection Agency directives.

This DCP will serve as the basis for Title I, II, and III design services for design and construction of the Haul Road and Rerouted North Entrance Road.

This DCP was prepared to be consistent with the outline provided in the FEMP Engineering Procedure Number 12-4003, *Design Criteria Package, Revision 0.*

1.1 Project Scope

PARSONS will provide two stand alone design packages for this project. One package will be the design for construction of the Haul Road and the other package will be the design for the rerouting of the North Entrance Road. Title III support during construction will also be provided.

Demolition of the low nitrate tank and the existing sewage treatment facility will only be addressed from the standpoint of the soil properties and conditions required at those locations prior to road construction. Demolition of the existing North Entrance Road is outside the scope of this project.

Maintenance of the roads is outside the scope of this project.

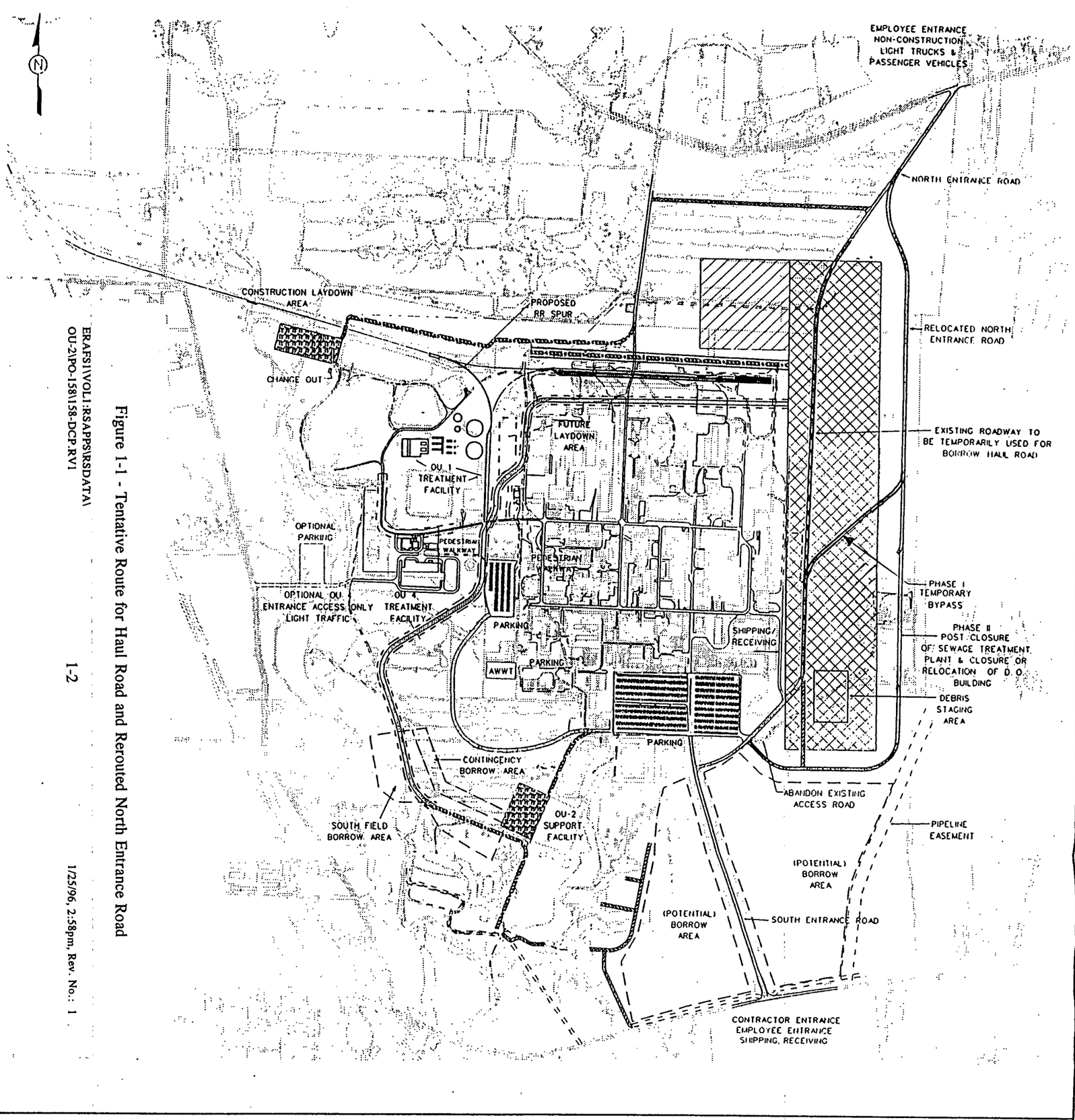

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Figure 1-1 - Tentative Route for Haul Road and Rerouted North Entrance Road

LEGEND

SYMBOL	TITLE	SERVICE
	WASTE HAUL ROAD - NEW SURFACE	HEAVY CONSTRUCTION VEHICLES/ WASTE TRANSPORT VEHICLES
	WASTE HAUL ROAD - EXISTING SURFACE	HEAVY CONSTRUCTION VEHICLES/ WASTE TRANSPORT VEHICLES
	WASTE HAUL ROAD - GRAVEL SURFACE	HEAVY CONSTRUCTION VEHICLES/ WASTE TRANSPORT VEHICLES
	EXISTING GRAVEL ROAD -	VARIOUS
	UPGRADED GRAVEL ROAD -	CONST. VEHICLES/PERSONNEL ACCESS
	NEW GRAVEL ROAD -	PERSONNEL ACCESS
	NEW ENTRANCE ROAD (BIT. PAVE.)-	PRIMARY ACCESS
	PHASE II ENTRANCE ROAD (BIT. PAVE.)-	PRIMARY ACCESS
	EXISTING PAVED ROADWAY -	PRIMARY ACCESS
	EXISTING PAVED ROADWAY -	SECONDARY ACCESS
	RAIL (CRU-1) -	OFFSITE SHIPMENTS
	ON-PROPERTY DISPOSAL FACILITY 2.5 MCY	CONTINGENCY EXPANSION AREA
	CONTINGENCY BORROW AREA	

NOTE: HAUL ROADS INTERNAL TO POTENTIAL BORROW AREAS ARE UNDER DEVELOPMENT

SCALE

CONCEPTUAL SITE WIDE TRAFFIC FLOW MASTER PLAN

REVISION 0 AUGUST 10, 1995 WJO | FIGURE 1

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1.2 Description of Alternative Selected

The proposed Haul Road route is approximately 1.6 miles long and is shown in Figure 1-1. The route generally follows existing gravel roads, crossing five abandoned railroad spurs and one active track. The Haul Road will have controlled access. Traffic on the Haul Road will primarily be dump trucks hauling waste material from the various operable units to the OSDF. Access to monitoring wells from the Haul Road will be provided. The Haul Road design will include a pedestrian bridge to allow pedestrian access to OU-4.

The proposed Relocated North Entrance Road route is approximately 1.2 miles long and is shown in Figure 1-1. This road will be constructed in two phases. Phase I will consist of the major portion of the Rerouted North Entrance Road and ~~will include the loop around~~ *a transition connecting the existing North Entrance Road, thus bypassing* the existing sewage treatment facility. Phase II will occur after the sewage treatment facility and the substation are demolished and will consist of straightening out the sewage treatment ~~bypass loop~~ *transition* from Phase I. The Rerouted North Entrance Road will serve as a primary access route for the site. Traffic on this road will mostly be passenger cars and light trucks. Access to monitoring wells from the Rerouted North Entrance Road will be provided.

1.3 General Description of the Project Components

1.3.1 Haul Road

The Haul Road will be located in both contaminated and clean areas of the site, but will be considered contaminated. It will be designed with two 12-foot lanes and 5-foot shoulders and will carry two way traffic. The Haul Road will be approximately 1.6 miles long with a primary purpose as a route for truck access between the existing waste storage areas of the FEMP site and the proposed OSDF. Road design will include a paved area in the controlled area for truck fueling. Service drives will be installed to provide access to monitoring wells.

1.3.2 Rerouted North Entrance Road

The North Entrance Road will be a permanent, uncontaminated facility and serve as a public access road to the site. It will be designed with two 12-foot lanes and 5-foot shoulders and will carry two way traffic. The existing North Entrance Road is being relocated because the OSDF is planned for the same location. The roadway length will be approximately 1.2 miles. Service drives will be installed to provide access to monitoring wells.

The North Entrance Road design will include two phases of construction. Phase I will include a ~~by pass loop~~ *transition* around the existing sewage treatment plant. This ~~loop~~ *transition* will not be clean closed

and will be demolished after Phase II construction is complete. Phase II will consist of construction of a straight section of road to replace the bypass loop around the sewage treatment plant and the substation. The Phase II road section will be clean closed.

The rerouted North Entrance Road will be used primarily for passenger cars and light trucks.

1.4 Assumptions

1) Relocation of utilities will be limited to the main telephone lines along the North Entrance Road.

2) Existing site utility system is adequate for providing power for the Haul Road railroad crossing signal, lighting for the Haul Road pedestrian bridge, and power for the North Entrance Road caution signal light.

3) Existing drainage patterns will be maintained along the Haul Road route. Retention and treatment of runoff from the Haul Road is outside the scope of this project.

4) Fernald Environmental Restoration Management Corporation (FERMCO) will be responsible for final disposition of samples submitted by the construction contractor.

5) Demolition of the Haul Road at end of service and demolition of the existing North Entrance Road are outside the scope of this project.

6) Demolition and remediation of the sewage treatment facility and the underlying soil is outside the scope of this project.

7) Prior to the start of the Phase II road work, the contaminated soil under the sewage treatment facility will have been removed and backfilled with clean material by FERMCO back to the existing grade as part of the sewage treatment facility demolition.

8) PARSONS will not provide plans for the removal of the low nitrate tank. PARSONS will only provide the compaction criteria and subgrade specification. CERCLA/RCRA Unit 3 (CRU-3) will develop the Decontamination and Demolition plan.

9) FERMCO will be responsible for compliance with stormwater management and wetlands issues.

10) FERMCO will prepare the Health and Safety Plan for this project.

11) An OU-5 construction contractor will remove contaminated soil to the Final Remediation Levels (FRLs) as defined by FERMCO, before the start of North Entrance Road area construction.

FERMCO currently estimates that only the top 6 inches of soil need to be removed. PARSONS will recommend locations for stockpiling contaminated soil in the radiologically controlled area of the site based on construction activities. The disposal of the contaminated soil is outside the scope of this project.

12) FERMCO will prepare and implement any sampling and analysis plans to characterize soil and/or determine compliance with cleanup levels.

13) Pavement section designs for the North Entrance Road and the Haul Road are to be based on the geotechnical parameters developed for the road design in Project Order 140 (PO-140).

14) Air monitoring shall be provided by FERMCO in accordance with ARARs.

15) Subgrade preparation and completion, as well as paving operations for each respective section of road, will be performed during the normal construction season from April through October. Implementation of compaction requirements of the design criteria and placing pavement could prove to be difficult if off-season or split-season work is needed to meet the schedule.

16) No collection system for fuel spillage is included.

17) The North Entrance Road drainage system will be independent of the OSDF drainage system.

18) No known subsurface interferences underlie the road route and FERMCO will survey as they deem necessary.

1.5 References

The following are the primary documents on which this DCP is based.

1) United States Department of Energy, 1987/1992, DOE Order 4700.1, "Project Management System."

2) United States Department of Energy, 1989, DOE Order 6430.1A, "General Design Criteria."

3) FEMP Engineering Procedure, Document No. 12-4003, "Design Criteria Package," September 1994, Revision 0.

4) PO Plan for PO-158, Haul Road and Rerouted North Entrance Road Design and Construction, October 1995, Rev. 2.

5) FERMCO site procedure, SSOP-0044, "Management of Excess Soil, Debris, and Waste from a Project."

6) *FERMCO Policies and Requirements Manual.*

7) Meeting minutes, dated October 26, 1995.

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SECTION 2

DESIGN CRITERIA

This section identifies the general and discipline-specific design criteria to which the design shall comply. Appendix A presents the list of ARARs and TBC criteria that shall be followed during design of the haul and entrance roads. The design shall also be based on the applicable portions of DOE Order 6430.1A.

2.1 Functional Requirements

The design life for the Haul Road is 5 years for the portion west of the proposed Operable Unit 1 (OU-1) railroad system and 10 years for the portion east of the OU-1 railroad system.

The design life for the Rerouted North Entrance Road is 20 years.

2.1.1 Haul Road

The purpose of the Haul Road is to provide a method of transporting waste material from the various operable units to the OSDF. Since the Haul Road is in a contaminated area and is to be abandoned eventually, use of rock for base will be avoided to minimize contaminated rocks to be disposed of at the OSDF.

2.1.2 Rerouted North Entrance Road

The purpose of the Rerouted North Entrance Road is to maintain access to the FEMP from the north, after the existing North Entrance Road is demolished due to construction of the OSDF. Phase I of the North Entrance Road alignment will clear existing oxygenation unit and Parshall flume at MH175.

2.1.3 Stormwater Management

The Haul Road is located in the contaminated area. The existing drainage system pattern will be maintained by providing culverts as needed for the Haul Road. Culverts are undesirable for the Rerouted North Entrance Road, but may be necessary at the north or south ends or at the bypass loop. Drainage will be collected by an open ditch system and will be designed for a 10-year, 24-hour storm event for the Haul Road and a 25-year, 24-hour storm event for the Rerouted North Entrance Road. Runoff controls from the disturbed areas will include measures to mitigate erosion and sediment transport. Stormwater control requirements are listed in the ARARs in Appendix A.

2.1.4 Support Elements

Staging areas for the construction material delivered to the site will be identified by FERMCO.

2.1.5 Utilities

A utility survey will be performed to locate existing underground utilities along the proposed road routes. Unknown utilities discovered during this time will be identified to FERMCO.

2.1.6 Temporary Support Facilities for Construction Activities

The road design for the Haul Road will include a roadside paved area in the controlled area, allowing the trucks on the Haul Road to be refueled from the uncontrolled area.

2.2 General Criteria

State and local building codes will be followed unless they conflict with DOE Order 6430.1A, in which case the most conservative will apply.

2.2.1 National, State, and Local Regulations, Codes, Standards, and DOE Orders

This section presents the general regulations, codes, standards, guidelines, and orders that are to be followed for the design of the road system and do not constitute ARARs/TBCs, which are detailed in Appendix A. This information is organized by engineering discipline.

Civil

1) American Association of State Highway and Transportation Officials (AASHTO), 1990. "A Policy on Geometric Design of Highways and Streets (AASHTO Green Book)." Washington, D.C.

2) Ohio Department of Transportation, "Location & Design Manual, Volumes I, II, and III." (Revised 1995). Columbus, Ohio.

3) ODOT, "Construction and Material Specifications," 1995. Columbus, Ohio.

4) Federal Highway Administration, "Manual on Uniform Traffic Control Devices (MUTCD)." 1988. Washington, D.C.

5) DOE 6430.1A, "General Design Criteria," Division 2.

Electrical

1) American National Standards Institute (ANSI) C2, National Electrical Safety Code.
2) ANSI C84.1, Electrical Power Systems and Equipment - Voltage Ratings (60 Hz).
3) National Fire Protection Agency (NFPA) 70, National Electrical Code.
4) NFPA 780, Lightning Protection Code.
5) DOE 6430.1A, General Design Criteria, Division 16, Electrical.

Environmental, Safety and Health

1) 29 CFR 1910, "Occupational Safety and Health Standards."

2) 29 CFR 1926, "Safety and Health Regulations for Construction."

3) 10 CFR 835, "Occupational Radiation Protection" (this is the promulgation of DOE Order 5480.11).

4) DOE Order 5480.10, "Contractor Industrial Hygiene Program."

5) DOE/EH-0256T, Radiological Control Manual.

6) DOE-EM-STD-5502-94, "Hazard Baseline Documentation."

Structural

Codes, standards, and orders applicable to the structural design follow:

1) Uniform Building Code (UBC) 1994

2) Ohio Basic Building Code (OBBC) 1995

3) American Society for Testing and Materials (ASTM) standards as referenced

4) DOE Order 6430.1A, "General Design Criteria," Division 3

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5) DOE-STD-1020-94, "Natural Phenomena Hazards, Design, and Evaluation Guidelines for DOE Facilities"

6) University of California Research Laboratory (UCRL)-53582, "Natural Phenomena Hazards Modeling Project; Seismic Hazard Models for DOE Sites"

7) American Society of Civil Engineers (ASCE), 7-93, "Minimum Design Loads for Buildings and Other Structures"

8) American Concrete Institute (ACI)-318, "Building Code Requirements for Reinforced Concrete"

9) American Institute of Steel Construction (AISC) Manual, 9th edition

10) DOE Order 5480.28, "Natural Phenomena Hazards Mitigation"

11) DOE-STD-1021, "Natural Phenomena Hazards Performance Categorization Criteria for Structures, Systems, and Components"

2.3 Discipline Criteria

2.3.1 Civil and Site Development

Traffic Volumes

The Haul Road and North Entrance Road will be designed with consideration of the design year traffic volumes for each roadway. They are as follows:

1) Haul Road: Average Daily Traffic (ADT) - 400 Vehicles per Day (VPD) (50/50 distribution)
2) North Entrance Road: ADT - 6000 VPD (50/50 distribution)
3) North Entrance Road Crossings by Site Haul Trucks: ADT - 400 VPD (50/50 distribution)

Design Vehicle

The Haul Road will be designed to accommodate heavy trucks (Class B vehicles). The traffic data will be converted to 18-kip Equivalent Single Axle Load (ESAL) applications for the design period using the procedures called out in the ODOT Location and Design Manual. The ODOT pavement design procedures are based on AASHTO design procedures. The ODOT manual provides conversion factors for trucks that are used to convert the traffic to 18-kip ESAL applications for pavement design. The geometric design and pavement design will be completed considering the special needs of these vehicles.

The North Entrance Road will primarily carry passenger cars and light trucks (Class A, and 10 percent Class B and Class C vehicles). Traffic data will be converted to 18-kip ESAL applications for the design using the procedures called out in the ODOT Location and Design Manual. Borrow soil haul trucks (Class B vehicles) hauling soil will cross this road at one location on a regular basis. Pavement design will be modified accordingly at this location for heavier loading. The North Entrance Road will probably require signs at the crossing for borrow soil haul trucks.

Design Speed

Design speed is defined as the maximum speed that can be safely maintained by vehicles traveling on a section of roadway. The design speed considers favorable driving conditions, topography, and the function of the roadway. The design speed will control the horizontal and vertical design elements of the roadway. The roadway section will typically have a posted speed limit lower than its design speed.

The Haul Road will carry heavy vehicles and have a restricted horizontal alignment. Due to the presence of existing and future facilities on the site, the horizontal alignment will require several curves with relatively short radii. The maximum design speed for the Haul Road shall be 30 mph. Areas of restricted curvature will require a reduced design speed and warning signs will be provided on the roadway.

The North Entrance Road will carry primarily passenger cars and light trucks. There are minimal geometric restrictions on the north sections, but 90 degree curves are present on the south end of the roadway ~~and for the by-pass loop~~. The maximum design speed for the North Entrance Road shall be 40 mph. Areas of restricted curvature will require a reduced design speed and warning signs will be provided on the roadway.

Posted Speed Limit

The maximum speed limit will be posted on each roadway with standard regulatory speed limit signs, as shown in the MUTCD. The Haul Road will have a posted speed of 20 mph and the North Entrance Road 30 mph. Supplementary warning signs will be used as required to lower the speeds on curves which do not meet the design speed requirements.

Horizontal Alignment

The horizontal alignment of a roadway is controlled by design elements that include the maximum degree of curve, superelevation rates, and sight distance. All horizontal design elements in this section follow the standards established in the AASHTO Green Book.

1) Maximum Degree of Curve

The maximum degree of curvature is established as the maximum allowable rate of curvature on the roadway for a given design speed. It can also be expressed as the minimum allowable radius. Curves with smaller degrees of curvature will allow higher design speeds, but are not always practical in cases such as the design of the Haul Road. The maximum degree of curvature is also a controlling factor in the maximum allowable rate of superelevation.

The Haul Road, which has a design speed of 30 mph, will have a maximum degree of curvature of 21 degrees (minimum radius of 273 ft). Any curves which do not meet the requirement will have supplemental warning signs on the curve with a lower speed limit. Lower speed limits are expected in the north section of the Haul Road where several short curves may be required to travel around existing and future facilities.

The North Entrance Road, which has a design speed of 40 mph, will have a maximum degree of curvature of 11.25 degrees (minimum radius of 509 ft). Any curves which do not meet the requirement will have supplemental warning signs on the curve with a lower speed limit. Lower speed limits are expected for the 90 degree curves at the south end of the North Entrance Road ~~and the by-pass loop~~.

2) Superelevation Transition

The superelevation of the two lane roadway is generally obtained by rotating the typical crowned pavement about the centerline. The maximum rate of superelevation for both the Haul Road and the North Entrance Road is 6 percent. The areas of roadway that have a short curve radius will typically have a maximum superelevation rate of 4 percent.

The length of superelevation runoff is the minimum length required to attain full superelevation from a tangent section. Typically 2/3 of the length will be on the tangent section of roadway and 1/3 on the curve. The minimum superelevation runoff lengths are 110 feet for the Haul Road and 125 feet for the North Entrance Road.

3) Sight Distance

Curves along the alignment may restrict the horizontal sight distance along the Haul Road and North Entrance Road. The horizontal sight distance can be measured on the centerline of the lane as a chord on the curve. Factors that may adversely impact sight distance include walls, buildings, and other longitudinal barriers along the roadway alignment. Sight distance is also a consideration for the Fernald Residues Vitrification Plant (CRU-4) access road crossing the Haul Road. Sight distance will be checked according to the standards provided in the AASHTO Green Book.

Vertical Alignment

The vertical alignment of a roadway is controlled by design elements that include the length of curve ("K" factor), maximum grade, stopping sight distance, passing sight distance, and vertical clearance. All vertical design elements in this section follow the standards established in the AASHTO Green Book.

1) Length of Curve ("K" factor)

Vertical curves allow for the gradual change between two tangent grades on the roadway. Design standards are provided for crest and sag vertical curves to set the minimum length of curve for a given design speed. For a given design speed, a "K" value can be determined. The K factor represents the rate of vertical curvature and is expressed as the length of curve per the algebraic difference between tangent grades (K = L/A).

The Haul Road has a K value of 30 for a crest vertical curve and 40 for a sag vertical curve. The North Entrance Road has a K value of 60 for a crest vertical curve and 60 for a sag vertical curve.

2) Maximum Grade

The site-specific conditions will result in a maximum grade of 3 percent, except at local intersections where the rate can not be reasonably achieved; the maximum grade will be limited to 6 percent. The 3 percent maximum grade is beneficial for trucks on the Haul Road which have restricted acceleration with their heavy loads. The recommended minimum grade is 0.5 percent.

3) Stopping Sight Distance

Stopping sight distance is the sum of the distance traveled by the vehicle from the time the driver sees the object and applies the breaks, and the distance required to stop the vehicle. The stopping sight distance for the Haul Road is 150 ft (30 mph) and the North Entrance Road is 200 ft (40 mph).

4) Passing Sight Distance

The Haul Road and North Entrance Road both have areas with geometry constrained. For safety purposes, no passing will be allowed at any point on either roadway, the centerline will be marked with a double yellow line, and signs will be posted accordingly.

5) Vertical Clearance

The recommended clearance for grade separations is 16.5 ft to allow sufficient room for large trucks. The Haul Road will require at least 16.5 ft of vertical clearance below the pedestrian bridge.

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Cross Section Elements and Roadside Design

1) Typical Section

The basic typical section for both the Haul Road and North Entrance Road will be as shown below. The pavement design will be performed as part of the roadway design.

(1) Two 12-ft. lanes; ~~full-depth bituminous pavement for Haul Road~~ *bituminous pavement* with aggregate *sub*base *for both roads. However, use minimum aggregate subbase for the Haul Road to minimize cross contamination of aggregates*

(2) 5-ft *gravel* shoulders *with tighter fines to reduce rutting*

(3) Wearing surface of Haul Road per ODOT Specification 402

(4) Wearing surface of North Entrance Road per ODOT Specification 404

(5) Non-woven geotextile for both roads

(6) Cross slope: pavement - 3/16 in/foot; shoulders - 1/2 in/foot

2) Side Slope and Ditch Design

Side slope and ditch design will be performed in accordance with ODOT and AASHTO standards. The ditches will be designed for a maximum velocity of 2 feet/sec to allow sediment to settle and to minimize ditch erosion. Ditch checks may be placed where required. Ditch design will clear, if possible, the underground utilities crossing the proposed North Entrance Road, both Phases I and II.

3) Guardrail Requirements

It is not anticipated that a guardrail be required along either roadway. If a problem is encountered, the use of guardrail or a similar barrier will be examined.

Intersection Design

1) Design Turning Radius

The Haul Road will be designed to accommodate the turning radius for a WB-40 truck. The North Entrance Road will consider the light truck as a design vehicle.

2) Railroad Crossings

One active railroad crossing exists on the Haul Road western portion. The Haul Road will require signs and/or signals at the crossing. The type of crossing traffic control will depend on the design rail and roadway traffic. The eastern portion of the Haul Road will cross five railroad spurs which are inactive but will remain. Signals will not be required.

Storm Drainage Design

Storm drainage design will be completed in accordance with the ODOT Location and Design Manual. Storm drainage will be analyzed for a 10-year, 24-hour storm for the Haul Road and a 25-year, 24-hour storm for the North Entrance Road to identify drainage differences, maintenance problems, and any impacts caused by the roadway.

The North Entrance Road drainage system design will be coordinated with the design of the OSDF, provided by FERMCO, and will provide for stormwater run-on control. The North Entrance Road ditch may encroach on a Cincinnati Gas & Electric easement. FERMCO will be responsible for any permitting requirements.

The drainage will be by open ditch systems, and will make use of existing drainage structures such as culverts and catch basins when possible. The existing drainage pattern in the Haul Road vicinity will be maintained by providing culverts as needed. Stormwater control requirements are listed in the ARARs in Appendix A.

Maintenance of Traffic

Maintenance of traffic will be required at both ends of the North Entrance Road. Plans will be prepared for any required lane closures or reductions using ODOT and MUTCD standards.

Environmental Controls

1) Erosion and Sediment Controls

Temporary sedimentation basins will be used during construction to prevent soil/sediment from running off the site. Diversion dikes, hay bales, filter fabric fence, and other erosion control measures will also be used when appropriate during construction. Plan drawings will detail the location and types of erosion control measures to be used on site. Material requirements will conform to the ODOT Construction and Material Specifications.

The non-paved areas of the final constructed roadway will be seeded to control roadside erosion and runoff to other areas of the site.

2) Dust Control

Dust control will be required during construction. Dust control procedures will be provided by the contractor as specified in the ODOT Construction and Material Specifications and as directed by FERMCO. Air particulate emission requirements are listed in the ARARs in Appendix A.

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The contractor will apply water or a dust palliative by use of tanks with a suitable sprinkling device to control dust within the project area.

Traffic Control Devices

1) Pavement Marking

The Haul Road and North Entrance Road will require pavement markings for two-way traffic. Both will be striped with a dual 4-inch yellow centerline and 4-inch white edge lines.

2) Signs

All signs will be placed to conform with the standards of the MUTCD. Typical signs will include: speed limit, stop, no passing, curve warning, and intersection warning. Sign placement and material specifications will be in accordance with ODOT standards and specifications.

Signs will be placed at crossing of the North Entrance Road for haul traffic from the South Borrow Area.

Utilities

The locations of existing utilities is available on FEMP Grid Utilities drawings. A utility survey will be performed to more accurately identify any utilities located on the site. Major utilities include the Cincinnati Gas and Electric high tension towers and gas line which are near the North Entrance Road. Due to site conditions, utility relocation will be avoided if possible. The road profile will be lowered if necessary to meet required clearance under overhead transmission lines, except that wooden power poles may be relocated or adjusted, if justified by cost savings.

Access Control

1) Fences and Gates

The type, size, and location of fences and gates will be determined in conjunction with FERMCO.

Pavement Design

Pavement design will be based on the subgrade California Bearing Ratio (CBR) value of 4. The in situ subgrade CBR is generally between 4 and 5 as determined by correlation/extrapolation from Cone Penetration Testing (CPT) data using data provided by FERMCO. This correlation/extrapolation is included in Appendix C of the *Geotechnical Investigation Report, On-Site Disposal Facility*, Revision 0

for PO-140. Traffic volumes and distributions, service lives, and design vehicles will be used with the CBR to design bituminous pavement sections for the Haul Road and North Entrance Road.

The Haul Road will be full depth bituminous pavement. To reduce the risk of cross contamination, a non-woven geotextile will be used and an aggregate base will not be used on the Haul Road.

The North Entrance Road will be bituminous pavement with an aggregate subbase. The use of the aggregate base will improve structural stability and provide for subgrade drainage.

Pavement design for both roadways will be performed using ODOT design standards for flexible pavement design and using the 18-kip ESAL number for each respective roadway.

Culverts, utility tunnels, and other structures shall be designed for H20-44 loading.

Subgrade

To achieve the design CBR value of 4 and to guard against soft spots, the upper 6 inches of cut sections and the upper 18 inches of fill sections will be compacted from 95 to 98 percent of Standard Proctor with moisture content controlled within 2 percent of optimum. Soils with silt contents above 50 percent should be undercut to a minimum depth of 2 feet below subgrade for frost protection. A geofabric will be used to prevent fines from fouling the subbase. A geogrid may be used as added reinforcement if deemed necessary.

Calculations

Calculations will be provided for estimating all quantities used in the construction of the roadways. Specific calculations will be provided for drainage design, pavement design, and earthwork.

Nitrate Tank Removal Requirements

Removal of the nitrate tank will be part of CRU-3 Decontamination and Decommissioning work packages. This project will define only the final requirements of backfilling and compaction to accomplish the road design.

Excavation and Disposal of Contaminated Materials

FERMCO or the construction contractor, as appropriate, will remove the contaminated soil to the FRLs and stockpile the soil at a designated on-site area. Subsection 2.3.5 provides a detailed discussion on soil management. The design and construction of the stockpile area and the disposal of the stockpiled soil is not in the scope of this project.

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2.3.2 Civil Design Drawings and Specifications

The following design drawings and specifications will be included in the Certified for Construction Package:

Table 2-1 - Civil Haul Road Drawings

Drawing	Qty	Initial Submission
Title Sheet	1	30%
Legends & Symbols	1	30%
Index of Sheets	1	30%
Site Plan	1	30%
General Notes	1	30%
General Summary	2	30%
Typical Sections (1"=2'H, 1"=4'V)	1	30%
Plan & Profile (1"=50'H, 1"=5'V)	6	30%
Cross Sections (1"=10'H & V)	8	30%
Intersection Details (1"=20')	1	90%
Grading & Sediment Control (1"=100')	3	90%
Superelevation Tables	1	90%
General Details	1	90%
Pavement Marking & Signing	2	90%
TOTAL Drawings	30	

Table 2-2 - Civil North Entrance Road Drawings

Drawing	Qty	Initial Submission
Title Sheet	1	30%
Legends & Symbols	1	30%
Index of Sheets	1	30%
Site Plan	1	30%
General Notes	1	30%
General Summary	2	30%
Typical Sections (1"=2'H, 1"=4'V)	1	30%
Plan & Profile (1"=50'H, 1"=5'V)	5	30%
Cross Sections (1"=10'H & V)	3	30%
Intersection Details (1"=20')	2	90%
Grading & Sediment Control (1"=100')	2	90%
Superelevation Tables	1	90%
Maintenance of Traffic (1"=100')	2	90%
Signing & Pavement Marking	2	90%
General Details	1	90%
TOTAL Drawings	26	

Technical Specifications

The ODOT Standard Specifications will be used for the design and construction of the Haul Road and North Entrance Road. When additional technical specifications or details are required, they will be prepared for the document submittal.

2.3.3 Electrical

Power will be provided from existing site sources for the following uses:

1) Lighting the pedestrian bridge across the Haul Road

2) Road/railroad crossing signal
3) North Entrance Road caution signal light
4) Air monitoring devices

Telephone Lines

PARSONS will provide the new routing of the existing telephone lines along the North Entrance Road to the FEMP. FERMCO will be responsible for coordination with the telephone company to relocate the telephone lines.

Power Lines

1) Minimum vertical clearance under transmission lines is 18 feet, 6 inches

2) Minimum vertical clearance under power line suspension from wooden pole is 18 feet, 0 inches for 600 volts or less; 18 feet, 6 inches from 600 volts up to 22 kV

Calculations

Calculations will be provided for all designs.

2.3.4 Electrical Design Drawings and Specifications

The following design drawings and specifications will be included in the Certified for Construction Package:

Table 2-3 - Electrical Haul Road Drawings

Drawing	Qty	Initial Submission
Electrical Utility Plan	2	30%
Partial Power Plan	1	30%
Ductbank Routing	1	90%
Miscellaneous Electrical Details	1	90%
TOTAL Drawings	5	

Table 2-4 - Electrical North Entrance Road Drawings

Drawing	Qty	Initial Submission
Electrical Utility Plan	1	30%
Partial Power Plan	1	30%
TOTAL Drawings	2	

Specifications

1) Section 16050 - Basic Electrical Materials and Methods
2) Section 16118 - Underground Ductbanks and Ducts
3) Section 16121 - Medium Voltage Cable
4) Section 16170 - Grounding and Bonding
5) Section 16370 - Overhead Power Distribution
6) Section 16461 - Dry Type Transformers
7) Section 16530 - Site Lighting

2.3.5 Environmental, Safety, and Health

The subsections below describe worker health and safety, radiation exposure, ARARs, and contaminated soil management. All of the requirements provided are included in the Standard/Requirements Identification Documents as identified in the *FERMCO Policies and Requirements Manual* (FERMCO 1995).

Worker Health and Safety

Provided below are several health and safety related requirements for this project. This subsection complements the project-specific Health and Safety Plan (H&SP [to be prepared later by FERMCO]) and is not to be considered a replacement or summary of the H&SP.

Construction activities will take place in controlled areas. Therefore, workers shall be required to have Hazardous Waste Operations and Emergency Response training in accordance with 29 CFR 1910.120.

Site clearing activities shall be done in accordance with 29 CFR 1926.604. Equipment used in site clearing activities shall also comply with this requirement.

Material handling equipment shall meet the requirements of 29 CFR 1926.602, which addresses seat belts, brakes, rollover protection, audible alarms, and scissor points.

Workers may be required to enter excavated trenches to relocate utilities. This type of work will be minimized by avoiding current underground utilities during design. Excavations shall be maintained in accordance with 29 CFR 1926 Subpart P.

Worker Exposure

Internal radiation exposure is the primary concern for this project. Radiologically contaminated soil will become airborne during earth-moving activities in contaminated areas. 10 CFR 835.1002 requires that airborne radioactive material be controlled and the inhalation of such material by workers kept to levels that are As Low As Reasonably Achievable.

To control airborne emissions, conventional dust suppression methods, as discussed in Subsection 2.3.1 of this DCP, shall be used. Eating, drinking, and smoking shall not be allowed in radiologically controlled areas. The need for respirators will be specified in the project-specific H&SP and/or the Radiation Work Permit when it is prepared.

Applicable or Relevant and Appropriate Requirements

The ARARs for this project are provided in Appendix A of this DCP. The table provides a requirement summary and implementation strategy for each ARAR. The implementation strategy references other sections of this DCP where appropriate.

Soil Remediation Prior to Construction

The levels of soil remediation for the Haul Road and North Entrance Road areas will be different. This difference is due to the use of each road and is discussed in detail in the subsections below.

Haul Road Soil Remediation

Parts of the Haul Road will be located in a contaminated area and is considered "temporary" per the FEMP Build-Over Policy, since the road will be removed after construction of the OSDF. Because the road is considered temporary, soil does not have to be remediated to meet FRLs until the road is removed. Therefore, the cleanup guidelines established by FEMP Removal Action 17 will apply. These guidelines have been implemented at the FEMP by site procedure SSOP-0044, entitled "Management of Excess Soil, Debris, and Waste From a Project."

Soils above the radiological disposition limits defined in SSOP-0044 will be stockpiled in a soil storage area that is covered by a tarp and surrounded by a security fence with proper signage. This stockpile shall not contain soil suspected or known to contain hazardous waste, Polychlorinated Biphenyls, or other non-radiological contaminants. Should excess soil be generated that contains non-radiological contaminants, it will be stored in an approved facility in accordance with SSOP-0044.

North Entrance Road Soil Remediation

The North Entrance Road will be a permanent structure and must be clean closed. Therefore, the FRLs from the draft *Record of Decision for the Remedial Actions at OU5* (FERMCO 1995), provided in Table 2-5, will apply.

Soil above the FRLs will be removed and stored on site for future placement into the OSDF. Soil above the FRLs will be stockpiled as described above. Remediation will occur in the surficial (top 6 to 12 inches) soils within 50 feet of the center line of the North Entrance Road.

2.3.6 Structural

The Pedestrian Bridge over the Haul Road to the Advanced Wastewater Treatment facility will provide a 6-foot wide walkway accessed by stairs on each end to accommodate foot traffic only. The bridge and stairs will be constructed of painted structural steel. The bridge deck floor and the stair stringers will be spanned with steel grating. The sides of the bridge shall be lined. The minimum vertical clearance over the roadway will be 16 feet, 6 inches and the horizontal span will be 40 feet center to center of the supports. Design of the access road crossing the Haul Road to the Fernald Residues Vitrification Plant will be done by CRU-4

Dead Loads

Dead loads shall include all loads that remain permanently in place, including weights of all permanent materials, equipment, and self weights.

The unit weights of materials and assemblies for buildings and other structures may be based on sources of data from manufacturer's drawings and catalogs, Table C1 of ASCE 7-93.

Dead loads shall also include weights of all permanent equipment and fixed furnishings.

Table 2-5 - Final Remediation Levels for Soil
(Source: Record of Decision for Remedial Actions at OU5 [DOE 1995])

Constituent	On-Property Final Remediation Levels
Radionuclides (pCi/g)	
Cesium-137 + 1d	1.4×10^{0}
Neptunium-237 + 1d	3.2×10^{0}
Lead-210 + 2d	3.8×10^{1}
Plutonium-238	7.8×10^{1}
Plutonium-239/240	7.7×10^{1}
Radium-226 + 8d	1.7×10^{0}
Radium 228 + 1d	1.8×10^{0}
Strontium-90 + 1d	1.4×10^{1}
Technetium-99	3.0×10^{1}
Thorium-228 + 7d	1.7×10^{0}
Thorium-230	2.8×10^{2}
Thorium-232 + 10d	1.5×10^{0}
Uranium, total (K_i = 325 L/kg[a]) (ppm)	8.2×10^{1}
Uranium, total (K_i = 15 L/kg[a]) (ppm)	2.0×10^{1}
Chemicals (mg/kg)	
Acetone	4.3×10^{4}
Antimony	9.6×10^{1}
Aroclor-1254	1.3×10^{-1}
Aroclor-1260	1.3×10^{-1}
Arsenic	1.2×10^{1}
Barium	6.8×10^{4}
Benzene	8.5×10^{2}
Benzo(a)anthracene	2.0×10^{1}
Benzo(a)pyrene	2.0×10^{0}
Benzo(b)fluoranthene	2.0×10^{1}
Benzo(k)fluoranthene	2.0×10^{2}
Beryllium	1.5×10^{0}
Bis(2-chloroisopropyl)ether	4.2×10^{2}
Bis(2-ethylhexyl)phthalate	8.2×10^{2}
Boron	7.4×10^{3}
Bromodichloromethane	4.0×10^{0}
Bromoform	3.1×10^{1}

Table 2-5 - Final Remediation Levels for Soil (Continued)

Constituent	On-Property Final Remediation Levels
Chemicals (Cont.) (mg/kg)	
Bromomethane	8.2×10^{3}
Cadmium	8.2×10^{1}
Carbazole	1.2×10^{1}
Carbon disulfide	5.0×10^{3}
Carbon tetrachloride	2.1×10^{0}
Chlordane	1.9×10^{-1}
Chlorobenzene	3.4×10^{2}
Chloroform	4.5×10^{1}
Chromium VI	3.0×10^{2}
Chrysene	2.0×10^{3}
Cobalt	7.4×10^{2}
Copper	2.2×10^{5}
Cyanide	1.2×10^{5}
Dibenzo(a,h)anthracene	2.0×10^{0}
3,3'-Dichlorobenzidine	5.5×10^{-1}
1,2-Dichloroethane	1.6×10^{-1}
1,1-Dichloroethene	4.1×10^{-1}
Dieldrin	1.5×10^{-2}
Di-n-octylphthalate	1.1×10^{3}
Ethylbenzene	5.1×10^{3}
Fluoride	7.8×10^{4}
Heptachlorodibenzofuran	8.8×10^{-4}
Heptachlorodibenzo-p-dioxin	8.8×10^{-4}
Indeno(1,2,3-cd)pyrene	2.0×10^{1}
Lead	4.0×10^{2}
Manganese	4.6×10^{3}
Mercury	7.5×10^{0}
Methyl-2-pentanone	2.5×10^{3}
Methylene chloride	3.7×10^{1}
4-Methylphenol	2.5×10^{2}
Molybdenum	2.9×10^{3}
Nickel	1.5×10^{4}
4-Nitroanaline	1.5×10^{2}
N-nitrosodiphenylamine	5.1×10^{1}

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Table 2-5 - Final Remediation Levels for Soil (Continued)

Constituent	On-Property Final Remediation Levels
Chemicals (Cont.) (mg/kg)	
N-nitrosodipropylamine	2.0×10^{-1}
Octachlorodibenzofuran	8.8×10^{-3}
Octachlorodibenzo-p-dioxin	8.8×10^{-3}
Pentachlorophenol	2.3×10^{0}
Selenium	5.4×10^{3}
Silver	2.9×10^{4}
Tetrachloroethene	3.6×10^{0}
Thallium	9.1×10^{1}
Tolulene	1.0×10^{5}
Tributyl phosphate	2.5×10^{2}
1,1,2-Trichloroethane	4.3×10^{0}
Trichloroethene	2.5×10^{1}
Vanadium	5.1×10^{3}
Vinyl chloride	1.3×10^{-1}
Xylenes, total	9.2×10^{5}
Zinc	1.2×10^{5}

Live Loads

Live loads shall include all loads resulting from occupancy and use of the structures. Live loads may act in any direction.

Live loads shall be as shown in Table 2-7, but not less than the minimum uniform or concentrated loads stipulated in ASCE 7-93.

Roof live loads shall include snow loads, snow drifts, or rain loads as applicable per ASCE 7-93.

Table 2-7 - Minimum Design Live Loads

Structure	Load
Pedestrian Bridges	60 psf
Stair	100 psf

Wind Loads

Wind load design criteria presented in this section shall be based on the requirements of DOE Order 6430.1A, DOE-STD-1020, ASCE 7-93, and the OBBC. Exposure "C" shall be used for all wind load calculations, per Section 0111-2.4.2 of DOE Order 6430.1A.

The effective velocity pressure q_z at any height Z above the ground shall be calculated using the following equation:

$$q_z = 0.00256\ K_z(IV)^2 \text{ (Section 6.5.1 of ASCE 7-93)}$$

where:

I = Importance Factor = 1.00 (Table 3-1 of DOE-STD-1020)
K_z = Velocity pressure coefficient at height Z (Table 6 of ASCE 7-93)
V = Basic wind speed = 80 mph (Section 1611-3 of OBBC)

Design wind loads shall be based on factors and coefficients stipulated in ASCE 7-93, Table 4.

Tornado Loads

Tornado loadings, tornado missiles, and Atmospheric Pressure Change loads are not applicable for PC-1 facilities per DOE-STD-1020 (Table 3-1). Tornado loadings, therefore, are not considered.

Seismic Design and Evaluation

The seismic criteria for the design and evaluation of SSCs shall be based on procedures detailed in Section 2.3.1 of DOE-STD-1020, PC-1, and UBC Section 1628.

The earthquake response shall be evaluated in accordance with procedures given in UBC Section 1627.8 using the static force method.

The design base shear using the static force procedure shall be calculated using the following formula:

$$V = \frac{ZIC}{R_w} W$$

where:

Z = A seismic zone factor equivalent to peak ground acceleration = 0.1 (based on site-specific seismic hazard curve for the FEMP from UCRL 53582)

I = Importance Factor = 1.0

C = Spectral Amplification Factor = 2.75 (Based on site-specific response spectra for the FEMP from UCRL 53582)

R_w = Reduction factor from UBC Table 16-N or Table 16-P, as applicable

W = Total dead load and applicable portions of their loads as listed in UBC Section 1628.1

The capacities shall be evaluated using the strength design or allowable stress design method. The story drift limitations shall be per UBC Section 1628.8.

The SSCs shall meet the UBC Seismic Zone No. 2 detailing provisions in accordance with UBC Section 1631.

Non-building structures shall meet the requirements of UBC Section 1632.

Lateral force on elements of structures and nonstructural components supported by structures shall be in accordance with UBC Section 1630.

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Other Loads

1) Other loads: Load criteria not specified above shall conform to DOE Order 6430.1A, paragraph 0111-2.8, "Other Loads for Buildings and Other Structures."

Other Structural Material/Design Requirements

The following presents design requirements for structural materials and design:

1) Concrete: Concrete material, design, and construction for buildings and other structures shall be per ACI 318-89. Minimum concrete strength at 28 days shall be 3,000 psi.

2) Reinforcement: Deformed billet steel shall conform to ASTM A615, Grade 60.

3) Grout: High strength, nonshrink grout shall be 1 inch minimum thickness under equipment, columns, and pipe support baseplates unless otherwise recommended by equipment supplier.

4) Structural Steel: Design, details, fabrication, and erection of structural steel shall conform to the UBC and the AISC Manual, 9th edition. The material for structural steel shapes and plates shall conform to ASTM A36. All structural steel and connections, including ladders, handrailing, and grating, shall be painted or galvanized. Connection bolts shall be high strength ASTM A325 with hardened washer and nut.

5) Field connections: Connections may be bolted or welded connections per AISC.

6) Minimum Headroom Clearance: Clearance shall be 7 feet, 6 inches above nosing line of stairs, and shall conform to Occupational Safety and Health Administration requirements.

7) Foundations: Per DOE Order 6430.1A, Section 0111-3.4, the provisions of UBC Chapter 18 shall be the minimum requirements for foundation design. Use spread, mat-type, or continuous strip footings placed in the upper natural soils, or properly compacted fill, for a presumed allowable bearing pressure of 2,000 psf at a depth of 3 feet below the adjacent final grade. Allowable soil bearing pressures and any other special foundation requirements shall be verified from existing soil data in the general area. Allowable stresses may be increased by a value of 1/3 when wind or earthquake forces are included. The minimum embedment depth of foundations in soil shall be 3 feet, 0 inches to prevent problems with frost penetration.

Factor of Safety Against Overturning

Per UBC Section 1619.1, the base overturning moment for the entire structure, or for any of its individual primary lateral-resisting elements, shall not exceed 2/3 of the dead-load-resisting moment. For an entire structure with a height-to-width ratio of 0.5 or less in the wind direction and a maximum height of 60 feet, the combination of the effects of uplift and overturning will be reduced by 1/3 (i.e., factor of safety equal to 1.0). The weight of earth superimposed over footings will be used to calculate the dead-load-resisting moment.

Per Section 1611-1-3 of the OBBC, the overturning moment due to wind load shall not exceed 2/3 of the dead load stabilizing moment unless the building or structure is anchored to resist the excess moment (i.e., factor of safety equal to 1.5).

Loading Combinations

Combinations of loads, allowable stresses, and strength requirements for buildings and other structures shall be in accordance with UBC 94, Chapter 16, Section 1603.6.

Calculations

Calculations will be provided for the design of the bridge and foundation.

2.3.7 Structural Design Drawings and Specifications

The following design drawings and specifications will be included in the Certified for Construction Package:

Table 2-6 - Structural Haul Road Design Drawings

Drawing	Qty	Initial Submission
Pedestrian Bridge Plan and Elevations	1	90%
Stair Sections and Details	1	90%
Foundation Plan and Detail	1	90%
TOTAL Drawings	3	

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Specifications

1) Section 03001 - Concrete
2) Section 05120 - Structural Steel

The SSCs for the pedestrian bridge are assumed to be NPH Performance Category 1 (PC-1) per DOE Order 5480.28 and DOE-STD-1021. It is further assumed that there are no safety class SSCs.

2.3.8 Cost Estimates

All project estimates will be prepared in accordance with the FERMCO format. The FERMCO format accounts for the latest subcontractor wage rates, the DOE's Cost Estimating Guide, and their latest subcontractor wage rates.

APPENDIX A

ARARS

Table A-1 - Applicable or Relevant and Appropriate Requirements

Category	Requirement Summary	Implementation Strategy
Solid Waste Action-Specific Requirements		
Stormwater Control	The landfill shall have: • a run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm; • a run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm. 40 CFR 258.26 (Relevant and Appropriate)	This project will not adversely affect stormwater drainage at or near the sanitary landfill or the OSDF. Stormwater control will be accomplished by having stormwater drain from the haul road into ditches that will transport stormwater into the FEMP wastewater treatment system. Section 2.3.1 of this DCP discusses stormwater control.

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Table A-1 - Applicable or Relevant and Appropriate Requirements (Continued)

Category	Requirement Summary	Implementation Strategy
	Radiological Action-Specific Requirements	
Radiation Exposure	The order adopts the ALARA process in planning and carrying out all DOE activities. ALARA requires judgment with respect to what is reasonably achievable. Factors that relate to social, technological, economic, and other public policy considerations shall be evaluated to the extent practicable. Factors to be considered, at a minimum, shall include: • maximum dose to members of the public; • collective dose to the population; • alternative processes, such as alternative treatment of discharge streams, operating methods, or controls; • doses for each process alternative; • cost for each of the technological alternatives; • examination of the changes in cost among alternatives; and • changes in societal impact associated with process alternatives (e.g., differential doses from various pathways). Except for meeting requirements of NEPA, qualitative analyses are acceptable, in most instances, for ALARA judgments, especially when the potential doses are well below the dose limit. The bases for these judgments should be documented. More detailed analyses should be considered if the decision might result in doses that approach the limit. 10 CFR 835 (Applicable) DOE Order 5400.5, Chapter I (4) and Chapter II (2) (To-Be-Considered)	Exposure to both workers and the public will be due to airborne contaminants generated during earth-moving activities. Exposure will be kept ALARA by using conventional dust suppression methods (i.e., water sprays). Section 2.3.1 of this DCP discusses dust suppression methods.

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Category	Requirement Summary	Implementation Strategy
	Other Action-Specific Requirements	
Air Emissions	Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state. The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors, and combinations of the above in such a manner or in such amounts as to endanger the health, safety, or welfare of the public or to cause unreasonable injury or damage to property shall be declared to be a public nuisance. It is unlawful for any person to cause, permit, or maintain any such public nuisance. OAC 3745-15-07 and ORC 3704.01-05 (Applicable)	Conventional dust suppression methods (i.e., water sprays) will be used to achieve compliance with this requirement. Dust suppression is discussed in Section 2.3.1 of this DCP.
Air Emissions	The level of the primary and secondary 24-hour ambient air quality standards for total suspended particulates is 150 $\mu g/m^3$, 24-hour average concentration. The level of the primary and secondary annual standards for total suspended particulates is 50 $\mu g/m^3$, annual arithmetic mean. The significant and avoidable deterioration of air quality in any part of the area where presently existing air quality is equal to or better than the particulate ambient air quality standards shall be prohibited. OAC 3745-17-02 and OAC 3745-17-05 (Applicable)	Air monitors will be provided at the work area to measure particulate emissions generated during earth-moving activities. Conventional dust suppression methods, as described in Section 2.3.1 of this DCP, will be used to ensure these standards are not exceeded.
Air Emissions	There shall be no visible particulate emissions from any paved roadway or parking area except for a period of time not to exceed 6 minutes during any 60-minute observation period. There shall be no visible particulate emissions from any unpaved roadway, parking area, or material storage piles except for a period of time not to exceed 13 minutes during any 60-minute observation period. OAC 3745-17-07(B)(4),(5),(6) (Applicable)	This requirement applies to the operation of roads and not the design. The new haul road will be a paved roadway. As with other roads at the FEMP, it will be operated in a manner to meet this requirement.

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Table A-1 - Applicable or Relevant and Appropriate Requirements (Continued)

Category	Requirement Summary	Implementation Strategy
	Other Action-Specific Requirements (Continued)	
Air Emissions	No person shall cause or permit any fugitive dust source to be operated; or any materials to be handled, transported, or stored; or a building or its appurtenances or a road to be used constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Such reasonably available control measures shall include, but not be limited to, one or more of the following which are appropriate to minimize or eliminate visible particulate emissions of fugitive dust: • the use of water or other suitable dust suppression chemicals for the control of fugitive dust from the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land; or • the periodic application of asphalt, oil, water, or other suitable dust suppression chemicals on dirt or gravel roads and parking lots, and any other surfaces which cause emissions of fugitive dust. OAC 3745-17-08 (Relevant and Appropriate)	Dust suppression methods are discussed in Section 2.3.1 of this DCP. The chosen method will meet this requirement.

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Category	Requirement Summary	Implementation Strategy
	Location-Specific Requirements	
Endangered Species and Critical Habitat	All Federal agencies must ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. 40 CFR 6.302(h), 50 CFR 17.21 and 17.94, and 50 CFR 402.1 (Applicable)	The FEMP has determined that there are no specific impacts on listed species or their habitats as a result of this project.
Historic Preservation	No person may appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object or antiquity situated or controlled by the Government of the United States. 16 U.S.C. 431 (Applicable)	A Phase II Archaeological Investigation will begin in mid-November at potential sites in the proximity of the haul road; however, preliminary investigations indicate the haul road project will not impact these sites.
Historic Preservation	Whenever any Federal agency funds, or is notified, in writing, by an appropriate historical or archaeological authority, that its activities in connection with any Federal construction project or federally licensed project, activity, or program may cause irreparable loss or destruction of significant scientific prehistorical, historical, or archaeological data, such agency shall notify the Secretary of the Interior, in writing, and shall provide the Secretary with appropriate information concerning the project, program, or activity. No person may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands unless such activity is pursuant to a permit. If an EPA activity may cause irreparable loss or destruction of significant scientific, prehistoric, historic, or archaeological data, the responsible official or the Secretary of the Interior is authorized to undertake data recovery and preservation activities. 16 U.S.C. 47099, 40 CFR 6.301(c), and 43 CFR 7.4(a) (Applicable)	A Phase II Archaeological Investigation will begin in mid-November at potential sites in the proximity of the haul road; however, preliminary investigations indicate the haul road project will not impact these sites.

Table A-1 - Applicable or Relevant and Appropriate Requirements (Continued)

Category	Requirement Summary	Implementation Strategy
	Location-Specific Requirements (Continued)	
Historic Preservation	A Federal agency must take into account how each of its undertakings could affect historic properties. The purpose of this Act is not only to protect those properties listed in or eligible for the National Register of Historic Places, but also those properties that have not been listed or formally determined to be eligible for the listings. The heads of all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency. Prior to any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible agency shall, to the extent possible, minimize the harm to such landmark. 16 U.S.C. 470, 36 CFR 800, and 40 CFR 6.301(a),(b) (Applicable)	A Phase II Archaeological Investigation will begin in mid-November at potential sites in the proximity of the haul road; however, preliminary investigations indicate the haul road project will not impact these sites.
Historic Preservation	Provides for the return of human remains and cultural objects from Native American graves to affiliated tribes. 25 U.S.C. 3001 (Applicable)	A Phase II Archaeological Investigation will begin in mid-November at potential sites in the proximity of the haul road; however, preliminary investigations indicate the haul road project will not impact these sites.
Historic Preservation	Provides for tribal access by native peoples to grave sites and sites of cultural, symbolic, or religions significance. 42 U.S.C. 1996 (Applicable)	A Phase II Archaeological Investigation will begin in mid-November at potential sites in the proximity of the haul road; however, preliminary investigations indicate the haul road project will not impact these sites.
Wetland Protection	Federal agencies conducting certain activities must avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands when a practicable alternative exists. 40 CFR 6.302(a) [Executive Order 11990] (Applicable)	Impacts on wetlands as a result of remedial activities have been discussed in the OU2 and OU5 RODs. Affected wetlands will be replaced as discussed in the OU5 ROD.
Floodplain Management	Federal agencies must evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. 40 CFR 6.302(b) [Executive Order 11988] (Applicable)	This project is not located within the 100-year floodplain.

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Table A-1 - Applicable or Relevant and Appropriate Requirements (Continued)

Category	Requirement Summary	Implementation Strategy
	Location-Specific Requirements (Continued)	
Wetland Protection and Floodplain Management	DOE shall exercise leadership and take action to: • avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative. • incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decision-making processes and shall, to the extent practicable: - reduce the hazard and risk of flood loss. - minimize the impact of floods on human safety, health, and welfare. - restore and preserve natural and beneficial values served by the floodplains. - minimize the destruction, loss, or degradation of wetlands. - preserve and enhance the natural and beneficial values of wetlands. • undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain. • identify, evaluate, and, as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts. • provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands. 10 CFR 1022.3(a);(b)(1),(2),(3),(5),(6);(c),(d),(e) (Applicable)	Impacts on wetlands as a result of remedial activities have been discussed in the OU2 and OU5 RODs. Affected wetlands will be replaced as discussed in the OU5 ROD.

Table A-1 - Applicable or Relevant and Appropriate Requirements (Continued)

Category	Requirement Summary	Implementation Strategy
Location-Specific Requirements (Continued)		
Wetland Protection and Floodplain Management	If DOE finds that no practicable alternative to locating in the floodplain/wetlands is available, consistent with the policy set forth in Executive Order 11988, DOE shall, prior to taking action, design or modify its action to minimize potential harm to or within the floodplain/wetlands. 10 CFR 1022.15(a) (Applicable)	Impacts on wetlands as a result of remedial activities have been discussed in the OU2 and OU5 RODs. Affected wetlands will be replaced as discussed in the OU5 ROD. This project is not located within the 100-year floodplain.

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Haul Road and Rerouted North Entrance Road Design and Construction Calculations

Operable Unit 2
Project Order 158

January 1996
DRAFT
30% Submittal

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio
FERMCO Subcontract No. 2-21487

PARSONS

25 Merchant Street
Cincinnati, Ohio 45246

Haul Road and Rerouted North Entrance Road Design and Construction Calculations

Operable Unit 2
Project Order 158

January 1996
DRAFT
30% Submittal

Environmental Remedial Action Project
Fernald Environmental Management Project
Fernald, Ohio
FERMCO Subcontract No. 2-21487

25 Merchant Street
Cincinnati, Ohio 45246

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Attached calculations are unchecked and are
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DE LEUW, CATHER
Engineers and Planners

SUBJECT FEMP HAUL RD PAVEMENT DESIGN JOB NO. 660620 03200
SHEET NO. 1 OF 2
MADE BY JMC DATE 11/16/95 CHECKED BY DD DATE 11/16/95

REV 1/11/96

HAUL ROAD - PAVEMENT DESIGN

DESIGN PARAMETERS: STANDARDS - ODOT LOCATION & DESIGN MANUAL

PAVEMENT SECTION: BITUMINOUS ON COMPACTED SUBGRADE

ADT: 400 VPD (50/50 DISTRIBUTION), 100% CLASS B VEH. -DD-

CBR = 4 (PO-140)

- SUBGRADE RESILIENT MODULUS - M_R

  $M_R = 1200 \times CBR = (1200)(4) = 4800$ psi (ODOT L&D MANUAL)

- CALCULATING 18 KIP EQUIVALENT SINGLE AXLE LOADING (W_{18})

  $W_{18} = ADT \times DD \times B \times (365\ day/yr) \times (10yr)$

  $W_{18} = (400\ VPD)(0.5)(1.44)(365\ \frac{day}{yr})(10\ yr) = 1,051,200$

- RELIABILITY (R) = 85 % (FIG. 701-11)

- OVERALL STANDARD DEVIATION (S_o) = 0.49 (FIG 701-11)

- DESIGN SERVICEABILITY LOSS (PSI)

  INITIAL PSI (FIG 701-11) - TERMINAL SERVICE ABILITY INDEX (P_t) (SECT 701.1)

  $PSI = 4.5 - 2.5 = 2.0$

→ USE FIGURE 701-12 & 701-13 TO SOLVE FOR THE DESIGN STRUCTURAL NUMBER (SN)

DE LEUW, CATHER
Engineers and Planners

SUBJECT TEMP HAUL RD JOB NO. 66620 02200
PAVEMENT DESIGN SHEET NO. 2 OF 2
MADE BY AMC DATE 11/16/95 CHECKED BY [illegible] DATE 11/16/95

REV 1/11/96

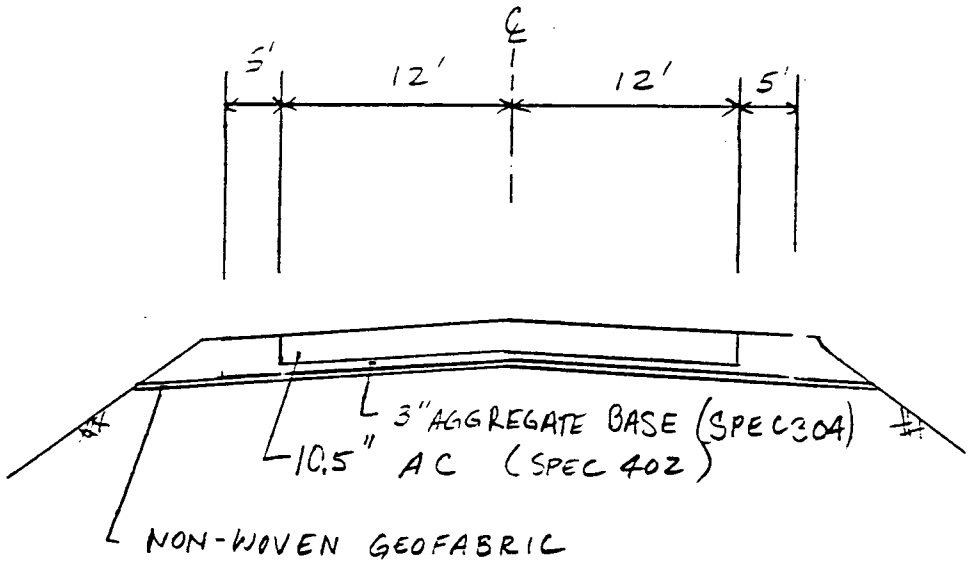
→ HAUL RD. DESIGN STRUCTURE NUMBER (SN) = 4.0

→ DETERMINE PAVEMENT THICKNESS

MATERIAL: ASPHALT CONCRETE (ODOT SPEC. 402)
COEF. 0.35 , THICKNESS - "X"
AGGREGATE BASE (ODOT SPEC 304)
COEF. 0.14 THICKNESS - 3"

$(0.14)(3_{IN}) + (X)(0.35) \geq 4.0$

$X = 10.23"$ USE → 10.5"

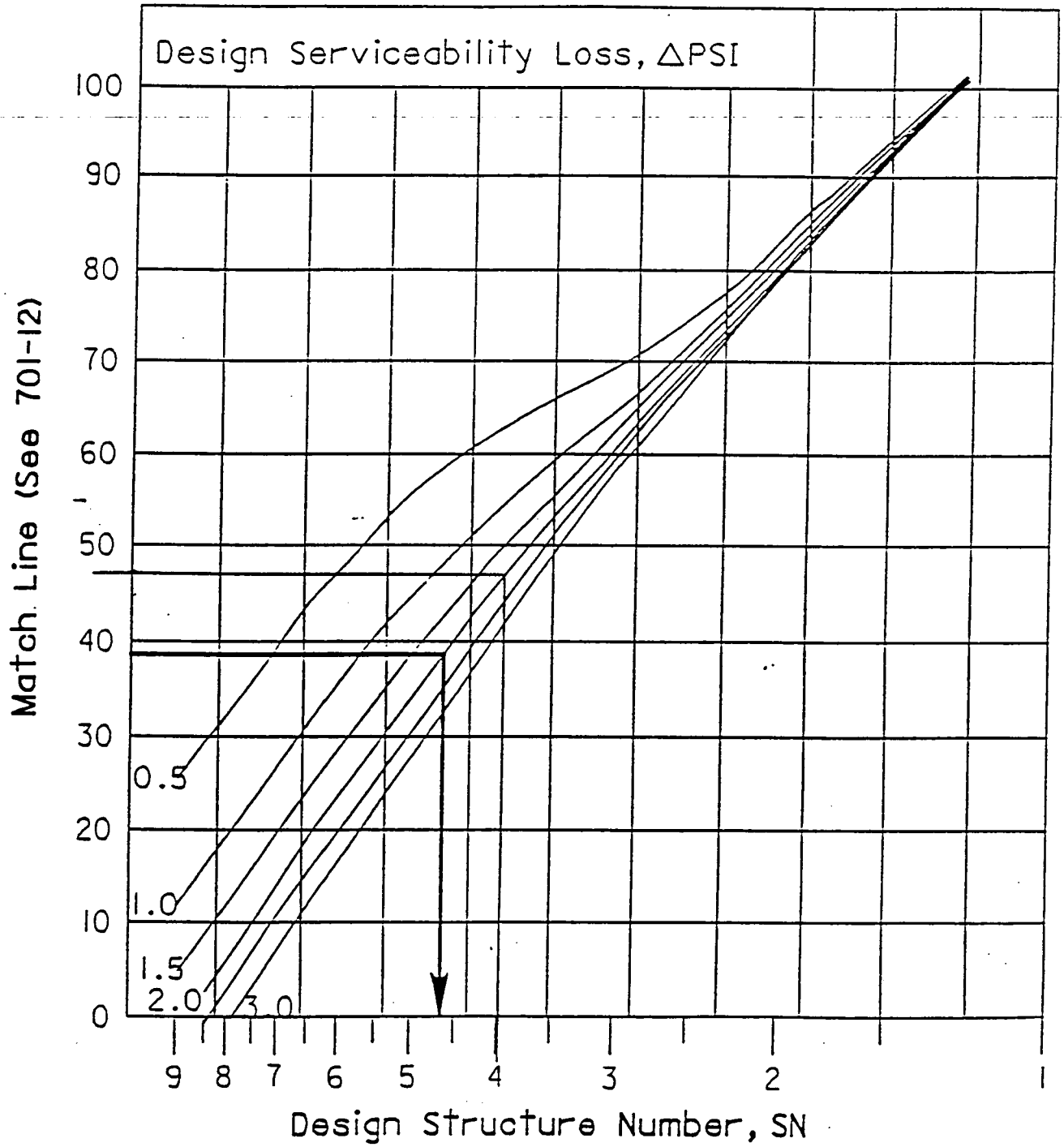


FLEXIBLE PAVEMENT DESIGN CHART SEGMENT 2

701-13

REFERENCE SECTION
FLEXIBLE PAVEMENT DESIGN EXAMPLE - STEP 1

HAUL ROAD



Example: ΔPSI= 2.0

Solution: SN= 4.65

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701 Structural Design of Pavement

701.1 Introduction

The pavement design procedures described herein are intended primarily for use on new or reconstruction projects and are based on the results of the AASHO Road Test and the AASHTO Guide for Design of Pavement Structures. In addition, the application of other studies, experiences, and engineering judgments have been included to fit Ohio's conditions. A copy of ODOT's Pavement Design Policy has been included as Appendix A of this manual.

The pavement design procedure relates the performance of a pavement to its structural design and the loading applied to the pavement. The performance of a pavement is measured by its serviceability which is defined as the ability to serve high speed, high volume automobile and truck traffic. An AASHTO procedure was developed to rate the serviceability of a pavement, based on its roughness, and the number of cracks and patches. A scale with a range from 0 to 5 was established for present serviceability index ratings, with 5 as the highest index (excellent) and 0 as the lowest (poor).

The AASHTO design procedures allow for the selection of any serviceability index at the end of a design period. Ohio has adopted a design period of 20 years and a terminal serviceability index (p_t) of 2.5.

The design procedure for both rigid and flexible pavement structures centers around the investigation and evaluation of the resilient modulus of the subgrade soil and the traffic, expressed in terms of equivalent 18 Kip single axle load applications. A brief description of the resilient modulus (M_R) and equivalent 18 Kip single axle load applications (W_{18}) follows:

701.2 Subgrade Resilient Modulus (M_R)

For design of either flexible or rigid pavements, the subgrade soil type is determined directly from soil tests made in conjunction with the soil profile or bridge foundation investigations. In Ohio, soils are classified based on gradation and Atterburg Limits (liquid limit and plasticity index) in a modified AASHTO system as shown in Fig. 701-1.

Extreme caution should be exercised in choosing the representative subgrade soil for pavement design. Normally, the weakest predominant soil type present is chosen. The following procedure is then used to determine the Resilience Modulus (M_R) of the soil:

1. Determine the Group Index from Figure 701-2.

2. Determine the California Bearing Ratio from Figure 701-3.

3. Utilize the equation on Figure 701-3 to calculate M_R.

For an example, see steps 1 and 2 of the Rigid Pavement Design accompanying the figures at the end of this section.

701.3 18 KIP Equivalent Single Axle Loading (W_{18})

Traffic information, in order to be used in pavement design, must be converted into the number of equivalent 18 Kip single axle load applications (W_{18}) over the pavement design period.

Available traffic information usually lumps together the number of B and C vehicles. Since the number of B and the number of C vehicles are required to obtain W_{18}, Figure 701-4 gives approximate ratios of B to C vehicles so the number of each can be estimated. An easy method of checking the B:C ratio is to observe the traffic at the project site. This may also reveal some severe pavement loadings, such as coal or gravel trucks which may be equivalent to 9 B or C trucks. A little thought given to the truck traffic in an area can go a long way toward determining the proper pavement thickness. Figure 701-4 B:C ratios should be used with caution.

Once the number of B and C vehicles per day is known, they are multiplied by the appropriate conversion factor (Figure 701-4) times 365 days per year, times 20 years to obtain W_{18}. W_{18} is then used in the nomographs in either Figure 701-9 or Figure 701-12.

For an example of a W_{18} calculation, see Step 3 of the Rigid Pavement Design accompanying the figures at the end of this section.

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701.4 Pavement Design Examples

Examples of both Rigid Pavement Design and Flexible Pavement Design are included with the Figures at the end of this section.

701.5 General

Recommendations in this manual are for paving materials that conform to ODOT specifications only.

Preparation of the subgrade is of prime importance. If conditions (utilities, etc.) hinder proper subgrade treatment, then a thicker pavement design should be considered. If subgrade conditions are extremely poor and require excessive pavement thickness, the thickness could be reduced by strengthening the subgrade using stabilization.

Reinforcing steel used in concrete does not strengthen it, but is only used to hold intermediate cracks tightly together.

For uncurbed pavements carrying 50 or more equivalent 18 Kip axle loads per day and for curbed pavements carrying 100 or more 18 Kip axle loads per day, a granular or stabilized subbase is considered desirable to prevent pumping for concrete pavements on fine textured soils.

701.6 Edge Course Design

701.61 Rigid Pavement

The subbase for a rigid pavement shall extend 18 inches beyond the pavement edge, or to the outside edge of the porous backfill over the pipe underdrain, or to 6" beyond the outside edge of the paved shoulder where called for in the shoulder design, whichever is greater.

Where curb and gutter or integral type 2 curb is used, subbase shall extend 12 inches back of the curb or to the outside of the porous backfill over the pipe underdrain, whichever is greater.

701.62 Composite Pavement

Concrete base shall extend beyond the wearing surface 3 inches. Subbase under the concrete base shall be treated the same as under rigid pavement.

701.63 Flexible Pavement

Subbase shall extend beyond the edge of the overlying base, a distance of 6 inches for subbase courses 9 inches or less and 12 inches for subbase thicker than 9 inches, to the outside edge of the porous backfill over the pipe underdrains, or to the outside edge of paved shoulders where called for in the shoulder design, whichever is greater.

Base courses should extend a distance equal to their own thickness beyond the overlying course. This provision will not apply when the edge of the pavement adjoins a curb or rigid type pavement. Where pipe underdrains are provided and no subbase is used, the base course should extend to the outside edge of the porous backfill over the underdrain.

Intermediate courses less than 2 inches thick, placed directly under the surface, should be shown as ending in the same vertical plane as the surface.

701.64 Paved Shoulders

All courses shall end in the same vertical plane at the outside edge of flexible paved shoulders.

702 Shoulder Design

702.1 General

Shoulders are used to provide an area for the accommodation of disabled vehicles, for the lateral support of the base and surface courses, and to improve the safety of a highway, and for future maintenance of traffic operations during maintenance and rehabilitation work..

702.2 Types

As noted in Section 301.22, there are four basic types of shoulders: paved, bituminous surface treated, stabilized aggregate, or turf. Figures 301-3 and 301-4 show when to use each type. It should be noted that turf shoulders may only be used on non-state maintained roads, at the option of the local government, if the current year ADT includes less than 250 B and C truck units. Design and use of the other types of shoulders are discussed in subsequent sections.

Figure 702-1 shows several paved shoulder designs. Bituminous surface treated and stabilized

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Example - Rigid Pavement Design

Given:

- Pavement: Dowelled, jointed concrete
- Subbase: 6" 310
- Shoulders: Tied, jointed, undowelled concrete
- Number of Lanes: 4
- Functional Classification: Principal Rural Arterial
- 1992 Traffic: 12,250 ADT
- 2012 Traffic: 25,040 ADT, 10% trucks (24 hour)
- Year pavement anticipated to be open to traffic 1996
- Soil Classification: Liquid Limit = 45, Plasticity Index = 12, 70% passing No. 200 sieve.

Problem:

Solve for thickness of concrete slab.

Solution:

Step 1 - Determine Group Index Number (G.I.) using Figure 701.2.

In chart A, solve for the Partial Group Index using the 70% Passing No. 200 Sieve and the Liquid Limit (LL) of 45. G.I. from Chart A = 7.9. In Chart B, solve for the Partial Group Index number using the 70% (55 or more) Passing No. 200 Sieve and the Plasticity Index of 12. G.I. from chart B - 0.8. The total G.I. is 7.9 plus 0.8 or 8.7 (Rounded off to 9).

Step 2 - Determine the Subgrade Resilient Modulus (M_R) using Figure 701-3.

Using the Group Index Number (G.I.) of 9 from Figure 701-2 (Step 1), the California Bearing Ratio (CBR) is 6 (Rounded). The CBR is used in the following formula to determine the Resilient Modulus.

$M_R = 1200 \times CBR = 1200 \times 6 = 7200$ psi.

Step 3 - Determine the 18 Kip Equivalent Single Axle Loading (W_{18})

If the truck volume is expressed as a percentage of peak hour traffic, as it is in the design designation, it should be multiplied by 1.6 to obtain the percentage for average daily truck traffic. Since the project probably would not be opened until 1996, the traffic period would be 1996 to 2016, with a mid-year of 2006 and an interpolated ADT of 21,203.

T_{24} = 10% (given)

D = 50% is Directional Distribution assuming ADT is evenly split over 24 hr. period.

Using Fig. 701-4

B:C ratio = 5:1

B factor = 2.16

C factor = 1.02

Lane Factor = .90

E-18's from B's

21203(.10)(5/6)(.5)(.9)(2.16) = 1717.4

E-18's from C's

21203(.10)(1/6)(.5)(.9)(1.02) = 162.2

E-18 = 1717.4 + 162.2 = 1879.6

W_{18} = 1879.6 x 365.25 days/yr x 20 yr

$w_{18} = 13{,}730{,}478$ say 13.7×10^6

Step 4 - Determine the Composite Modulus of Subgrade Reaction (K_c) using Figure 701-6.

Starting with the assumed subbase thickness (D_{sb}) of 15,000 psi (6" 310 Subbase from Figure 701-5), and down to a Subgrade Resilient Modulus (M_R) of 7200 psi (From Figure 701-3, Step 2), results in a K_c of 340 psi.

Step 5 - Determine the Effective Modulus of Subgrade Reaction (K) using Figure 701-7.

The Composite Modulus of Subgrade Reaction (K_c) is 340 pci from Figure 701-6, Step 4. The Loss of Support (LS) for the 310 Subbase is 1.0 from Figure 701-5. This results in a K of 110 pci.

Step 6 - Determine the thickness of the concrete slab using Figures 701-8 and 701-9.

Figure 701-8 is used to solve for the Match Line Number using the following information.

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Effective Modulus of Subgrade (K) = 110 pci (Figure 701-7, Step 5)

Concrete Elastic Modulus (Ec) = $3.6X10^6$ psi (Figure 701-10)

Load Transfer Coefficient (J) - 2.8 (Figure 701-10)

Drainage Coefficient (C_D) = 1.0 (Figure 701-10)

The resulting Match Line Number of 66 is then used on Figure 701-9, along with the following information, to solve for the Design Slab Thickness (D).

Design Serviceability Loss (psi) - Initial PSI (Figure 701-10) minus the (P_t) Terminal Serviceability Index (Section 701.1) or 4.2 - 2.5 = 1.7

Reliability (R) = 85% (Figure 701-11)

Overall Standard Deviation (S_o) = 0.39 (Figure 701-10)

18 Kip Equivalent (W_{18}) = $13.7X10^6$ (Step 3)

Therefore: Design Slab Thickness (D) 9.6"

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Example - Flexible Pavement Design

Given:

- Pavement: Flexible
- 18 Kip Equivalent (W_{18}): 9,300,000 (Calculated as shown in Step 3 under Rigid Design)
- Functional Classification: Principal Rural Arterial
- Resilient Modulus (M_R): 7200 psi (See Step 2 under Rigid Design)

Problem:

Solve for flexible pavement design.

Solution:

Step 1 - Determine the Design Structural Number (SN) using Figures 701-12 and 701-13.

In Figure 701-12, solve for the Match Line Number using the following information:

Reliability (R) = 85% (Figure 701-11)

Overall Standard Deviation (S_o) = 0.49 (Figure 701-11)

18 Kip Equivalent (W_{18}) = 9,300,000 (Given)

Resilient Modulus (M_R) = 7,200 psi (Given)

The resulting Match Line Number of 40 is then used on Figure 701- 13, along with the following information, to solve for the Design Structural Number (SN).

Design Serviceability Loss (PSI) = Initial PSI (Figure 701-11) minus the (P_t) Terminal Serviceability Index (Section 701.1) or 4.5 - 2.5 = 2.0

Therefore: Design Structural Number (SN) = 4.65

Step 2 - Determine flexible pavement design by equating the structural number (SN) to thickness using the structural coefficients in Figure 701-11. The total SN for the pavement design shall equal or exceed the SN from Figure 701-12.

Material	Thickness		Coefficient		SN
404	1-1/4"	X	0.35	=	0.44
402	1-3/4"	X	0.35	=	0.61
301	10-1/2"	X	0.35	=	3.68
	13-1/2"				4.73

Alternate Design Using Granular Base

404 & 402	3"	X	0.35	=	1.05
301	8"	X	0.35	=	2.80
304	6"	X	0.14	=	0.84
	17"				4.69

When full depth thickness of less than 5" is required (SN=1.80), a granular base design is suggested.

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W_{18} CONVERSION FACTORS

701-4

REFERENCE SECTION
RIGID PAVEMENT DESIGN EXAMPLE - STEP 3

RATIO OF B TO C COMMERCIAL VEHICLES

FUNCTIONAL CLASSIFICATION	B:C RATIO
Rural Interstate	6:1
Rural Principle Arterial	5:1
→ All other Rural	1:2
Urban Interstate	2:1
Urban Freeway & Expressway	1:1
Urban Principal Arterial	6:1
All other Urban	1:6

NOT? SIGNIFICANT

Use actual B and C counts when available

CONVERSION FACTORS

Function Classification	Rigid		Flexible	
	B	C	B	C
Rural Interstate	2.27	0.914	1.60	0.735
All other Rural	2.16	1.02	1.44	0.777
Urban Inter., Freeway & Exp.	2.50	1.48	1.74	1.13
All other Urban	1.61	0.673	1.11	0.534

Notes:

B= Tractor-trucks with semi-trailers and trucks with trailers.

C= Single unit trucks (2 axle, 6 tires or more) not included in A.

The information on this figure will be periodically updated by the Bureau of Technical Services.

LANE FACTORS

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NUMBER OF LANES	% TRUCKS IN DESIGN LANE
4 - Lane Divided	90
6 (or more) - Lane Divided	80

PAVEMENT DESIGN RELIABILITY LEVELS AND FLEXIBLE PAVEMENT DESIGN FACTORS	701-11 REFERENCE SECTION FLEXIBLE PAVEMENT DESIGN EXAMPLE - STEPS 1 & 2

PAVEMENT DESIGN RELIABILITY LEVELS

FUNCTIONAL CLASSIFICATION	RELIABILITY LEVELS (%)(R) URBAN	RURAL
Interstate and Freeway	95	90
Principle Arterials	90	85
Collectors	90	85
Local	80	80

FLEXIBLE PAVEMENT DESIGN FACTORS

Initial PSI	4.5
Overall Standard Deviation (S_0)	0.49

STRUCTURAL COEFFICIENTS

Asphalt Concrete (404,402;301,448,446)	0.35
Aggregate Base (304)	0.14
Subbase (310)	0.11
Broken and Seated Concrete	0.27
Existing Asphalt	0.23
Rubblized Concrete	0.14

DRAFT

De Leuw, Cather
Engineers and Planners

Subject: Haul Road **Job No.** 660620
Sheet No. 1 of 1
Made by: [signature] **Date:** 12/5/95
Checked by: [signature] **Date:** 12/5/95
REV 1/22/96

304 - 20000 AGGREGATE BASE

Thickness= 3 in
Width= (2)(12' lanes) = 24 ft

STA 100 + 00 to STA 162 + 65= 6265 ft

Volume: (6265 ft)*(3 in/12)*(24 ft)*(1 cu yd/27 cu ft)= 1392.22

(6265 ft)*(2)(5 ft)*(10.5 in/12)*(1 cu yd/27 cu ft)= 2030.32

Total: **3424 cu yd**

De Leuw, Cather
Engineers and Planners

Subject: Haul Road **Job No.** 660620
Sheet No. 1 of 1
Made by: AMC **Date:** 12/5/95
Checked by: [signature] **Date:** 12/5/95
REV 1/22/96

402 - 20000 ASPHALT CONCRETE

Thickness= 10.5 in.
Width= (2)(12' lanes)= 24 ft

STA 100 + 00 to STA 162 + 65 = 6265 ft

Volume: (6265 ft)(24 ft)(10.5 in/12)= 131565

(131,565 cf)(1cu yd/27 cf)= 4873

Total: **4,873 CU YD**

De Leuw, Cather
Engineers and Planners

Subject: Haul Road **Job No.** 660620
Sheet No. 1 of 1
Made by: AWC **Date:** 12/5/95
Checked by: [signature] **Date:** 12/5/95

REV 1/22/96

Non - Woven Geotextile

Typical width: 34' Pavt + 3'Rt + 3' Lt= 40 ft

STA 100 + 00 to STA 162 + 65= 6265 ft

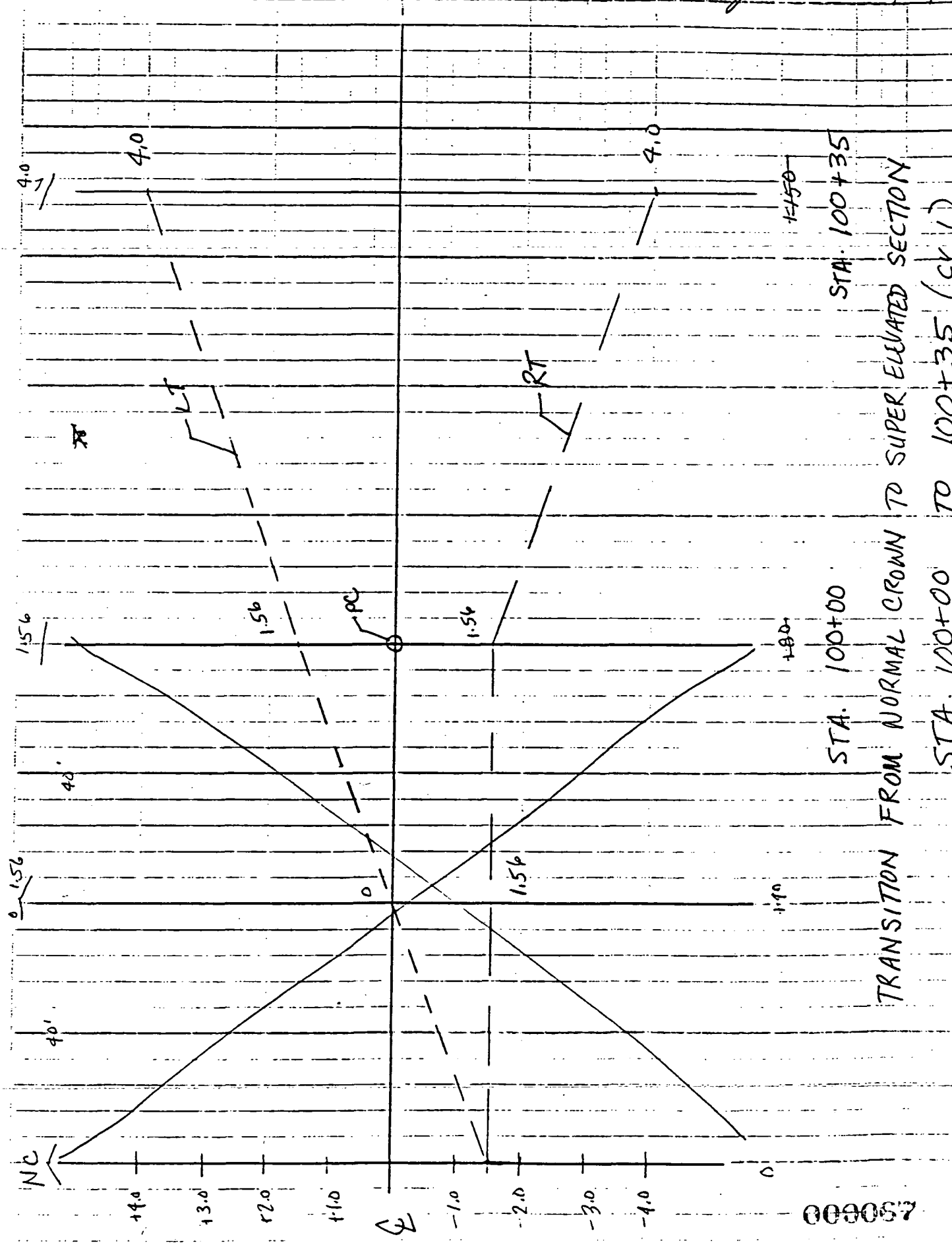
Area: (6265 ft)(40 ft)= 250600 sq ft

(250600 sq ft.)(sq yd/9 sq ft)= 27844.44 sq yd

TOTAL: **27,845 sq yd**

DE LEUW, CATHER
Engineers and Planners

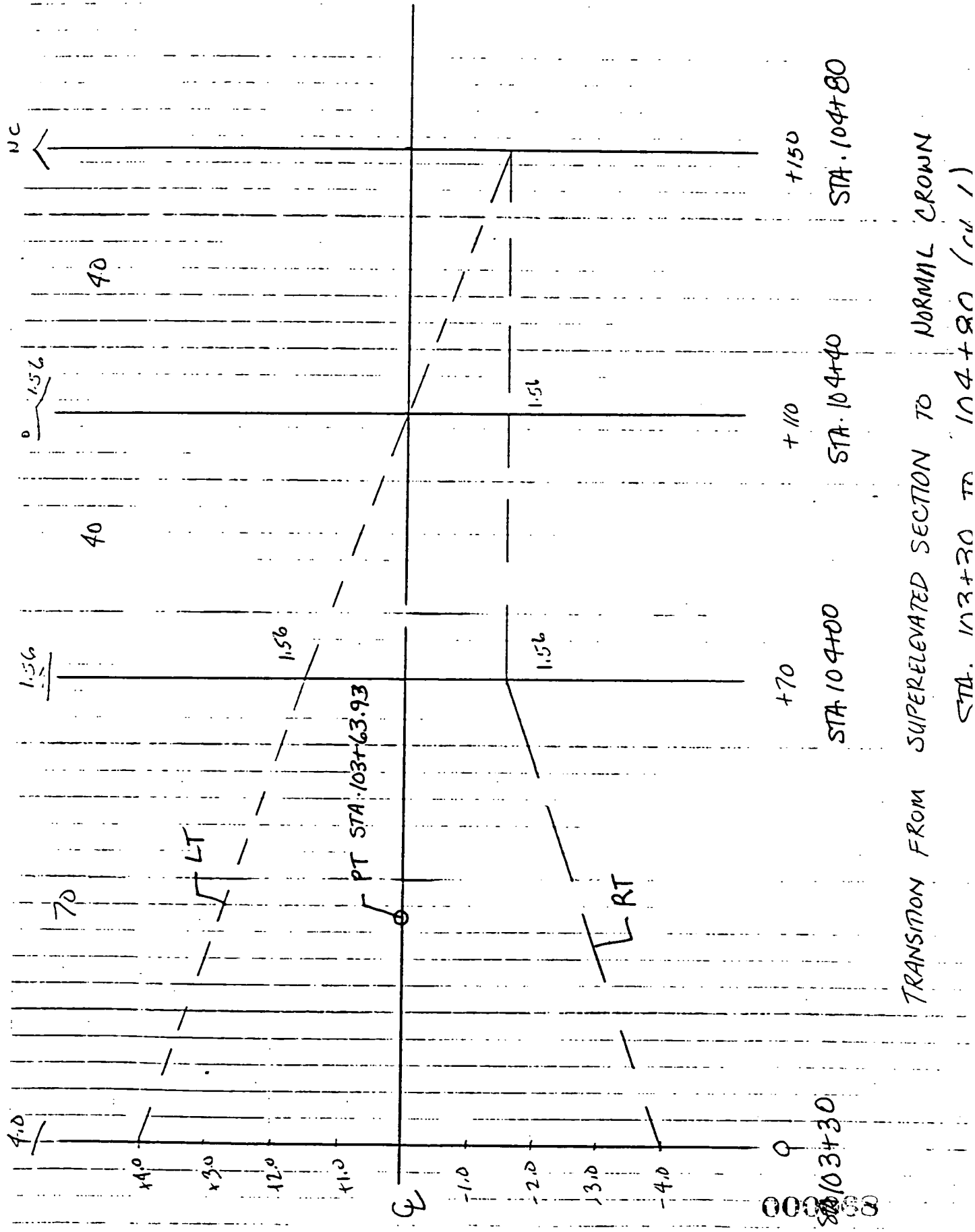
SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 660670 02200
SHEET NO. 1 OF 15
MADE BY AWC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95



000057

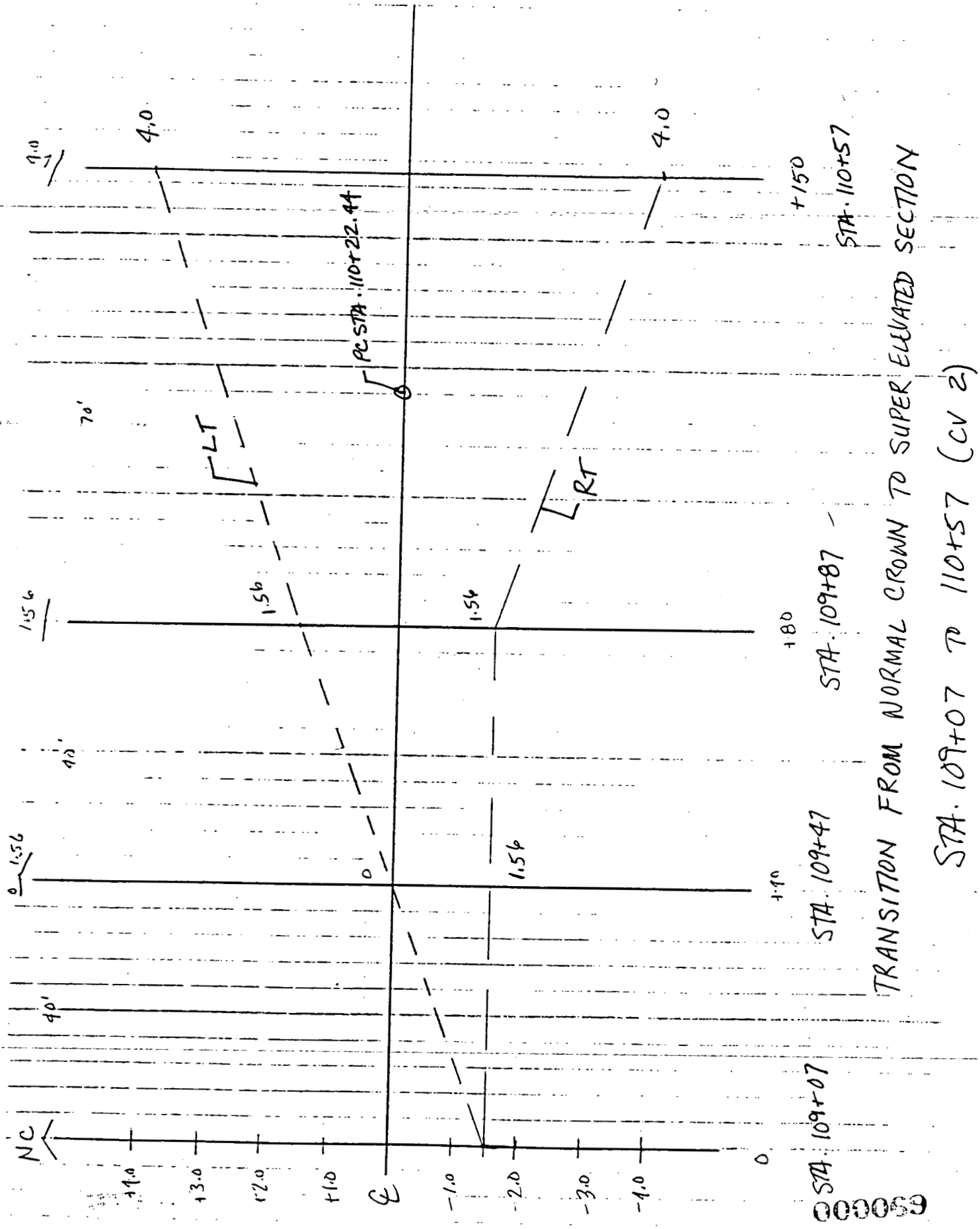
DE LEUW, CATHER
Engineers and Planners

SUBJECT FAUL ROAD JOB NO. 666620 02200
SUPERELEVATION TRANSITIONS SHEET NO. 2 OF 15
MADE BY JMC DATE 12/18/95 CHECKED BY JMC DATE 12/18/95



DE LEUW, CATHER
Engineers and Planners

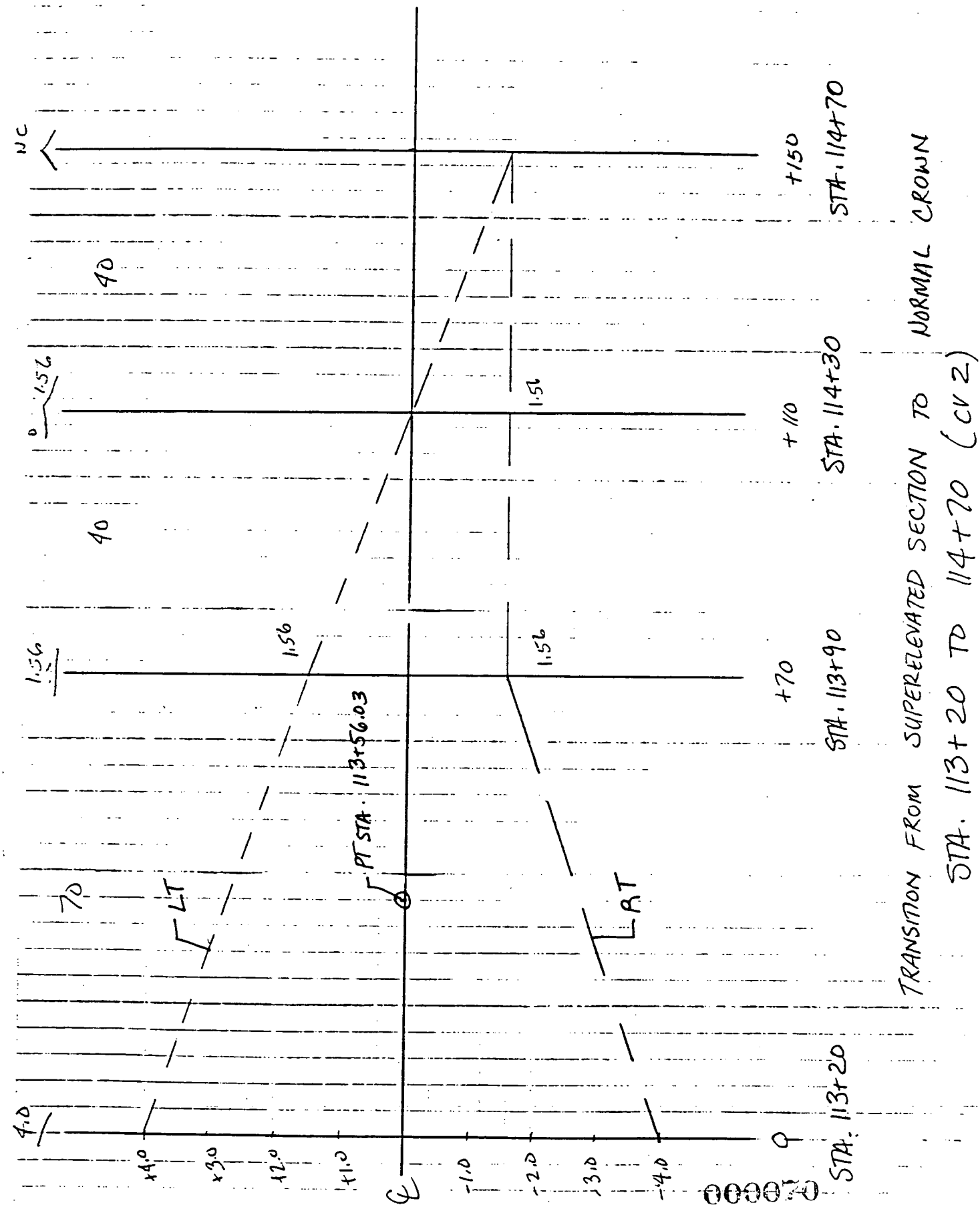
SUBJECT HEUL ROAD JOB NO. 660670 02205 1
SUPERELEVATION TRANSITIONS SHEET NO. 3 OF 15
MADE BY AMC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95



000059

DE LEUW, CATHER
Engineers and Planners

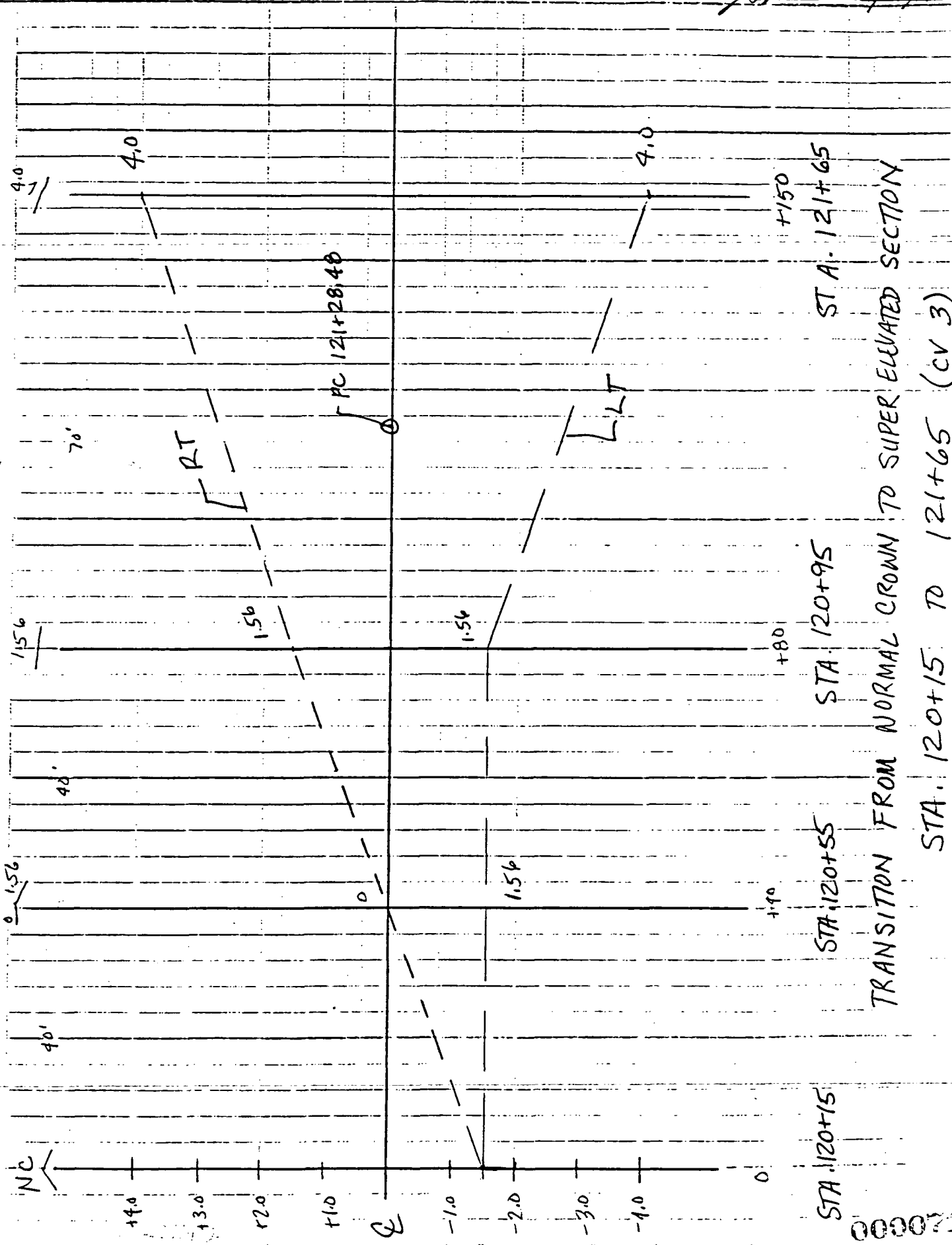
SUBJECT HAUL ROAD JOB NO. 666620 02200
SUPERELEVATION TRANSITIONS SHEET NO. 4 OF 15
MADE BY KMC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95



000070

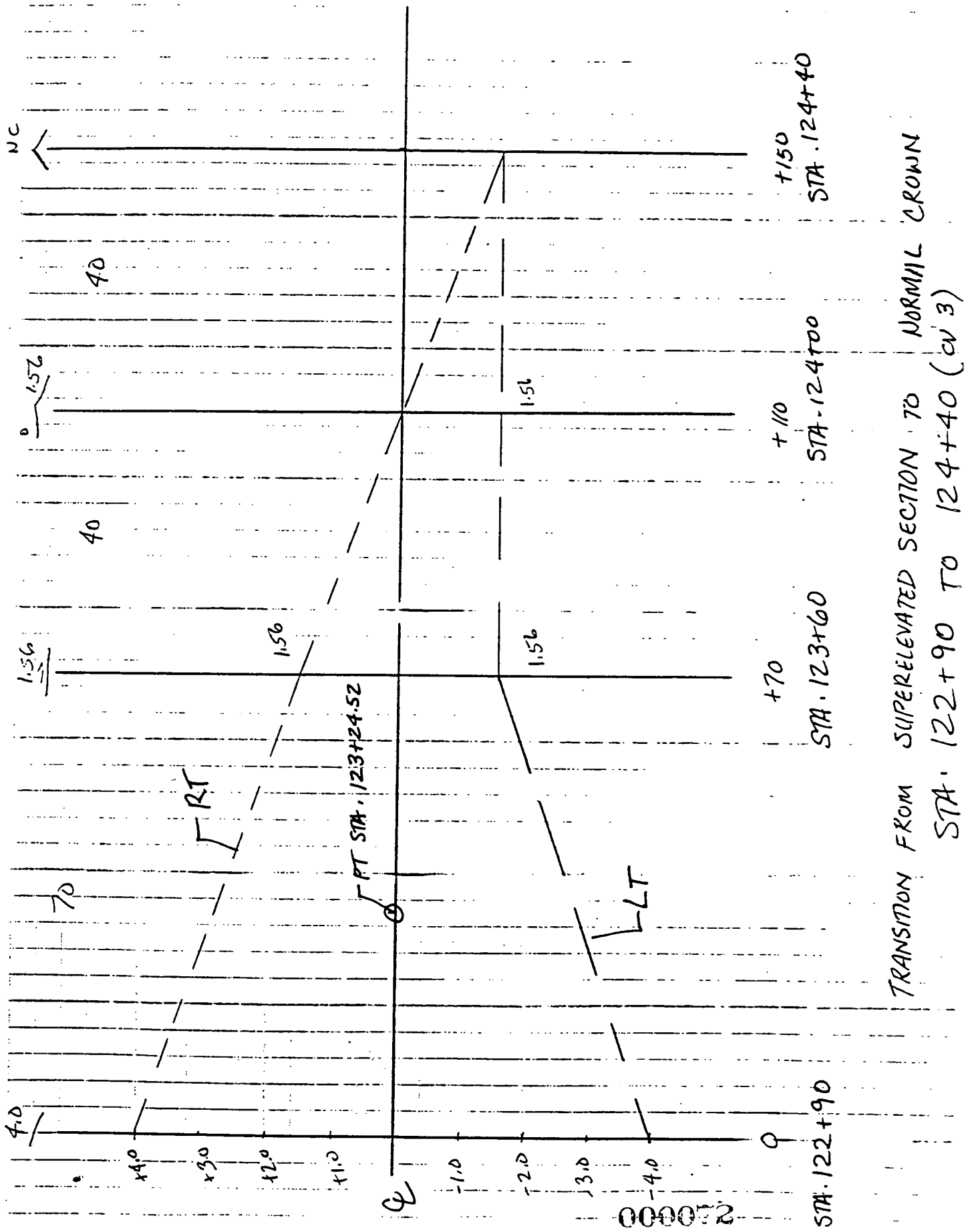
DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 660620 02200
SHEET NO. 5 OF 15
MADE BY AMC DATE 12/18/95 CHECKED BY [signature] DATE 12/18/95



DE LEUW, CATHER
Engineers and Planners

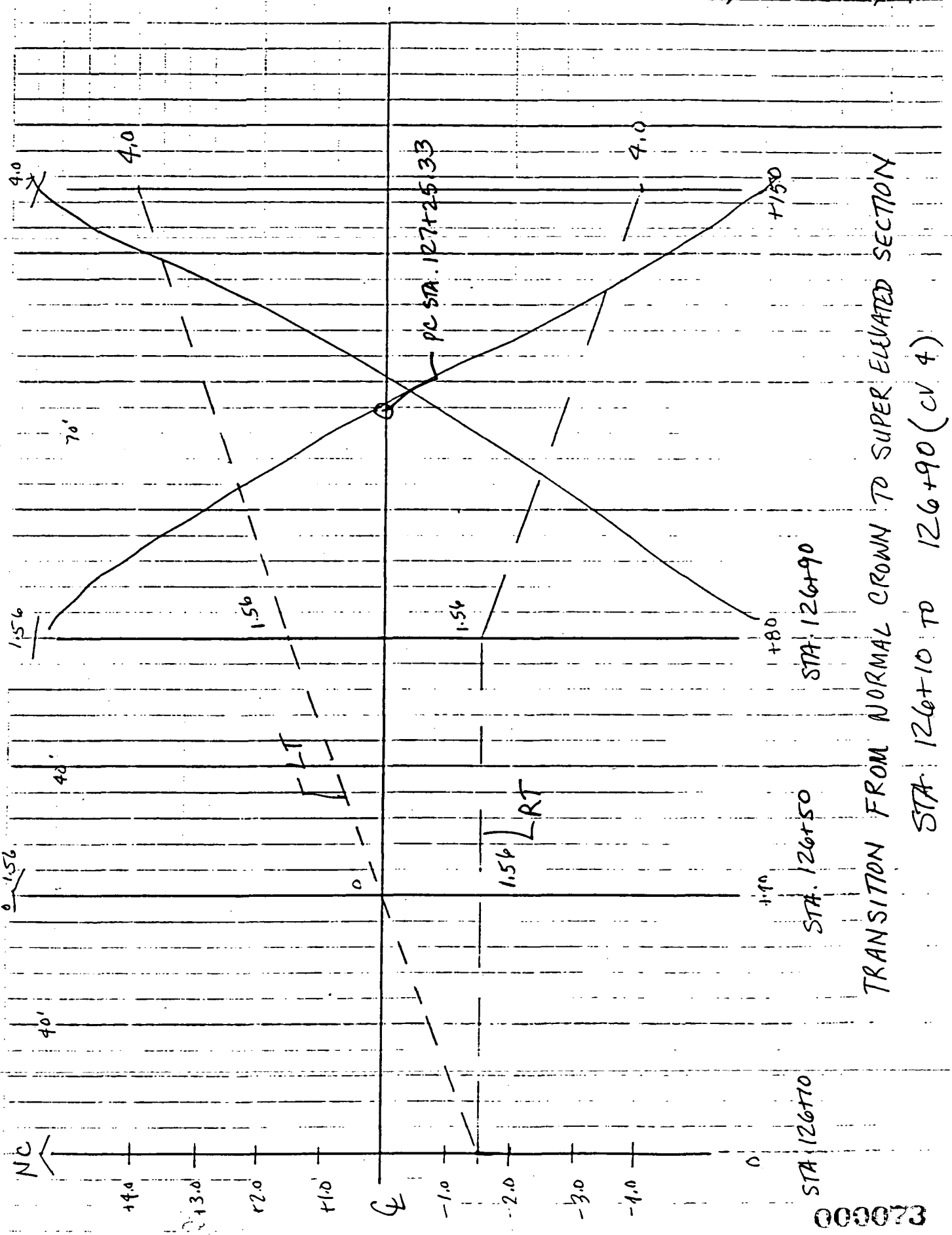
SUBJECT HAUL ROAD JOB NO. 66620 02200
SUPERELEVATION TRANSITIONS SHEET NO. 6 OF 15
MADE BY AMC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/9



02200

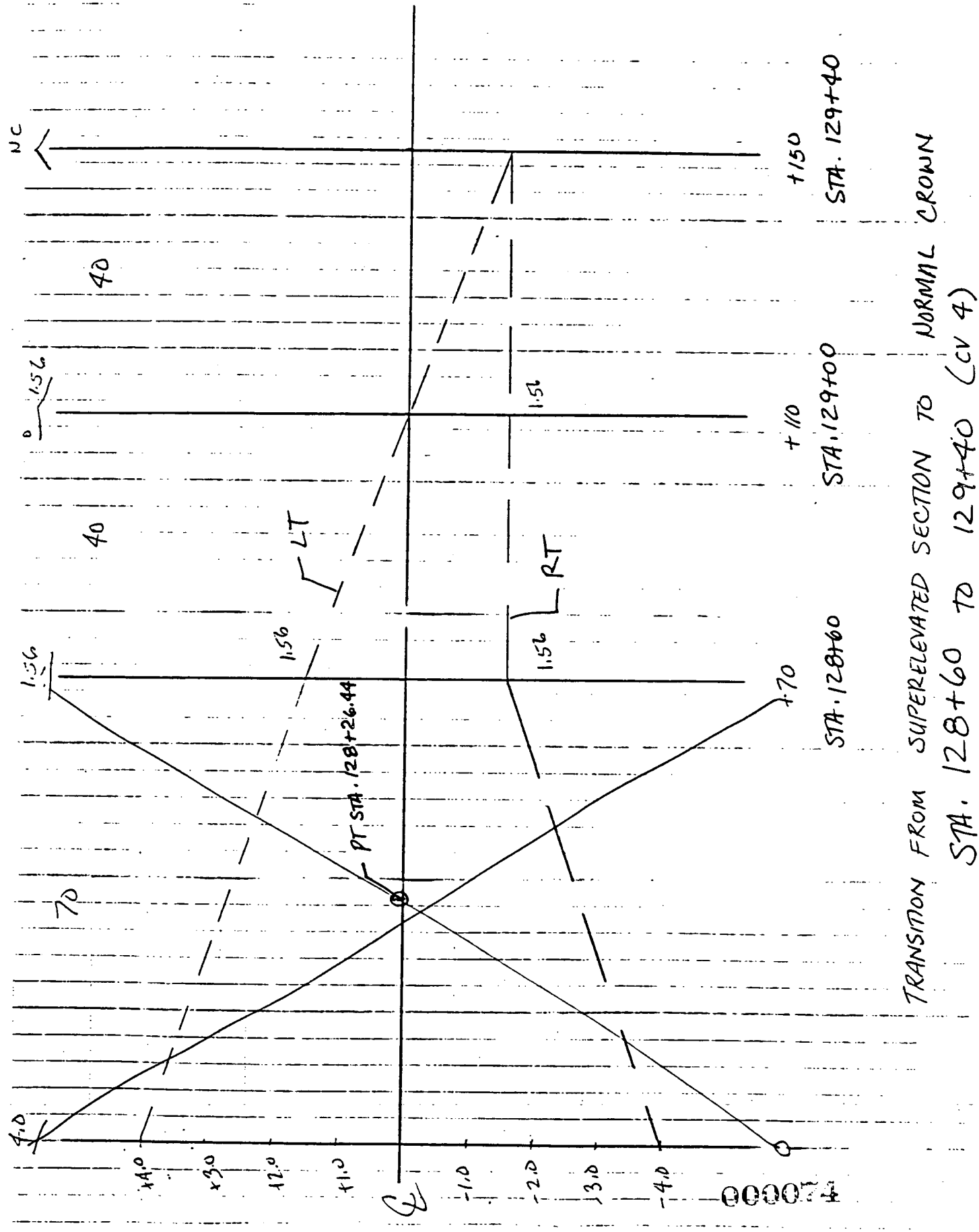
DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 660670 02200
SHEET NO. 7 OF 15
MADE BY AMC DATE 12/19/95 CHECKED BY [illegible] DATE 12/18/95



DE LEUW, CATHER
Engineers and Planners

SUBJECT 4-UL ROAD JOB NO. 66.620 02200
SUPERELEVETION TRANSITIONS SHEET NO. 8 OF 15
MADE BY AMC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95

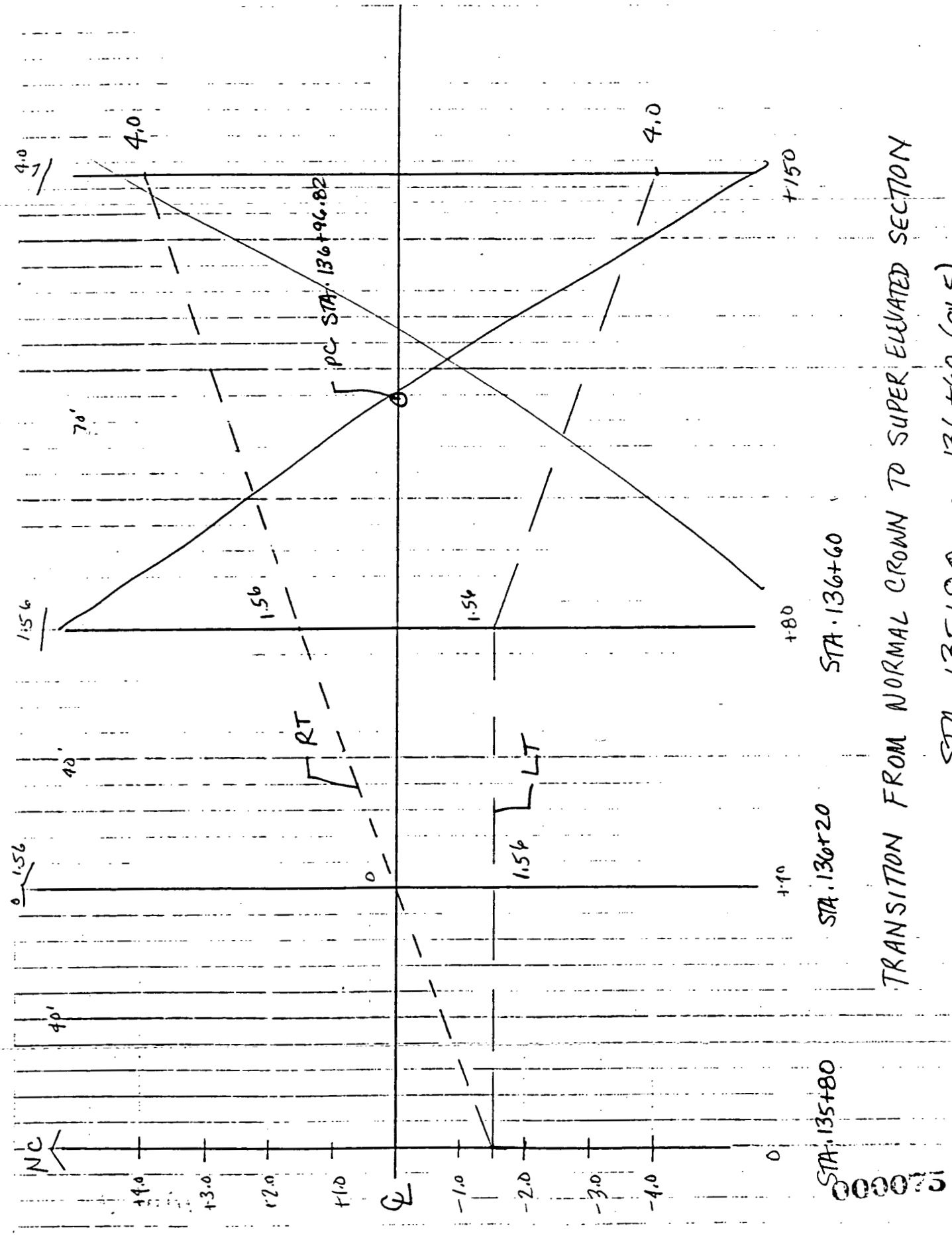


000074

DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 660670 SHEET NO. 9 OF 15

MADE BY MIC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95

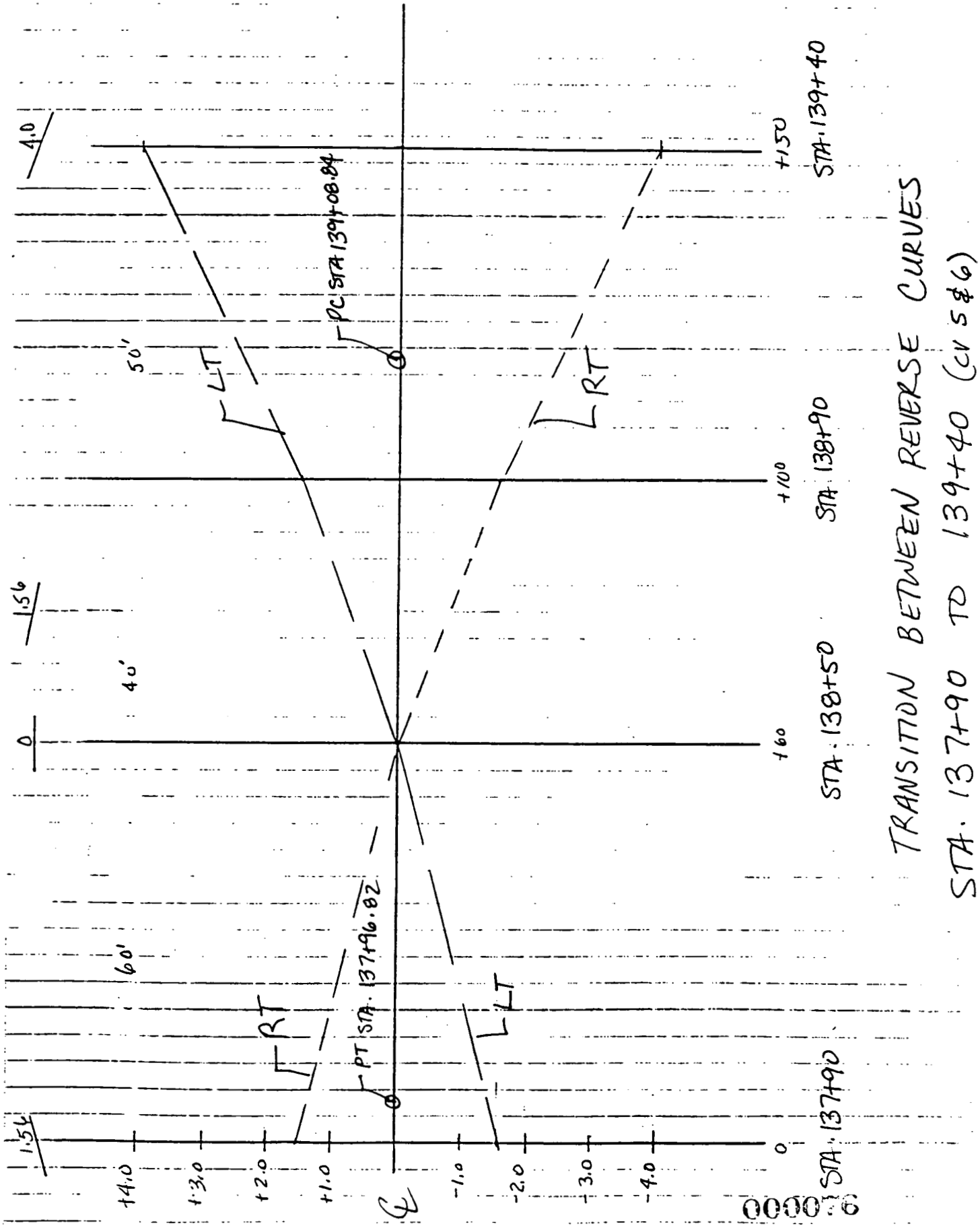


DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 166630 C2200

SHEET NO. 10 OF 15

MADE BY AMC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95

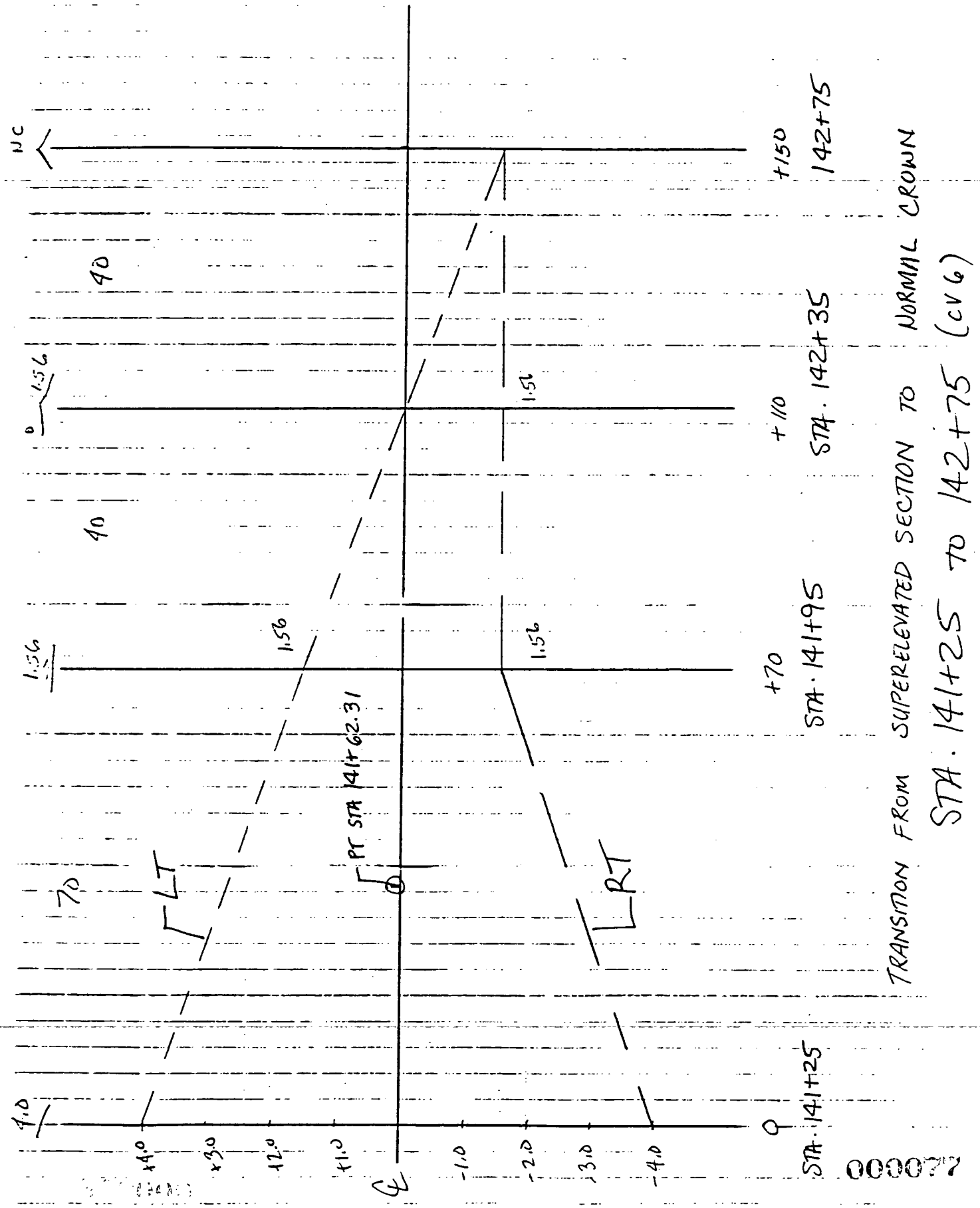


TRANSITION BETWEEN REVERSE CURVES
STA. 137+90 TO 139+40 (CV 5 & 6)

0000

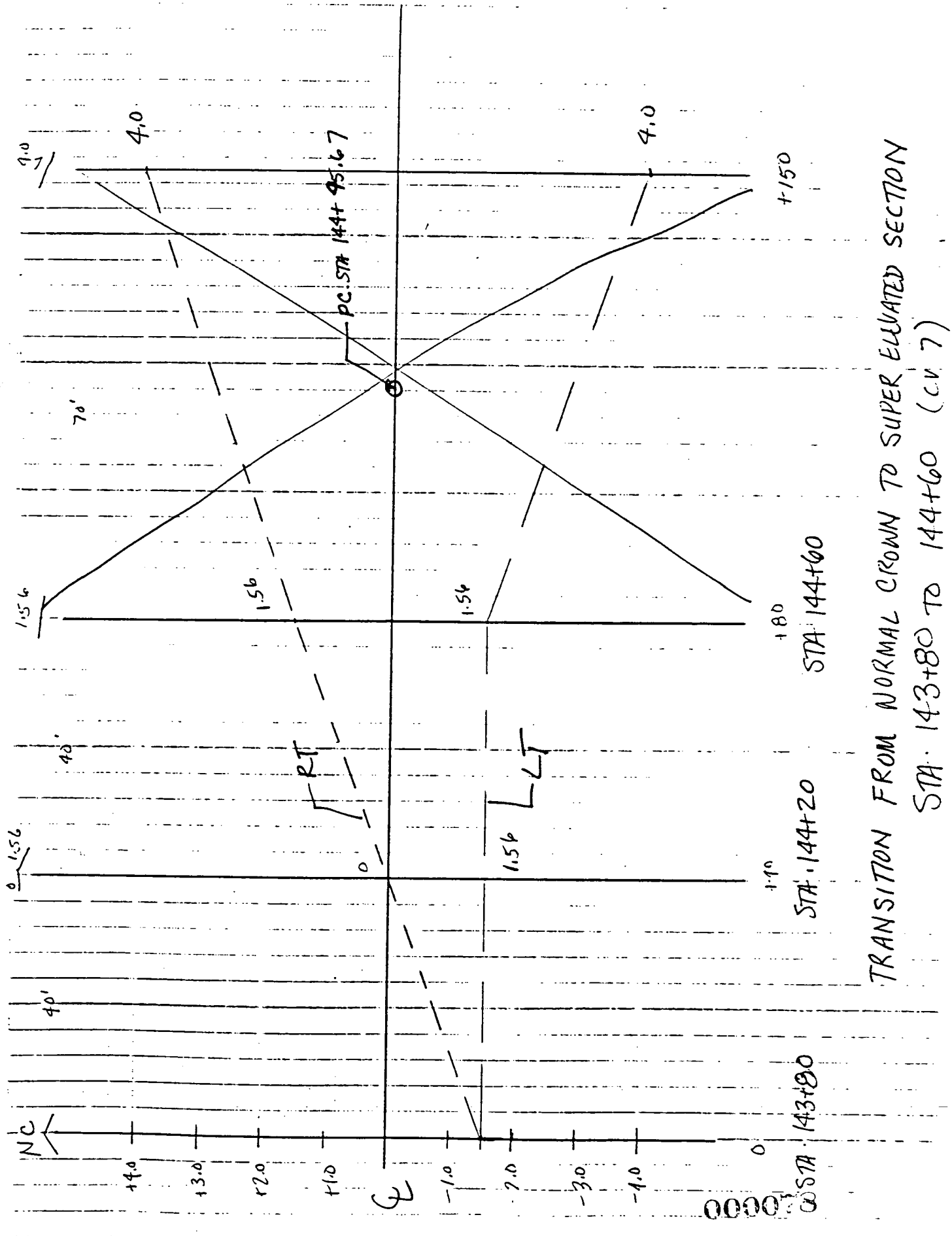
DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD JOB NO. 666620
SUPERELEVATION TRANSITIONS SHEET NO. 11 OF 15
MADE BY RMM DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95



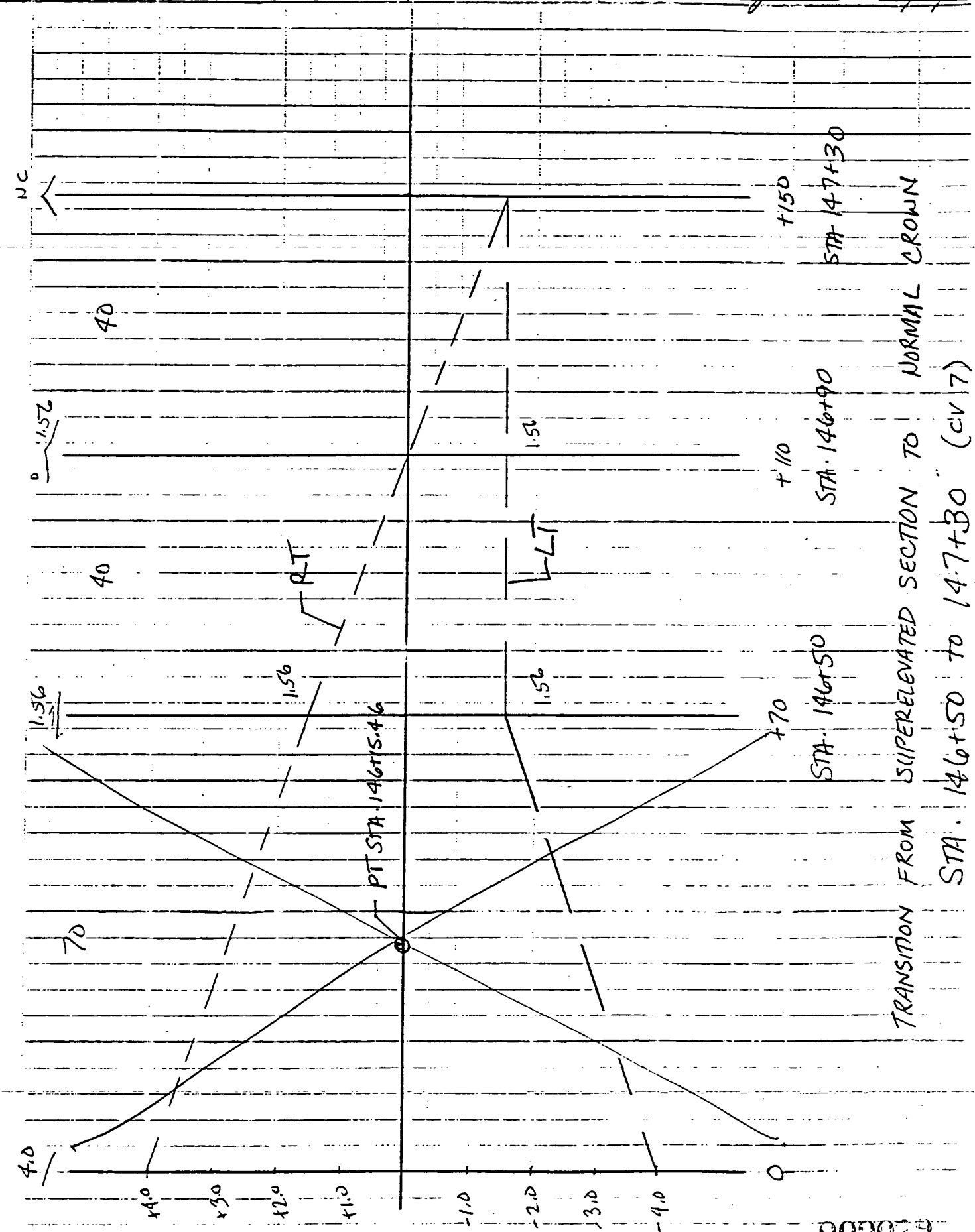
DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD JOB NO. 660670 CC200
SUPERELEVATION TRANSITIONS SHEET NO. 12 OF 15
MADE BY AMC DATE 12/18/95 CHECKED BY [signature] DATE 12/18/95



DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD JOB NO. 666620 02201
SUPERELEVATION TRANSITIONS SHEET NO. 13 OF 15
MADE BY AMC DATE 12/18/95 CHECKED BY JMH DATE 12/18/95

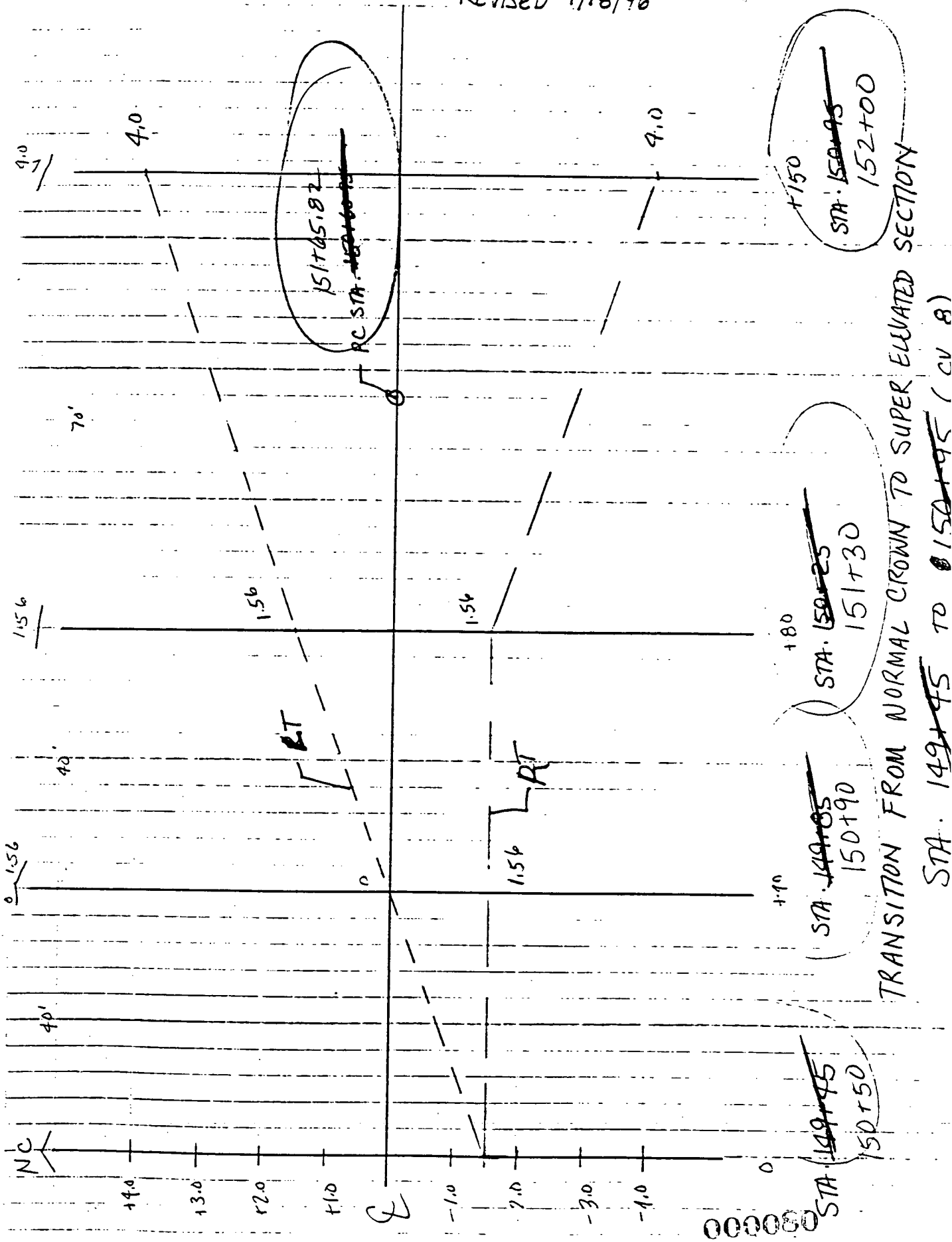


000079

DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 22200
SHEET NO. 14 OF 15
MADE BY KMC DATE 12/18/95 CHECKED BY JGH DATE 12/18/

REVISED 1/18/96



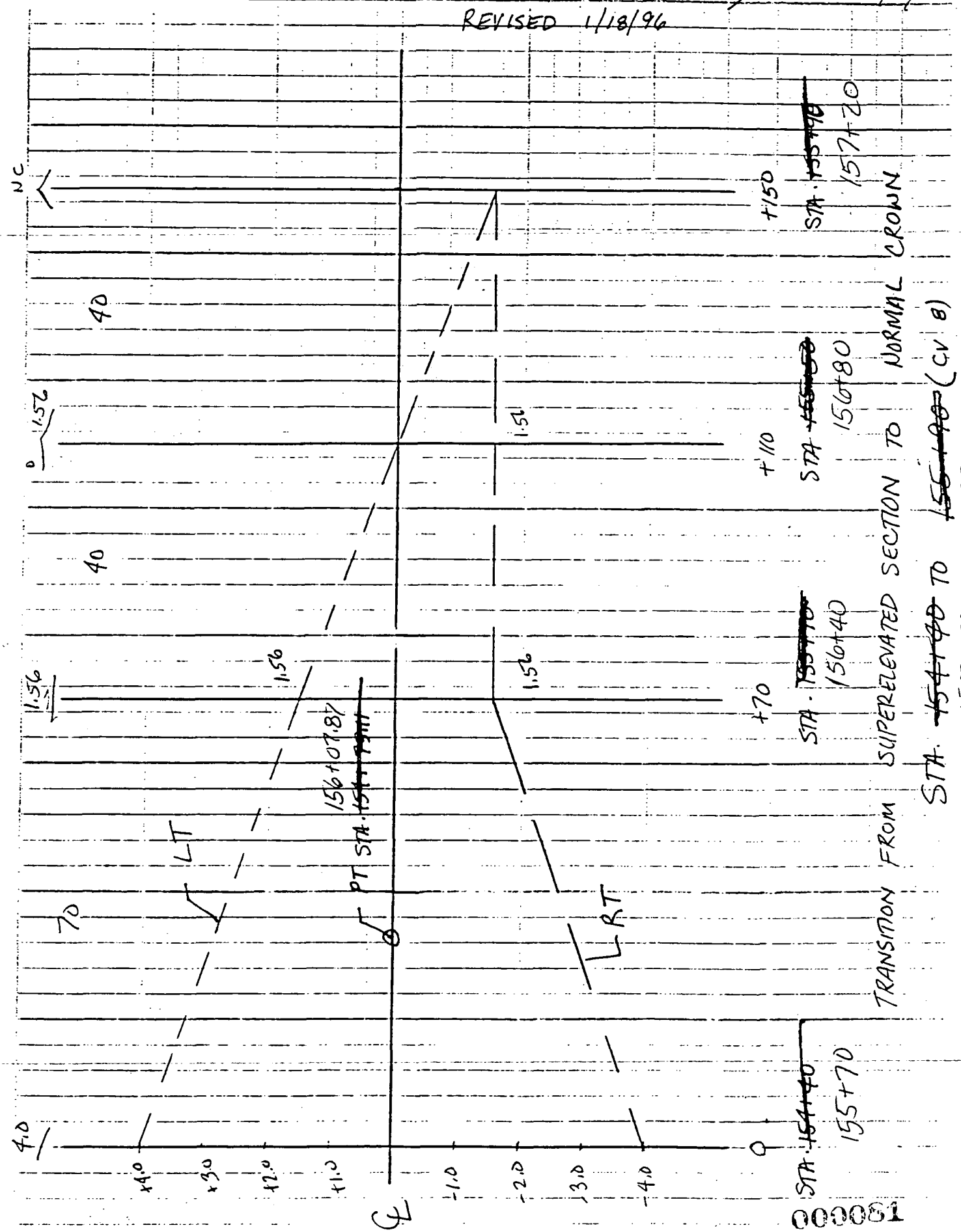
TRANSITION FROM NORMAL CROWN TO SUPER ELVATED SECTION
STA. 149+45 TO @ 150+95 (CV 8)

000080

DE LEUW, CATHER
Engineers and Planners

SUBJECT HAUL ROAD SUPERELEVATION TRANSITIONS JOB NO. 666620 02200
SHEET NO. 15 OF 15
MADE BY HMC DATE 12/18/95 CHECKED BY [illegible] DATE 12/18/95

REVISED 1/18/96



000081

DE LEUW, CATHER AND COMPANY
ENGINEERS

JOB NO. 6 6606
DATE, JAN 23, 199
DATA BY
PAGE NO. 1

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 FERNALD HAUL ROAD

STATION	P.G. ELEV	GRADE-LVC	OFFSET	TAN ELEV
10000.0000	568.0000			
10050.0000	568.1661			
10100.0000	568.3322			
10150.0000	568.4983			
10200.0000	568.6644			
10250.0000	568.8305			
10300.0000	568.9966			
10350.0000	569.1627			
10400.0000	569.3288			
10450.0000	569.4949			
10500.0000	569.6610			
10550.0000	569.8271			
10600.0000	569.9932			
10650.0000	570.1593			
10700.0000	570.3254			
10750.0000	570.4915			
10800.0000	570.6576			
10850.0000	570.8237			
10900.0000	570.9898			
10950.0000	571.1559			
11000.0000	571.3220			
11050.0000	571.4881			
11100.0000	571.6542			
11150.0000	571.8203			
11200.0000	571.9864			
11250.0000	572.1525			
11300.0000	572.3186			
11350.0000	572.4847			
11400.0000	572.6508			
11450.0000	572.8169			
11500.0000	572.9831			
11550.0000	573.1492			
11600.0000	573.3153			
11650.0000	573.4814			
11700.0000	573.6475			
11750.0000	573.8136			
11800.0000	573.9797			
11850.0000	574.1458			
11900.0000	574.3119			
11950.0000	574.4780			
12000.0000	574.6441			
12050.0000	574.8102			
12100.0000	574.9763			
12150.0000	575.1424			
12200.0000	575.3085			
12250.0000	575.4746			
12300.0000	575.6407			
12350.0000	575.8068			
12400.0000	575.9729			
12450.0000	576.1390			

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 FERNALD HAUL ROAD

STATION	P.G. ELEV		GRADE-LVC	OFFSET	TAN ELEV
12500.0000	576.3051				
12550.0000	576.4712				
12600.0000	576.6373				
12650.0000	576.8034				
12700.0000	576.9695				
12750.0000	577.1356				
12800.0000	577.3017				
12850.0000	577.4678				
12900.0000	577.6339	PVC	.3322		
12950.0000	577.7435	PVI	100.00	-.0565	577.8000
12973.4633	577.7559				
13000.0000	577.7400	PVT	-.1200		
13050.0000	577.6800				
13100.0000	577.6200	PVC	-.1200		
13106.0142	577.6164				
13150.0000	577.8094	PVI	100.00	.2494	577.5600
13200.0000	578.4976	PVT	1.8753		
13250.0000	579.4353				
13300.0000	580.3729				
13350.0000	581.3106				
13400.0000	582.2482				
13450.0000	583.1859				
13500.0000	584.1235				
13550.0000	585.0612				
13600.0000	585.9988				
13650.0000	586.9365				
13700.0000	587.8741				
13750.0000	588.8118				
13800.0000	589.7494	PVC	1.8753		
13850.0000	590.5922				
13900.0000	591.2453				
13950.0000	591.7087				
14000.0000	591.9824	PVI	400.00	-1.5176	593.5000
14047.1318	592.0666				
14050.0000	592.0663				
14100.0000	591.9606				
14150.0000	591.6651				
14200.0000	591.1800	PVT	-1.1600		
14250.0000	590.6000				
14300.0000	590.0200	PVC	-1.1600		
14350.0000	589.4950				
14400.0000	589.0800				
14450.0000	588.7750				
14500.0000	588.5800	PVI	400.00	.8800	587.7000
14550.0000	588.4950				
14563.6364	588.4909				
14600.0000	588.5200				
14650.0000	588.6550				
14700.0000	588.9000	PVT	.6000		
14750.0000	589.2000				

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 FERNALD HAUL ROAD

STATION	P.G. ELEV		GRADE-LVC	OFFSET	TAN ELEV
14800.0000	589.5000				
14850.0000	589.8000				
14900.0000	590.1000				
14950.0000	590.4000				
15000.0000	590.7000				
15050.0000	591.0000				
15100.0000	591.3000				
15150.0000	591.6000				
15200.0000	591.9000	PVC	.6000		
15250.0000	592.1625				
15300.0000	592.3500	PVI	200.00	-.1500	592.5000
15350.0000	592.4625				
15400.0000	592.5000	PVT	.0000		
15450.0000	592.5000				
15500.0000	592.5000				
15550.0000	592.5000				
15600.0000	592.5000				
15650.0000	592.5000				
15700.0000	592.5000				
15750.0000	592.5000				
15800.0000	592.5000				
15850.0000	592.5000				
15900.0000	592.5000				
15950.0000	592.5000				
16000.0000	592.5000				
16050.0000	592.5000				
16100.0000	592.5000	PVC	.0000		
16150.0000	592.6875				
16200.0000	593.2500	PVI	200.00	.7500	592.5000
16250.0000	594.1875				
16300.0000	595.5000	PVT	3.0000		

Stop - Program terminated.

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GEOPAK

Project: haulii
Subject:
Job No. 660 Operator: MB
Date: Thursday January 25, 1996 12:08 pm
SYSTEM FIX 4 ASEC 2 BEAR PRI 0 NOR NE STA 2 FILE: 'HAULR'

* 1 Describe Chain HAUL

Chain HAUL contains:
CUR HAUL-1 CUR HAUL-2 CUR HAUL-3 CUR HAUL-4 CUR HAUL-5 CUR HAUL-6 CUR HAUL-7 CUR HAUL-8 100

Beginning chain HAUL description

			Curve Data			
Curve HAUL-1						
P.I. Station		101+91.72	N	478,350.9118	E	1,347,418.0831
Delta	=	44^ 32' 39.26"	(RT)			
Degree	=	12^ 14' 24.40"				
Tangent	=	191.7152				
Length	=	363.9202				
Radius	=	468.0986				
External	=	37.7383				
Long Chord	=	354.8242				
Mid. Ord.	=	34.9228				
P.C. Station		100+00.00	N	478,265.7571	E	1,347,589.8486
P.T. Station		103+63.92	N	478,532.0889	E	1,347,355.3969
C.C.			N	478,685.1457	E	1,347,797.7654
Back	= N	63^ 37' 46.37" W				
Ahead	= N	19^ 05' 07.11" W				
Chord Bear	= N	41^ 21' 26.74" W				

Course from PT HAUL-1 to PC HAUL-2 N 13^ 17' 05.73" W Dist 658.5262

			Curve Data			
Curve HAUL-2						
P.I. Station		112+08.84	N	479,354.3989	E	1,347,161.2421
Delta	=	63^ 42' 36.44"	(RT)			
Degree	=	19^ 05' 59.88"				
Tangent	=	186.3938				
Length	=	333.5614				
Radius	=	299.9784				
External	=	53.1925				
Long Chord	=	316.6406				
Mid. Ord.	=	45.1810				
P.C. Station		110+22.45	N	479,172.9925	E	1,347,204.0718
P.T. Station		113+56.01	N	479,473.1457	E	1,347,304.9148
C.C.			N	479,241.9218	E	1,347,496.0235
Back	= N	13^ 17' 02.98" W				
Ahead	= N	50^ 25' 33.46" E				
Chord Bear	= N	18^ 34' 15.24" E				

Course from PT HAUL-2 to PC HAUL-3 N 50^ 25' 33.46" E Dist 772.4862

			Curve Data			
Curve HAUL-3						
P.I. Station		122+32.91	N	480,031.7979	E	1,347,980.8327
Delta	=	48^ 50' 09.07"	(LT)			

Degree	=	24^ 54' 43.43"				
Tangent	=	104.4158				
Length	=	196.0330				
Radius	=	229.9921				
External	=	22.5926				
Long Chord	=	190.1526				
Mid. Ord.	=	20.5718				
P.C. Station		121+28.49	N	479,965.2772	E	1,347,900.3487
P.T. Station		123+24.53	N	480,136.1735	E	1,347,983.7301
C.C.			N	480,142.5556	E	1,347,753.8266
Back	= N	50^ 25' 33.46" E				
Ahead	= N	1^ 35' 24.39" E				
Chord Bear	= N	26^ 00' 28.92" E				

Course from PT HAUL-3 to PC HAUL-4 N 1^ 35' 24.39" E Dist 400.7362

Curve Data

Curve HAUL-4						
P.I. Station		127+76.35	N	480,587.8263	E	1,347,996.2679
Delta	=	19^ 19' 44.41"	(RT)			
Degree	=	19^ 05' 52.30"				
Tangent	=	51.0906				
Length	=	101.2103				
Radius	=	300.0115				
External	=	4.3192				
Long Chord	=	100.7310				
Mid. Ord.	=	4.2579				
P.C. Station		127+25.26	N	480,536.7554	E	1,347,994.8502
P.T. Station		128+26.47	N	480,635.5493	E	1,348,014.5098
C.C.			N	480,528.4304	E	1,348,294.7461
Back	= N	1^ 35' 24.39" E				
Ahead	= N	20^ 55' 08.80" E				
Chord Bear	= N	11^ 15' 16.60" E				

Course from PT HAUL-4 to PC HAUL-5 N 20^ 55' 10.45" E Dist 870.3066

Curve Data

Curve HAUL-5						
P.I. Station		137+47.04	N	481,495.0988	E	1,348,344.0625
Delta	=	19^ 58' 44.26"	(LT)			
Degree	=	20^ 04' 44.58"				
Tangent	=	50.2611				
Length	=	99.5015				
Radius	=	285.3511				
External	=	4.3926				
Long Chord	=	98.9982				
Mid. Ord.	=	4.3260				
P.C. Station		136+96.78	N	481,448.4876	E	1,348,325.2589
P.T. Station		137+96.28	N	481,545.3295	E	1,348,345.8086
C.C.			N	481,555.2428	E	1,348,060.6298
Back	= N	21^ 58' 11.50" E				
Ahead	= N	1^ 59' 27.24" E				
Chord Bear	= N	11^ 58' 49.37" E				

Course from PT HAUL-5 to PC HAUL-6 N 1^ 59' 27.24" E Dist 112.5995

Curve Data

Curve HAUL-6						
P.I. Station		140+68.23	N	481,817.1181	E	1,348,355.2564
Delta	=	88^ 00' 43.27"	(RT)			
Degree	=	34^ 43' 43.78"				
Tangent	=	159.3532				
Length	=	253.4264				

Radius	=	164.9805				
External	=	64.3926				
Long Chord	=	229.2350				
Mid. Ord.	=	46.3155				
P.C. Station		139+08.88	N	481,657.8611	E	1,348,349.7204
P.T. Station		141+62.31	N	481,817.1100	E	1,348,514.6097
C.C.			N	481,652.1295	E	1,348,514.6013
Back	= N	1^ 59' 27.24" E				
Ahead	= S	89^ 59' 49.49" E				
Chord Bear	= N	45^ 59' 48.87" E				

Course from PT HAUL-6 to PC HAUL-7 S 88^ 32' 32.13" E Dist 333.3016

Curve Data

Curve HAUL-7						
P.I. Station		145+55.82	N	481,807.1011	E	1,348,907.9907
Delta	=	12^ 42' 59.56"	(LT)			
Degree	=	10^ 36' 15.47"				
Tangent	=	60.2067				
Length	=	119.9188				
Radius	=	540.3072				
External	=	3.3441				
Long Chord	=	119.6728				
Mid. Ord.	=	3.3235				
P.C. Station		144+95.61	N	481,808.6309	E	1,348,847.8034
P.T. Station		146+15.53	N	481,818.8577	E	1,348,967.0384
C.C.			N	482,348.7637	E	1,348,861.5324
Back	= S	88^ 32' 38.31" E				
Ahead	= N	78^ 44' 22.13" E				
Chord Bear	= N	85^ 05' 51.91" E				

Course from PT HAUL-7 to PC HAUL-8 N 78^ 44' 22.13" E Dist 550.2884

Curve Data

Curve HAUL-8						
P.I. Station		153+87.76	N	481,969.6526	E	1,349,724.4088
Delta	=	12^ 46' 44.17"	(RT)			
Degree	=	2^ 53' 26.90"				
Tangent	=	221.9480				
Length	=	442.0544				
Radius	=	1,982.0000				
External	=	12.3884				
Long Chord	=	441.1387				
Mid. Ord.	=	12.3114				
P.C. Station		151+65.82	N	481,926.3127	E	1,349,506.7334
P.T. Station		156+07.87	N	481,963.7714	E	1,349,946.2789
C.C.			N	479,982.4673	E	1,349,893.7593
Back	= N	78^ 44' 22.13" E				
Ahead	= S	88^ 28' 53.71" E				
Chord Bear	= N	85^ 07' 44.21" E				

Course from PT HAUL-8 to 100 S 88^ 28' 53.70" E Dist 962.3791

Point 100 N 481,938.2700 E 1,350,908.3200 Sta 165+70.25

==========

Ending chain HAUL description

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PAVEMENT DESIGN SHEET NO. 1 OF 2
MADE BY [illegible] DATE 11/16/95 CHECKED BY [illegible] DATE 11/16/95

• NORTH ENTRANCE ROAD PAVEMENT DESIGN

DESIGN PARAMETERS: STANDARDS - ODOT LOCATION & DESIGN MANUAL

PAVEMENT SECTION: BITUMINOUS ON AGGREGATE BASE ON COMPACTED SUBGRADE

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ADT: 6000 VPD (50/50 DISTRIBUTION), 10% CLASS B&C

CBR = 4 (PO-140)

• SUBGRADE RESILIENT MODULUS - M_R

$M_R = 1200 \times CBR = (1200)(4) = 4800$ PSI (ODOT L&D MANUAL)

• CALCULATING 18 KIP EQUIVALENT SINGLE AXLE LOADING (W_{18})

FIG 701-4: B:C RATIO = 1:2 B FACTOR = 1.44 C FACTOR = 0.777

E_{18}'s FROM B's: (6000 VPD [AADT]) (0.10 [%T]) (1/3) (0.5 [DD]) (1.44) = 144.0

E_{18}'s FROM C's: (6000 VPD) (0.10) (2/3) (0.5) (0.777) = 155.4

$E_{18} = 144.0 + 155.4 = 299.4$

$W_{18} = (299.40)(365\ day/yr)(20\ yr) = 2,185,620$

• RELIABILITY (R) = 85% (FIG 701-11)

• OVERALL STANDARD DEVIATION (S_o) = 0.49 (FIG 701-11)

• DESIGN SERVICEABILITY LOSS (PSI)

INITIAL PSI (FIG 701-11) - TERMINAL SERVICEABILITY INDEX (P_t) (SECT 701.1)

PSI = 4.5 - 2.5 = 2.0

→ USE FIGURE 701-12 & 701-13 TO SOLVE FOR THE DESIGN STRUCTURAL NUMBER (SN)

→ NORTH ENTRANCE RD. DESIGN STRUCTURE NUMBER(SN) = 4.35

→ DETERMINE PAVEMENT THICKNESS

MATERIAL : X" ASPHALT CONCRETE (ODOT SPECS. 404 & 402) COEF. = 0.3
6" AGGREGATE BASE (ODOT SPEC 304) COEF. = 0.14

$(X)(0.35) + (6")(0.14) \geq 4.35$

$X \geq 10.03$ IN

USE = 2" AC SURFACE
8" AC BASE

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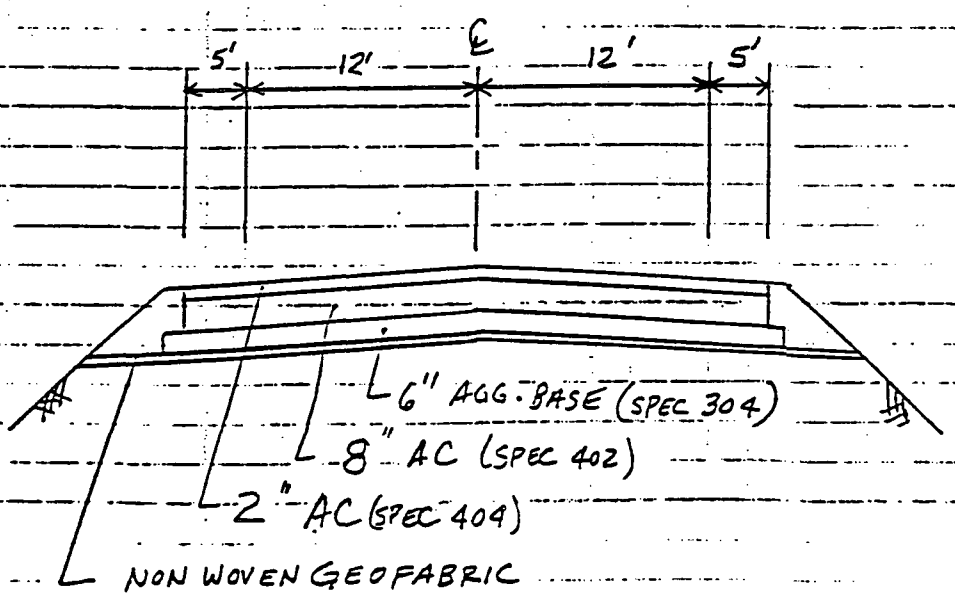
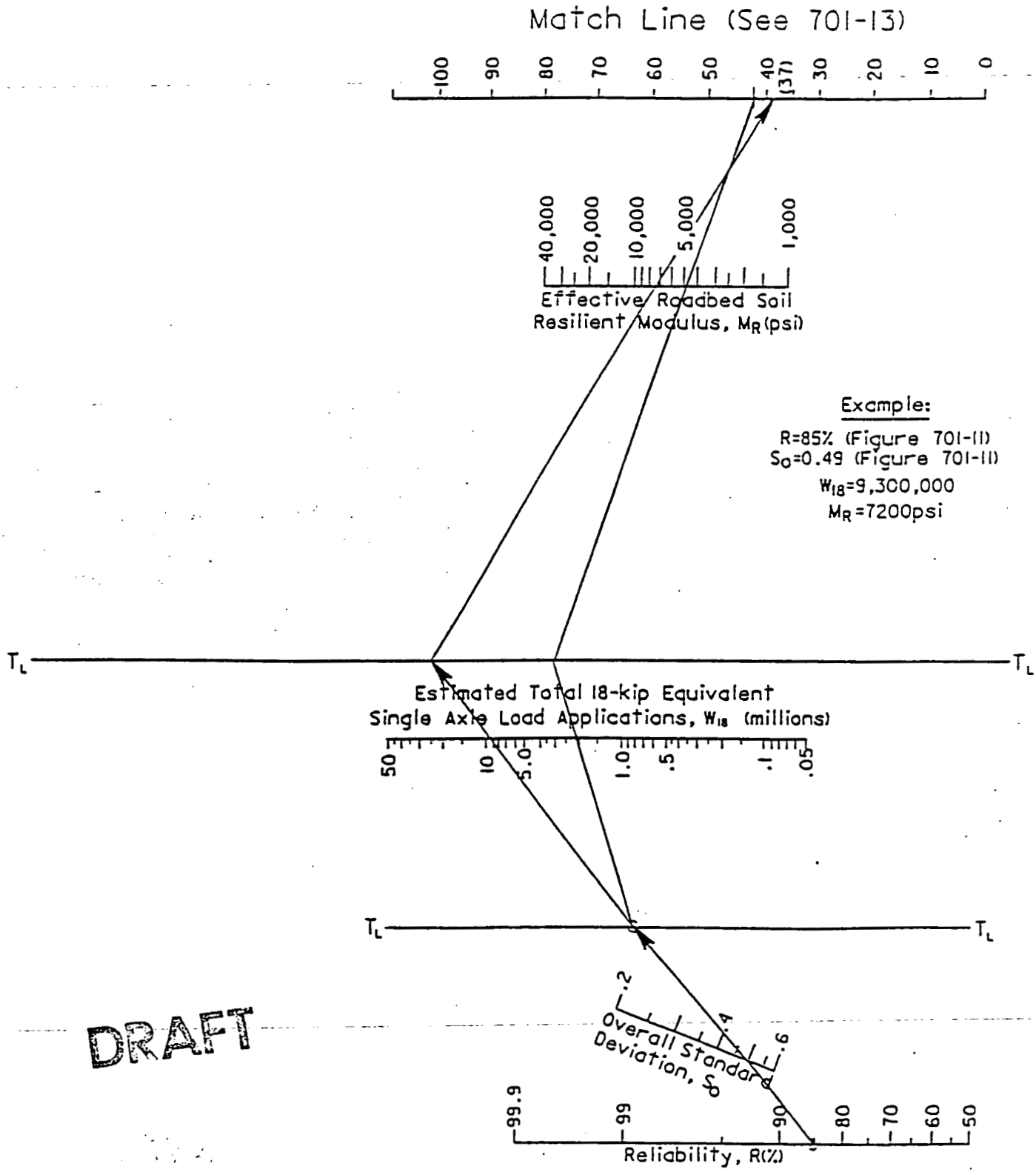


FLEXIBLE PAVEMENT DESIGN CHART SEGMENT 1

701-12

REFERENCE SECTION
FLEXIBLE PAVEMENT DESIGN
EXAMPLE - STEP 1

NORTH ENTRANCE ROAD



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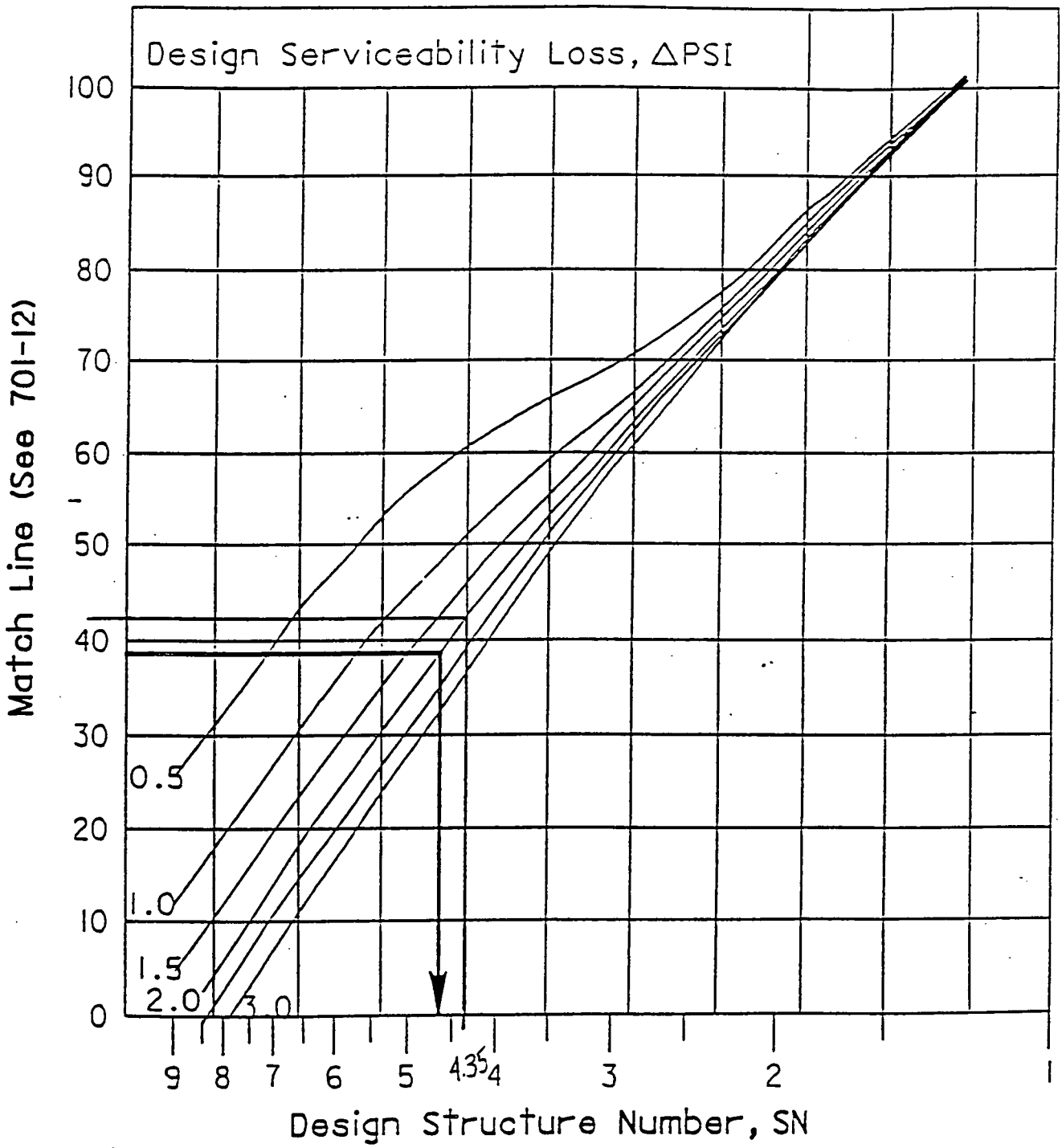
FLEXIBLE PAVEMENT DESIGN CHART SEGMENT 2

701-13

REFERENCE SECTION
FLEXIBLE PAVEMENT DESIGN EXAMPLE - STEP 1

NORTH ENTRANCE ROAD



Example: ΔPSI= 2.0

Solution: SN= 4.65

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701 Structural Design of Pavement

701.1 Introduction

The pavement design procedures described herein are intended primarily for use on new or reconstruction projects and are based on the results of the AASHO Road Test and the AASHTO Guide for Design of Pavement Structures. In addition, the application of other studies, experiences, and engineering judgments have been included to fit Ohio's conditions. A copy of ODOT's Pavement Design Policy has been included as Appendix A of this manual.

The pavement design procedure relates the performance of a pavement to its structural design and the loading applied to the pavement. The performance of a pavement is measured by its serviceability which is defined as the ability to serve high speed, high volume automobile and truck traffic. An AASHTO procedure was developed to rate the serviceability of a pavement, based on its roughness, and the number of cracks and patches. A scale with a range from 0 to 5 was established for present serviceability index ratings, with 5 as the highest index (excellent) and 0 as the lowest (poor).

The AASHTO design procedures allow for the selection of any serviceability index at the end of a design period. Ohio has adopted a design period of 20 years and a terminal serviceability index (p_t) of 2.5.

The design procedure for both rigid and flexible pavement structures centers around the investigation and evaluation of the resilient modulus of the subgrade soil and the traffic, expressed in terms of equivalent 18 Kip single axle load applications. A brief description of the resilient modulus (M_R) and equivalent 18 Kip single axle load applications (W_{18}) follows:

701.2 Subgrade Resilient Modulus (M_R)

For design of either flexible or rigid pavements, the subgrade soil type is determined directly from soil tests made in conjunction with the soil profile or bridge foundation investigations. In Ohio, soils are classified based on gradation and Atterburg Limits (liquid limit and plasticity index) in a modified AASHTO system as shown in Fig. 701-1.

Extreme caution should be exercised in choosing the representative subgrade soil for pavement design. Normally, the weakest predominant soil type present is chosen. The following procedure is then used to determine the Resiliance Modulus (M_R) of the soil:

1. Determine the Group Index from Figure 701-2.

2. Determine the California Bearing Ratio from Figure 701-3.

3. Utilize the equation on Figure 701-3 to calculate M_R.

For an example, see steps 1 and 2 of the Rigid Pavement Design accompanying the figures at the end of this section.

701.3 18 KIP Equivalent Single Axle Loading (W_{18})

Traffic information, in order to be used in pavement design, must be converted into the number of equivalent 18 Kip single axle load applications (W_{18}) over the pavement design period.

Available traffic information usually lumps together the number of B and C vehicles. Since the number of B and the number of C vehicles are required to obtain W_{18}, Figure 701-4 gives approximate ratios of B to C vehicles so the number of each can be estimated. An easy method of checking the B:C ratio is to observe the traffic at the project site. This may also reveal some severe pavement loadings, such as coal or gravel trucks which may be equivalent to 9 B or C trucks. A little thought given to the truck traffic in an area can go a long way toward determining the proper pavement thickness. Figure 701-4 B:C ratios should be used with caution.

Once the number of B and C vehicles per day is known, they are multiplied by the appropriate conversion factor (Figure 701-4) times 365 days per year, times 20 years to obtain W_{18}. W_{18} is then used in the nomographs in either Figure 701-9 or Figure 701-12.

For an example of a W_{18} calculation, see Step 3 of the Rigid Pavement Design accompanying the figures at the end of this section.

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701.4 Pavement Design Examples

Examples of both Rigid Pavement Design and Flexible Pavement Design are included with the Figures at the end of this section.

701.5 General

Recommendations in this manual are for paving materials that conform to ODOT specifications only.

Preparation of the subgrade is of prime importance. If conditions (utilities, etc.) hinder proper subgrade treatment, then a thicker pavement design should be considered. If subgrade conditions are extremely poor and require excessive pavement thickness, the thickness could be reduced by strengthening the subgrade using stabilization.

Reinforcing steel used in concrete does not strengthen it, but is only used to hold intermediate cracks tightly together.

For uncurbed pavements carrying 50 or more equivalent 18 Kip axle loads per day and for curbed pavements carrying 100 or more 18 Kip axle loads per day, a granular or stabilized subbase is considered desirable to prevent pumping for concrete pavements on fine textured soils.

701.6 Edge Course Design

701.61 Rigid Pavement

The subbase for a rigid pavement shall extend 18 inches beyond the pavement edge, or to the outside edge of the porous backfill over the pipe underdrain, or to 6" beyond the outside edge of the paved shoulder where called for in the shoulder design, whichever is greater.

Where curb and gutter or integral type 2 curb is used, subbase shall extend 12 inches back of the curb or to the outside of the porous backfill over the pipe underdrain, whichever is greater.

701.62 Composite Pavement

Concrete base shall extend beyond the wearing surface 3 inches. Subbase under the concrete base shall be treated the same as under rigid pavement.

701.63 Flexible Pavement

Subbase shall extend beyond the edge of the overlying base, a distance of 6 inches for subbase courses 9 inches or less and 12 inches for subbase thicker than 9 inches, to the outside edge of the porous backfill over the pipe underdrains, or to the outside edge of paved shoulders where called for in the shoulder design, whichever is greater.

Base courses should extend a distance equal to their own thickness beyond the overlying course. This provision will not apply when the edge of the pavement adjoins a curb or rigid type pavement. Where pipe underdrains are provided and no subbase is used, the base course should extend to the outside edge of the porous backfill over the underdrain.

Intermediate courses less than 2 inches thick, placed directly under the surface, should be shown as ending in the same vertical plane as the surface.

701.64 Paved Shoulders

All courses shall end in the same vertical plane at the outside edge of flexible paved shoulders.

702 Shoulder Design

702.1 General

Shoulders are used to provide an area for the accommodation of disabled vehicles, for the lateral support of the base and surface courses, and to improve the safety of a highway, and for future maintenance of traffic operations during maintenance and rehabilitation work..

702.2 Types

As noted in Section 301.22, there are four basic types of shoulders: paved, bituminous surface treated, stabilized aggregate, or turf. Figures 301-3 and 301-4 show when to use each type. It should be noted that turf shoulders may only be used on non-state maintained roads, at the option of the local government, if the current year ADT includes less than 250 B and C truck units. Design and use of the other types of shoulders are discussed in subsequent sections.

Figure 702-1 shows several paved shoulder designs. Bituminous surface treated and stabilized

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Example - Rigid Pavement Design

Given:

- Pavement: Dowelled, jointed concrete
- Subbase: 6" 310
- Shoulders: Tied, jointed, undowelled concrete
- Number of Lanes: 4
- Functional Classification: Principal Rural Arterial
- 1992 Traffic: 12,250 ADT
- 2012 Traffic: 25,040 ADT, 10% trucks (24 hour)
- Year pavement anticipated to be open to traffic 1996
- Soil Classification: Liquid Limit = 45, Plasticity Index = 12, 70% passing No. 200 sieve.

Problem:

Solve for thickness of concrete slab.

Solution:

Step 1 - Determine Group Index Number (G.I.) using Figure 701.2.

In chart A, solve for the Partial Group Index using the 70% Passing No. 200 Sieve and the Liquid Limit (LL) of 45. G.I. from Chart A = 7.9. In Chart B, solve for the Partial Group Index number using the 70% (55 or more) Passing No. 200 Sieve and the Plasticity Index of 12. G.I. from chart B - 0.8. The total G.I. is 7.9 plus 0.8 or 8.7 (Rounded off to 9).

Step 2 - Determine the Subgrade Resilient Modulus (M_R) using Figure 701-3.

Using the Group Index Number (G.I.) of 9 from Figure 701-2 (Step 1), the California Bearing Ratio (CBR) is 6 (Rounded). The CBR is used in the following formula to determine the Resilient Modulus.

$M_R = 1200 \times CBR = 1200 \times 6 = 7200$ psi.

Step 3 - Determine the 18 Kip Equivalent Single Axle Loading (W_{18})

If the truck volume is expressed as a percentage of peak hour traffic, as it is in the design designation, it should be multiplied by 1.6 to obtain the percentage for average daily truck traffic. Since the project probably would not be opened until 1996, the traffic period would be 1996 to 2016, with a mid-year of 2006 and an interpolated ADT of 21,203.

T_{24} = 10% (given)

D = 50% is Directional Distribution assuming ADT is evenly split over 24 hr. period.

Using Fig. 701-4

B:C ratio = 5:1

B factor = 2.16

C factor = 1.02

Lane Factor = .90

E-18's from B's

21203(.10)(5/6)(.5)(.9)(2.16) = 1717.4

E-18's from C's

21203(.10)(1/6)(.5)(.9)(1.02) = 162.2

E-18 = 1717.4 + 162.2 = 1879.6

W_{18} = 1879.6 x 365.25 days/yr x 20 yr

$w_{18} = 13{,}730{,}478$ say 13.7×10^6

Step 4 - Determine the Composite Modulus of Subgrade Reaction (K_c) using Figure 701-6.

Starting with the assumed subbase thickness (D_{SB}) of 15,000 psi (6" 310 Subbase from Figure 701-5), and down to a Subgrade Resilient Modulus (M_R) of 7200 psi (From Figure 701-3, Step 2), results in a K_c of 340 psi.

Step 5 - Determine the Effective Modulus of Subgrade Reaction (K) using Figure 701-7.

The Composite Modulus of Subgrade Reaction (K_c) is 340 pci from Figure 701-6, Step 4. The Loss of Support (LS) for the 310 Subbase is 1.0 from Figure 701-5. This results in a K of 110 pci.

Step 6 - Determine the thickness of the concrete slab using Figures 701-8 and 701-9.

Figure 701-8 is used to solve for the Match Line Number using the following information.

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Effective Modulus of Subgrade (K) = 110 pci (Figure 701-7, Step 5)

Concrete Elastic Modulus (E_c) = $3.6X10^6$ psi (Figure 701-10)

Load Transfer Coefficient (J) - 2.8 (Figure 701-10)

Drainage Coefficient (C_D) = 1.0 (Figure 701-10)

The resulting Match Line Number of 66 is then used on Figure 701-9, along with the following information, to solve for the Design Slab Thickness (D).

Design Serviceability Loss (psi) - Initial PSI (Figure 701-10) minus the (P_t) Terminal Serviceability Index (Section 701.1) or 4.2 - 2.5 = 1.7

Reliability (R) = 85% (Figure 701-11)

Overall Standard Deviation (S_o) = 0.39 (Figure 701-10)

18 Kip Equivalent (W_{18}) = $13.7X10^6$ (Step 3)

Therefore: Design Slab Thickness (D) 9.6"

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Example - Flexible Pavement Design

Given:

- Pavement: Flexible
- 18 Kip Equivalent (W_{18}): 9,300,000 (Calculated as shown in Step 3 under Rigid Design)
- Functional Classification: Principal Rural Arterial
- Resilient Modulus (M_R): 7200 psi (See Step 2 under Rigid Design)

Problem:

Solve for flexible pavement design.

Solution:

Step 1 - Determine the Design Structural Number (SN) using Figures 701-12 and 701-13.

In Figure 701-12, solve for the Match Line Number using the following information:

Reliability (R) = 85% (Figure 701-11)

Overall Standard Deviation (S_o) = 0.49 (Figure 701-11)

18 Kip Equivalent (W_{18}) = 9,300,000 (Given)

Resilient Modulus (M_R) = 7,200 psi (Given)

The resulting Match Line Number of 40 is then used on Figure 701- 13, along with the following information, to solve for the Design Structural Number (SN).

Design Serviceability Loss (PSI) = Initial PSI (Figure 701-11) minus the (P_t) Terminal Serviceability Index (Section 701.1) or 4.5 - 2.5 = 2.0

Therefore: Design Structural Number (SN) = 4.65

Step 2 - Determine flexible pavement design by equating the structural number (SN) to thickness using the structural coefficients in Figure 701-11. The total SN for the pavement design shall equal or exceed the SN from Figure 701-12.

Material	Thickness		Coefficient		SN
404	1-1/4"	X	0.35	=	0.44
402	1-3/4"	X	0.35	=	0.61
301	10-1/2"	X	0.35	=	3.68
	13-1/2"				4.73

Alternate Design Using Granular Base

404 & 402	3"	X	0.35	=	1.05
301	8"	X	0.35	=	2.80
304	6"	X	0.14	=	0.84
	17"				4.69

When full depth thickness of less than 5"± is required (SN=1.80), a granular base design is suggested.

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W_{18} CONVERSION FACTORS

701-4

REFERENCE SECTION
RIGID PAVEMENT DESIGN EXAMPLE - STEP 3

RATIO OF B TO C COMMERCIAL VEHICLES

FUNCTIONAL CLASSIFICATION	B:C RATIO
Rural Interstate	6:1
Rural Principle Arterial	5:1
→ All other Rural	1:2
Urban Interstate	2:1
Urban Freeway & Expressway	1:1
Urban Principal Arterial	6:1
All other Urban	1:6

NORTH SIERRA CO.

Use actual B and C counts when available

CONVERSION FACTORS

Function Classification	Rigid		Flexible	
	B	C	B	C
Rural Interstate	2.27	0.914	1.60	0.735
All other Rural	2.16	1.02	1.44	0.777
Urban Inter., Freeway & Exp.	2.50	1.48	1.74	1.13
All other Urban	1.61	0.673	1.11	0.534

Notes:

B= Tractor-trucks with semi-trailers and trucks with trailers.

C= Single unit trucks (2 axle, 6 tires or more) not included in A.

The information on this figure will be periodically updated by the Bureau of Technical Services.

LANE FACTORS

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NUMBER OF LANES	% TRUCKS IN DESIGN LANE
4 - Lane Divided	90
6 (or more) - Lane Divided	80

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PAVEMENT DESIGN RELIABILITY LEVELS AND FLEXIBLE PAVEMENT DESIGN FACTORS	701-11
	REFERENCE SECTION: FLEXIBLE PAVEMENT DESIGN EXAMPLE - STEPS 1 & 2

PAVEMENT DESIGN RELIABILITY LEVELS

FUNCTIONAL CLASSIFICATION	RELIABILITY LEVELS (%)(R) URBAN	RURAL
Interstate and Freeway	95	90
Principle Arterials	90	85
Collectors	90	85
Local	80	80

FLEXIBLE PAVEMENT DESIGN FACTORS

Initial PSI	4.5
Overall Standard Deviation (S_0)	0.49

STRUCTURAL COEFFICIENTS

Asphalt Concrete (404,402;301,448,446)	0.35
Aggregate Base (304)	0.14
Subbase (310)	0.11
Broken and Seated Concrete	0.27
Existing Asphalt	0.23
Rubblized Concrete	0.14

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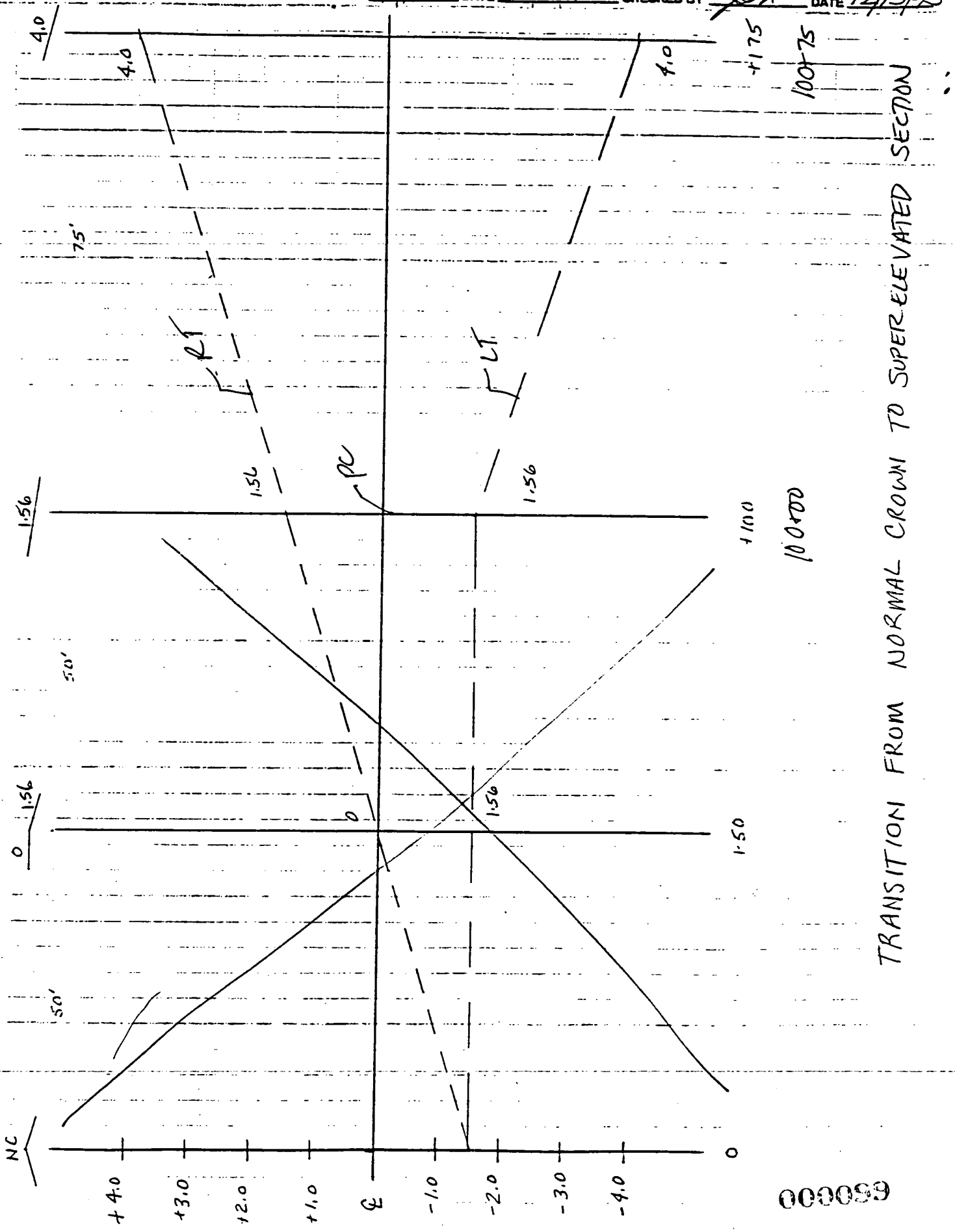

TRANSITION FROM NORMAL CROWN TO SUPERELEVATED SECTION

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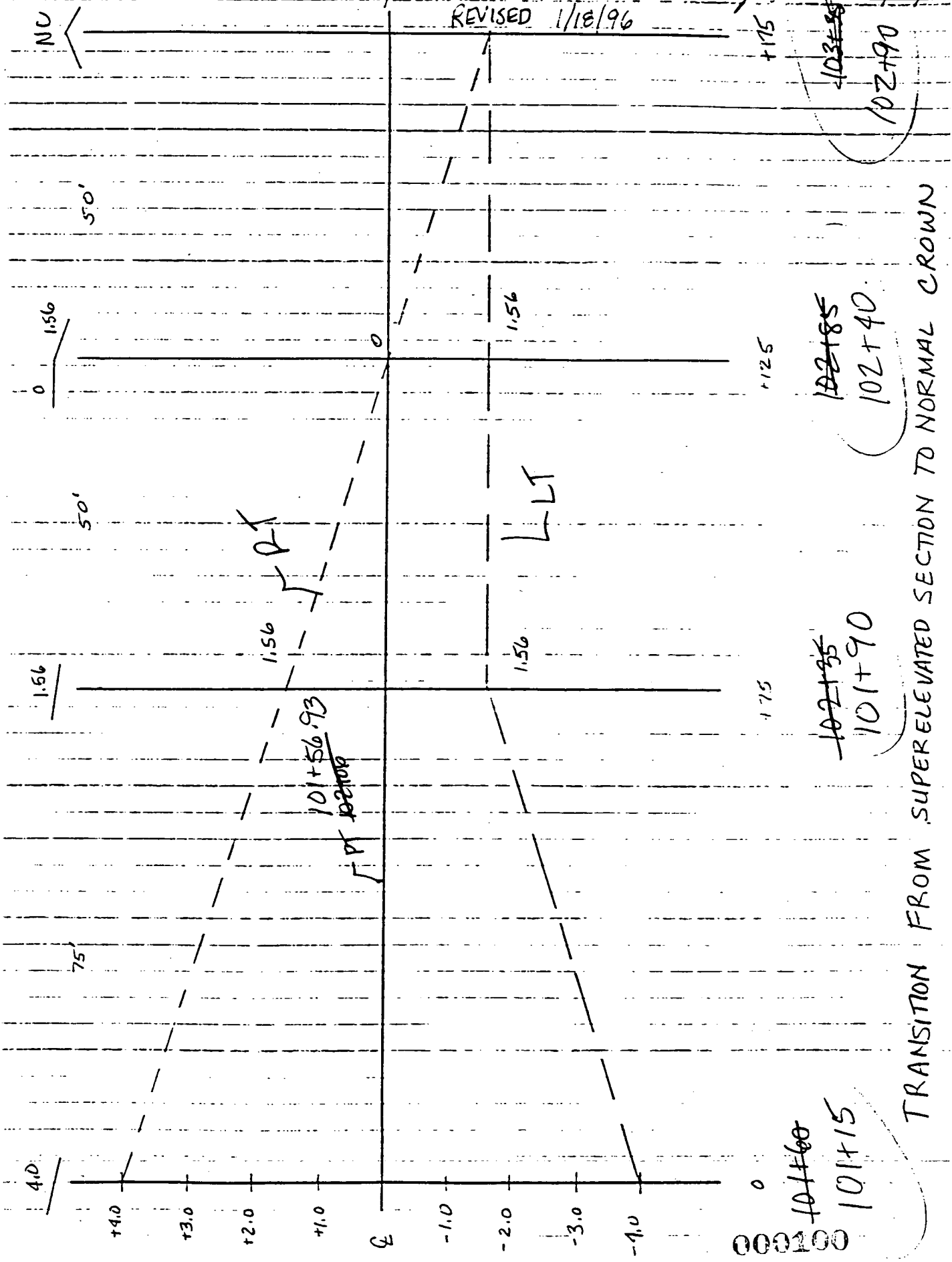

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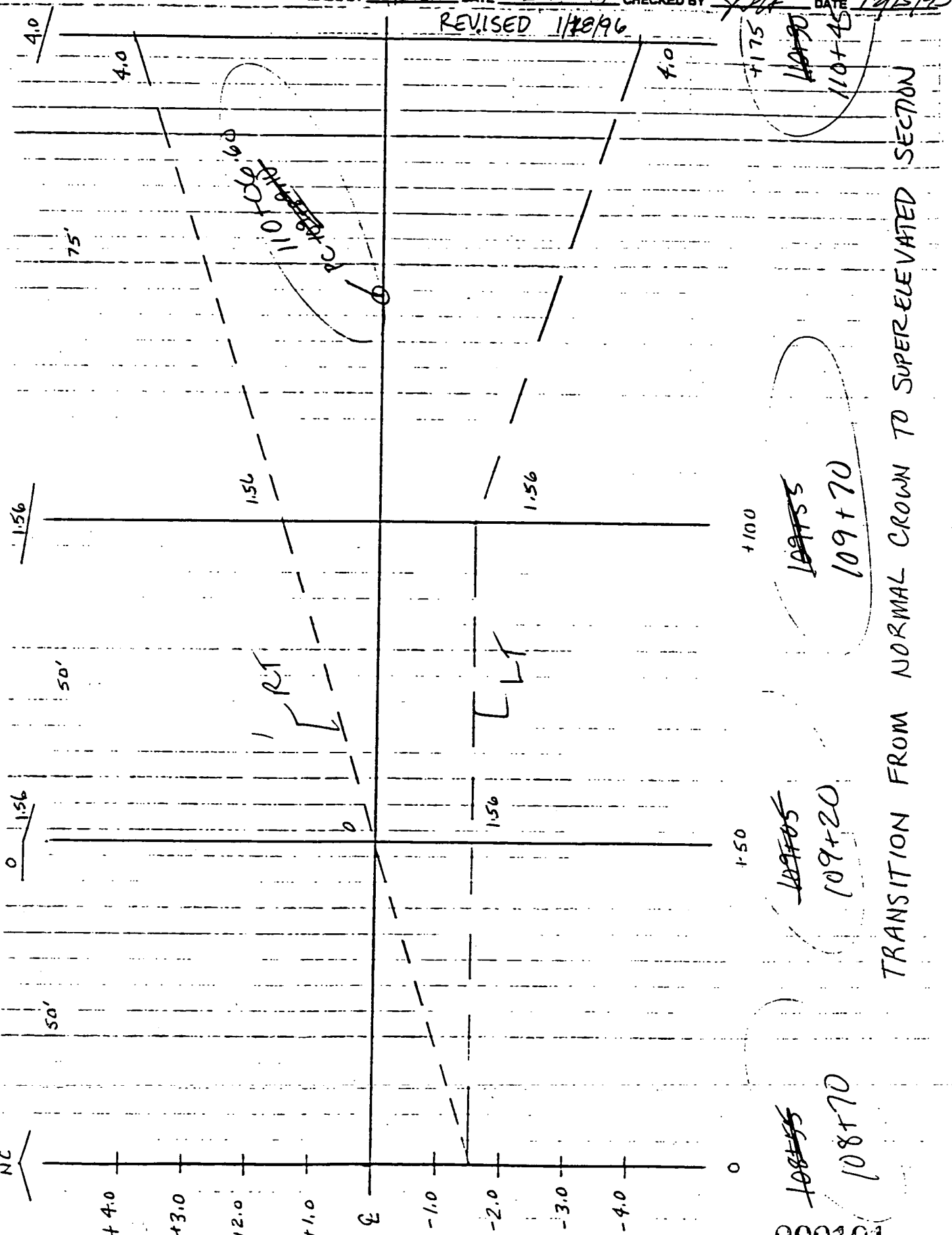

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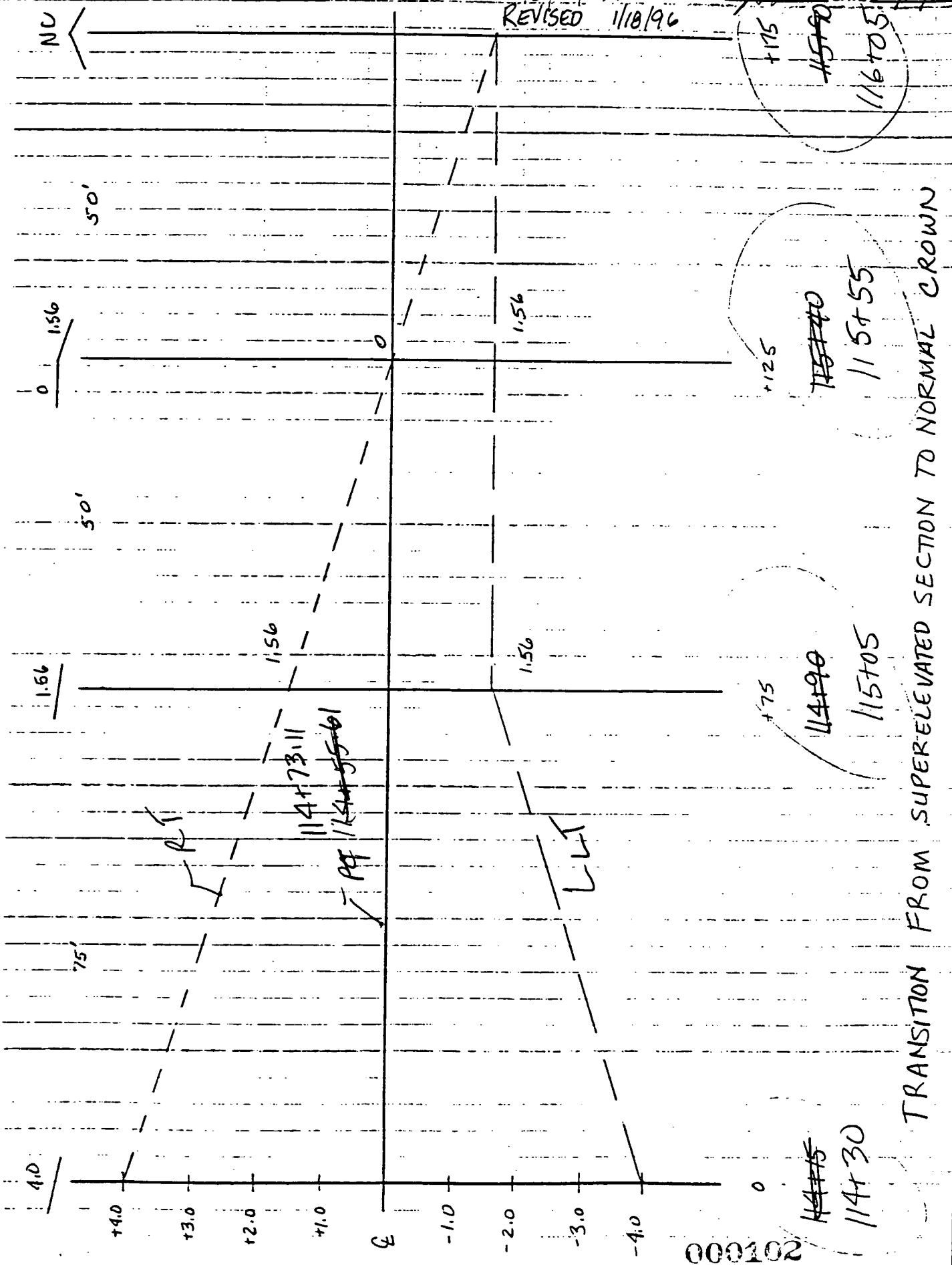

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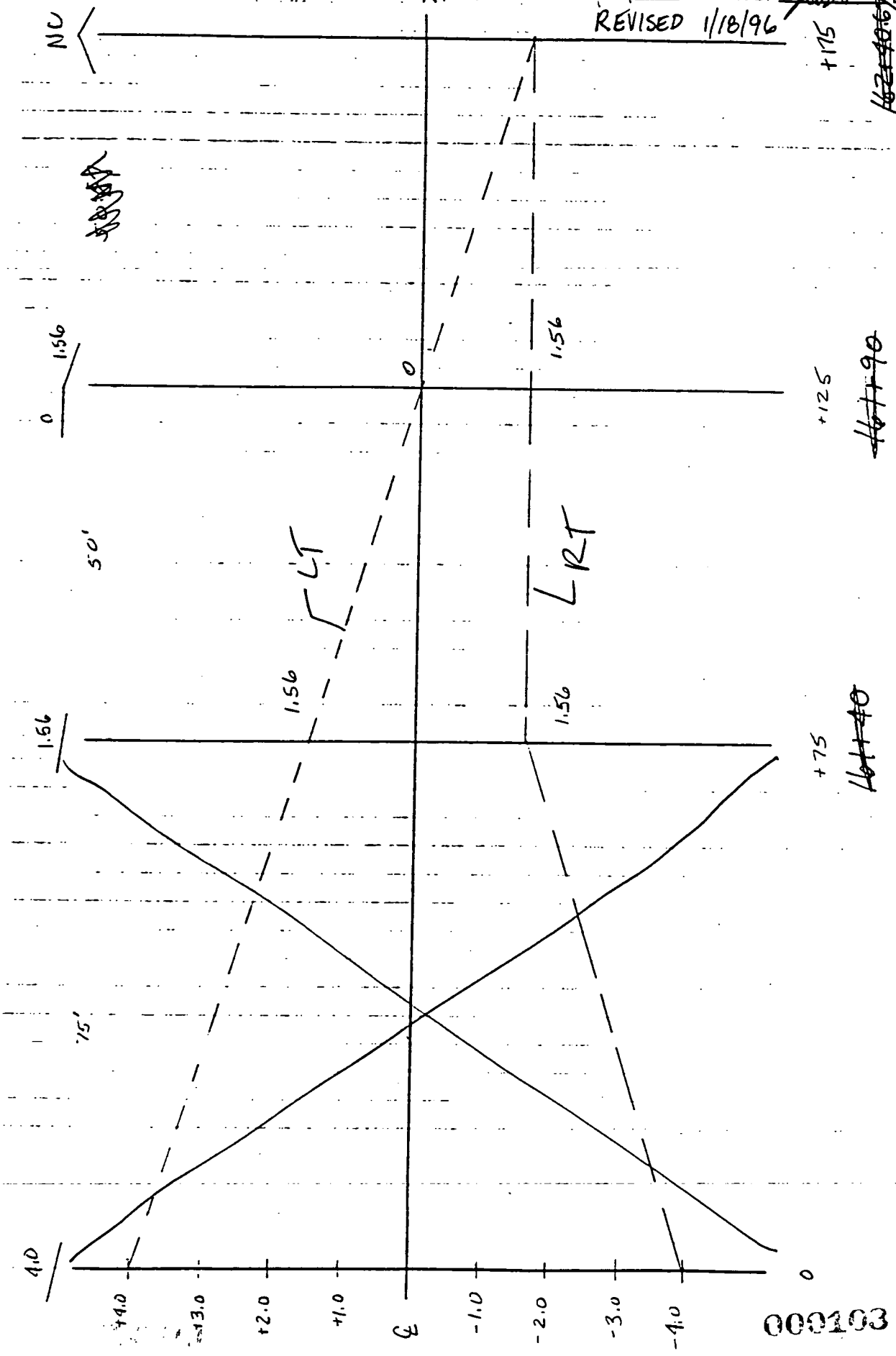

TRANSITION FROM SUPERELEVATED SECTION TO NORMAL CROWN

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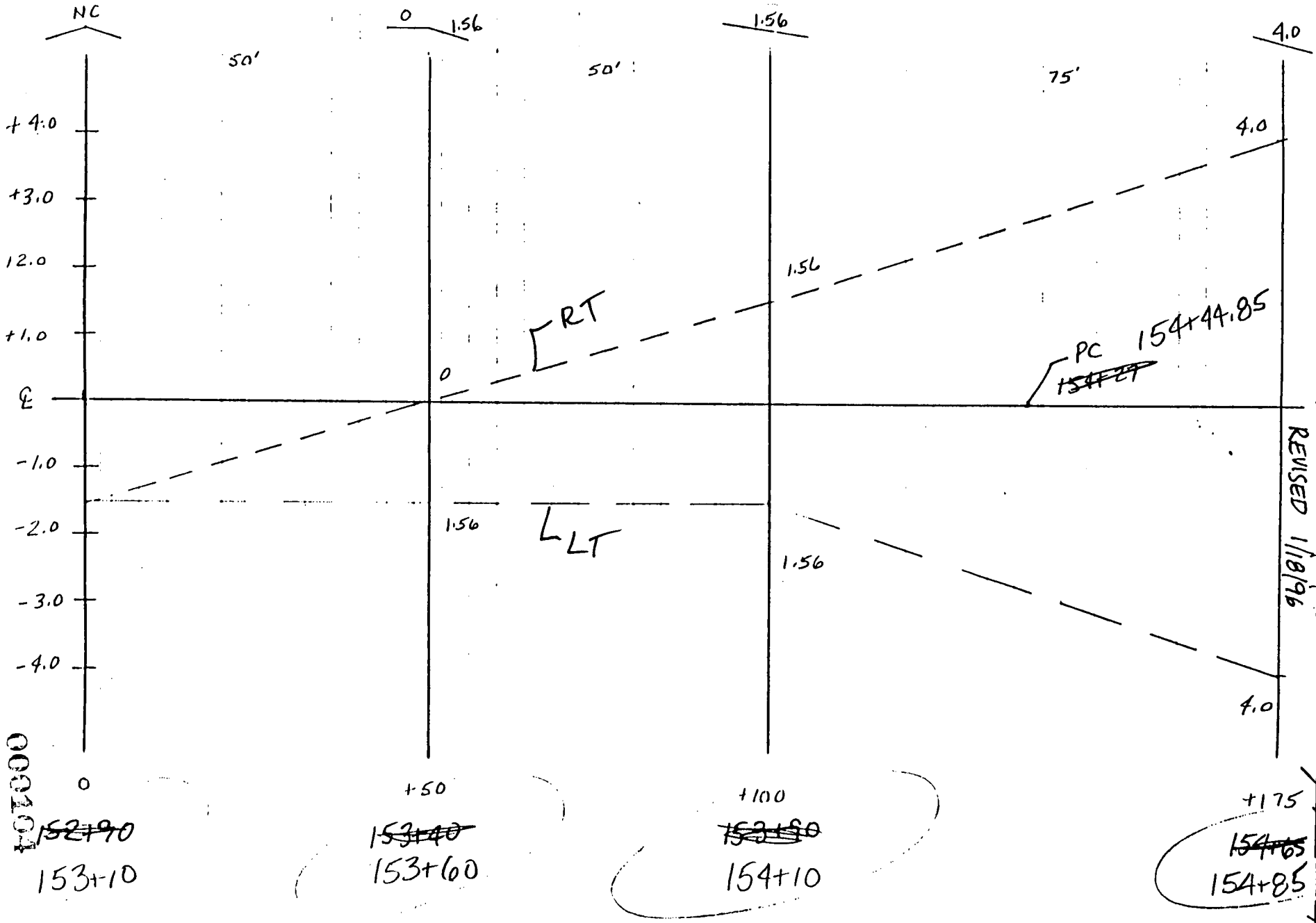

TRANSITION FROM NORMAL CROWN TO SUPERELEVATED SECTION

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SUPERELEVATION TRANSITIONS SHEET NO. 6 OF 11
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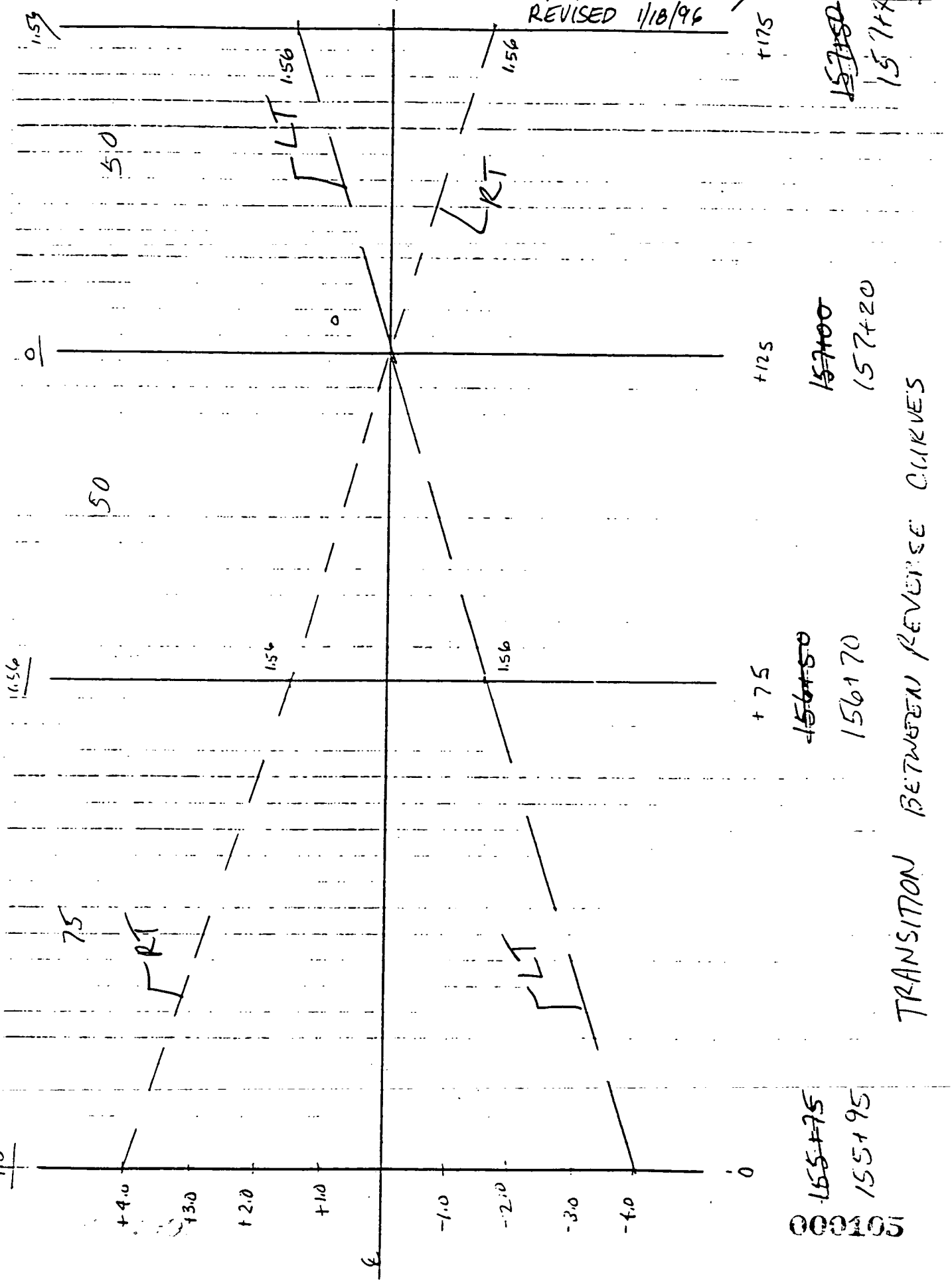

TRANSITION BETWEEN REVERSE CURVES

00105

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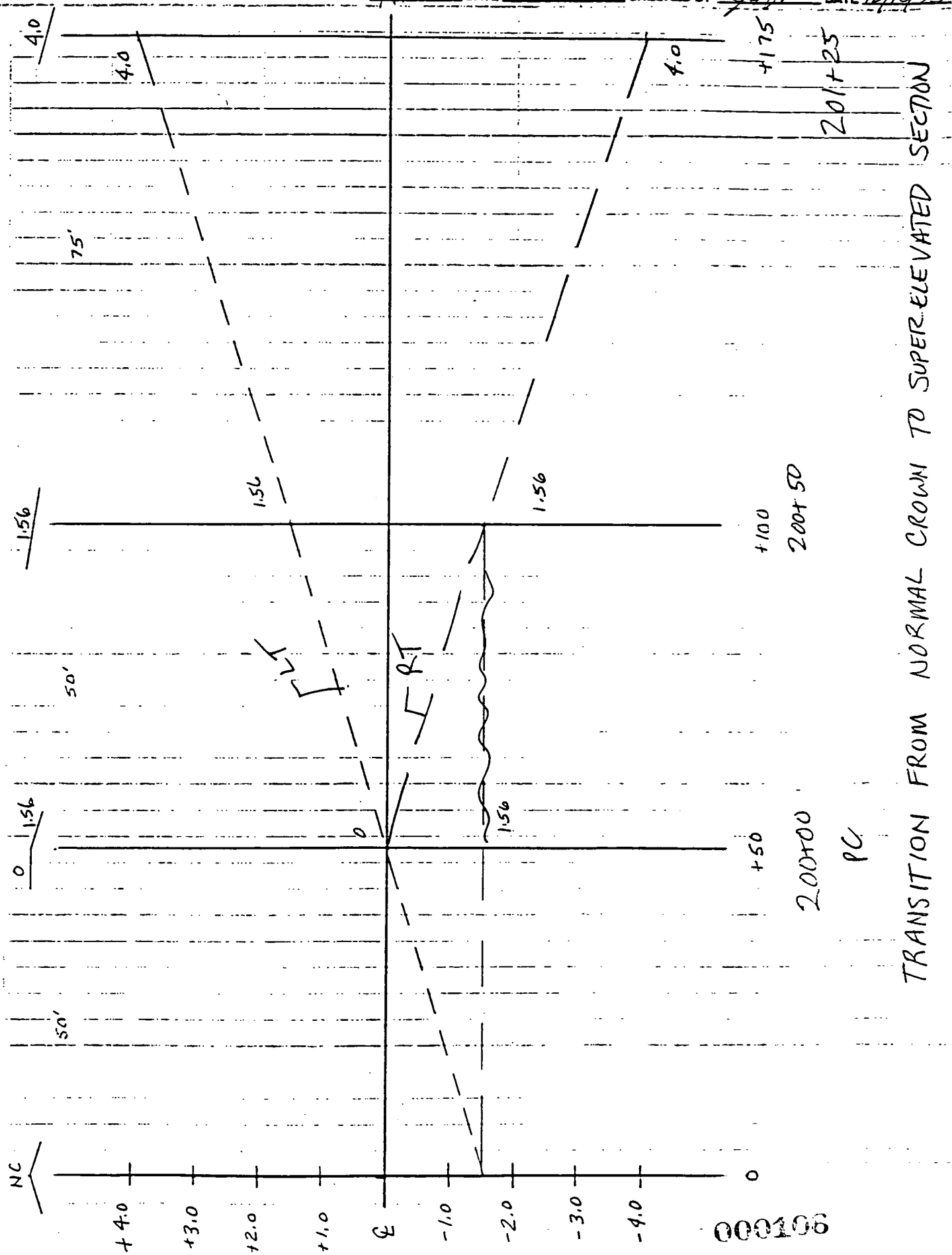

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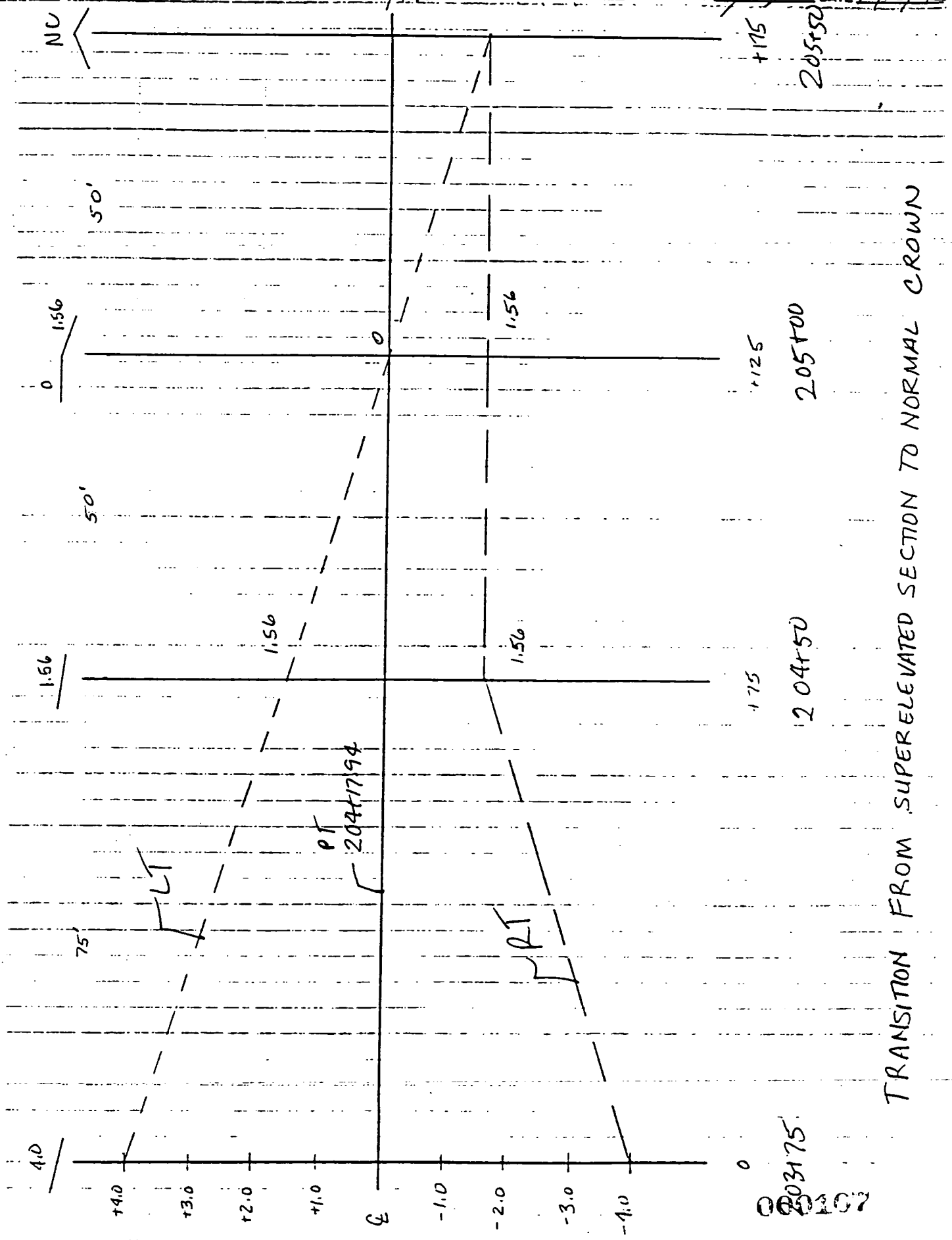

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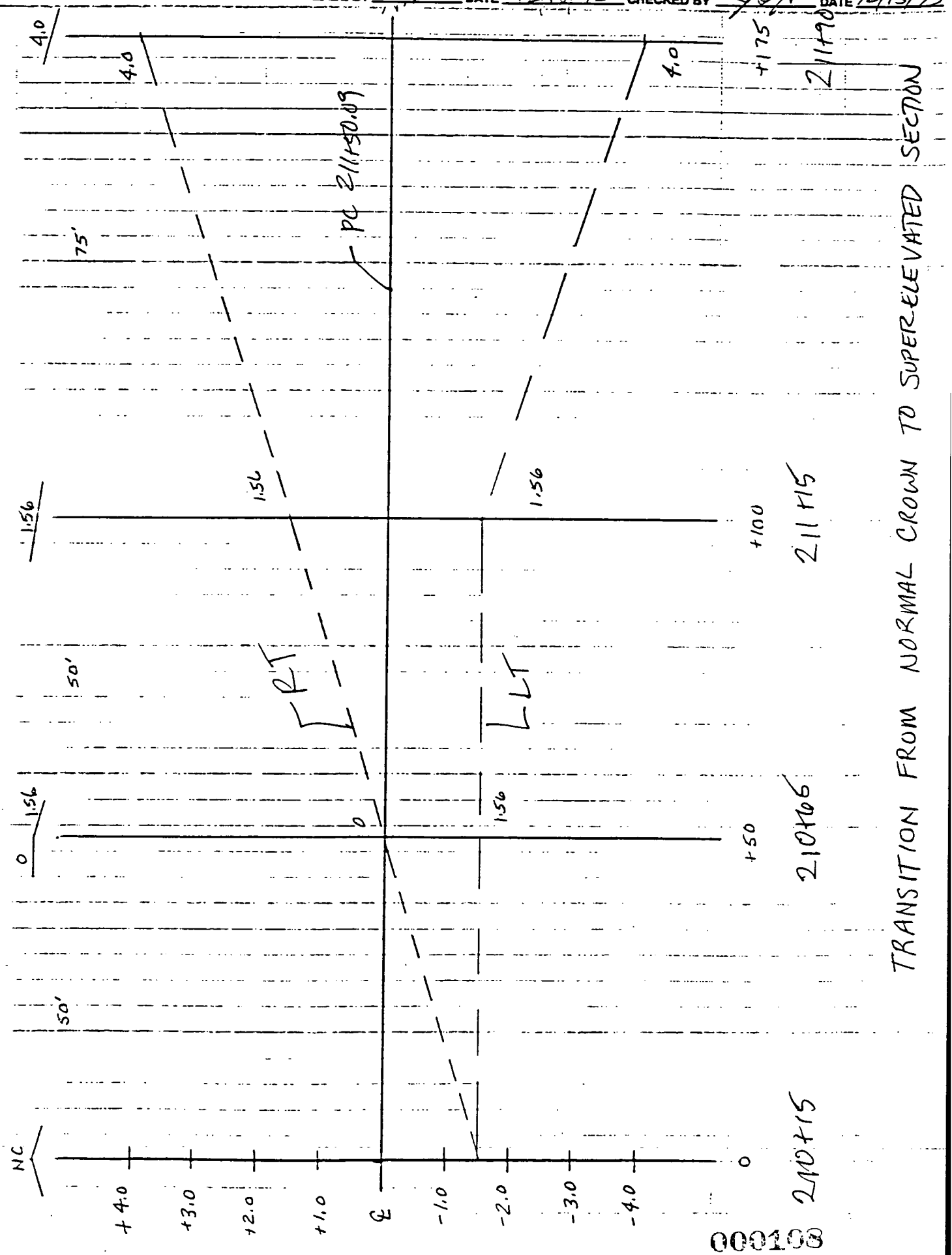
SUBJECT NORTH ENTRANCE RD. JOB NO. 660620 | 02200
SUPERELEVATION TRANSITIONS SHEET NO. 10 OF 11
MADE BY DMC DATE 12/15/95 CHECKED BY [illegible] DATE 12/15/95

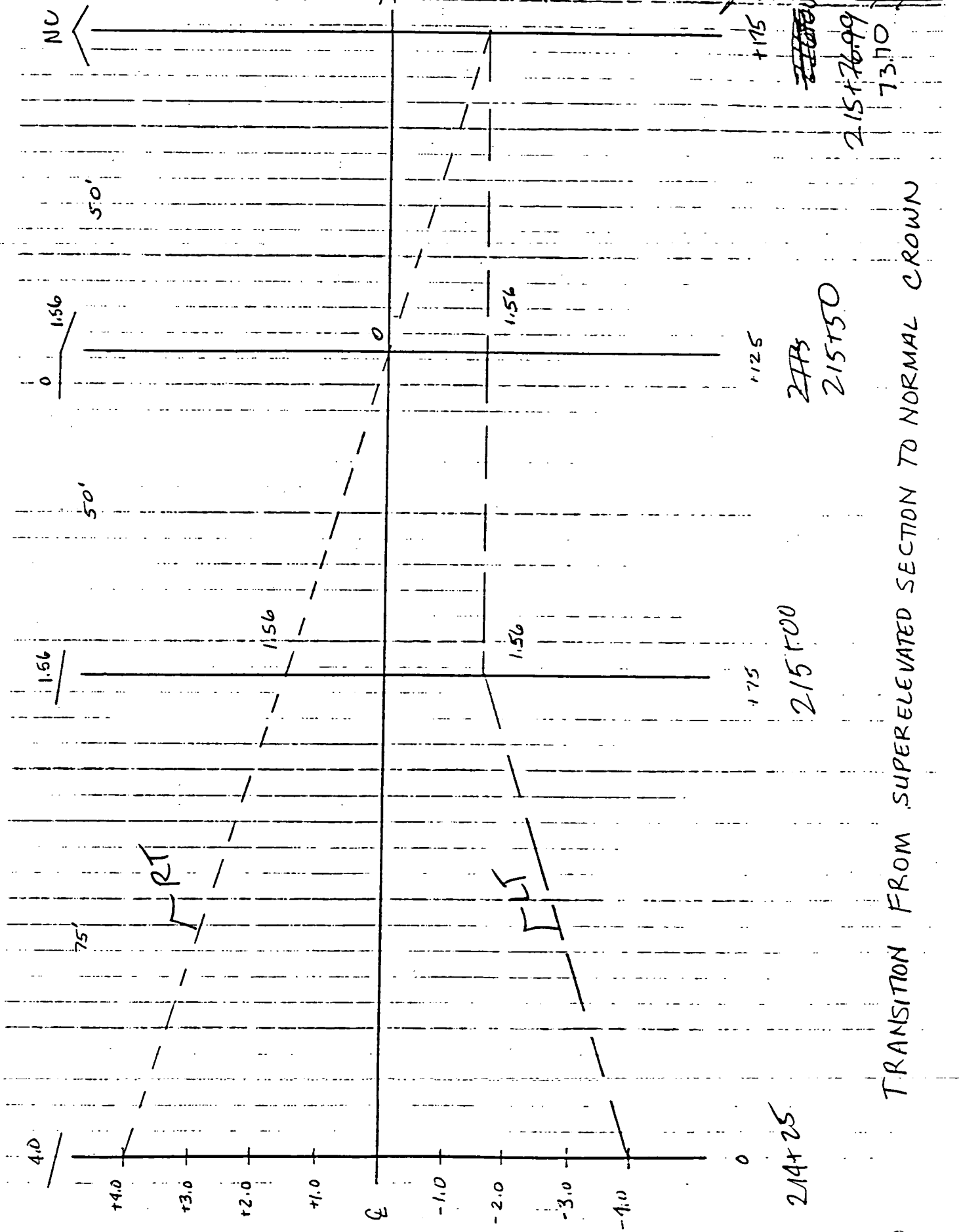


TRANSITION FROM NORMAL CROWN TO SUPERELEVATED SECTION

000103

DE LEUW, CATHER
Engineers and Planners

SUBJECT NORTH ENTRANCE RD JOB NO. 660620
SUPERELEVATION TRANSITIONS SHEET NO. 11 OF 11
MADE BY HMC DATE 12/15/95 CHECKED BY [illegible] DATE 12/15/95



De Leuw, Cather
Engineers and Planners

Subject: North Entrance Rd **Job No.** 660620
Sheet No. 1 of 1
Made by: Anne **Date:** 12/4/95
Checked by: [illegible] **Date:** 12/11/95
REV 1/22/96

304 - 20000 AGGREGATE BASE

Thickness= 6 in.
Width= (2)(12' lanes) + (2)(5' shld) + (2)(1') = 36 ft.

PHASE I:

Sta 200 + 00 to 215 + 73.70 = 1573.70 ft

Sta 137 + 78 to 162 + 58.18 = 2480.18 ft

4053.88 4054 ft

Volume: (4054 ft)*(36 ft)*(6in /12)*(1cu yd /27 cu ft) = 2702.667

(4054 ft)*(2 ft)(5 ft)*(10 in/12)*(1cu yd/27 cu ft) 1251.235

Total: 3955 cu yd

PHASE II:

Sta 100 + 00 to 137 + 78 = 3778 ft

Volume: (3778 ft)*(36 ft)*(6 in /12)*(1 cu yd /27 cu ft)= 2518.667

(3778 ft)*(2)(5 ft)*(10 in /12)*(1 cu yd /27 cu ft) 1166.049

Total: 3689 cu yd

De Leuw, Cather
Engineers and Planners

Subject: North Entrance Rd **Job No.** 660620
Sheet No. 1 of 1
Made by: AMC **Date:** 12/11/95
Checked by: [illegible] **Date:** 12/11/95

REV 1/22/96

402 - 20000 ASPHALT CONCRETE

Thickness= 8 in
Width= (2)(12' lanes)= 24 ft

PHASE I:

Sta 200 + 00 to 215 + 73.70 = 1573.70 ft

Sta 137 + 78 to 162 + 58.18 = 2480.18 ft

4053.88 4054 ft

Volume: (4054 ft)*(24 ft)*(8 in/12)*(1 cu yd/27 cu ft)= 2402.37

Total: 2403 cu yd

PHASE II:

Sta 100 + 00 to 137 + 78 = 3778 ft

Volume: (3778 ft)*(24 ft)*(8 in/12)*(1cu yd/27 cu ft)= 2238.815

Total: 2239 cu yd

De Leuw, Cather
Engineers and Planners

Subject: North Entrance Rd **Job No.** 660620
Sheet No. 1 of 1
Made by: AMC **Date:** 12/11/95
Checked by: [illegible] **Date:** 12/11/95
REV 1/22/96

404 - 20000 ASPHALT CONCRETE

Thickness= 2 in
Width= (2)(12' lanes) 24 ft

PHASE I :

Sta 200 + 00 to 215 + 73.70 = 1573.70 ft

Sta 137 + 78 to 162 + 58.18 = 2480.18 ft

4053.88 4054 ft

Volume: (4054 ft)*(24 ft)*(2 in/12)*(1cu yd/27 cu ft) = 600.5926

Total: 600 cu yd

PHASE II:

Sta 100 + 00 to 137 + 78 = 3778 ft

Volume: (3778 ft)*(24 ft)*(2 in/12)*(1 cu yd/27 cu ft) = 559.7037

Total: 560 cu yd

De Leuw, Cather
Engineers and Planners

Subject: North Entrance Rd
Job No. 660620
Sheet No. 1 of 1
Made by: JMC
Date: 12/11/95
Checked by SJH
Date: 12/11/95
REV 1/22/96

408 - 10000 BITUMINOUS PRIME COAT

PHASE I :	(4054 ft)*(24 ft)*(1 sq yd/9 sq ft) =	10810.67	sq yd
	(0.5 gal/1 sq yd)*(10811 sq yd) =	5405.5	gal
	Phase I Total:	**5406**	**gal**
PHASE II :	(3778 ft)*(24 ft)*(1 sq yd/9 sq ft) =	10074.67	sq yd
	(0.5 gal/1 sq yd)*(10075 sq yd) =	5037.5	
	Phase II Total:	**5040**	**gal**

De Leuw, Cather
Engineers and Planners

Subject: North Entrance R **Job No.** 660620
Sheet No. 1 of 1
Made by: [illegible] **Date:** 12/11/95
Checked by: [illegible] **Date:** 12/11/95

REV 1/22/96

NON - WOVEN GEOTEXTILES

Typical Width= 34' Pavt + 3' Rt + 3' Lt = 40 ft

PHASE I : Sta 200 + 00 to 215 + 73.70 = 1573.70 ft

Sta 137 + 78 to 162 + 58.18 = 2480.18 ft

4053.88 4054 ft

Area: (4054 ft)*(40 ft)*(1 sq yd/9 sq f 18017.78

Phase I Total: 18018 sq yd

PHASE II: Sta 100 + 00 to 137 + 78 = 3778 ft

Area: (3778 ft)*(40 ft)*(1 sq yd/9 sq f 16791.11

Phase II Total: 16792 sq yd

B- 211

DE LEUW, CATHER AND COMPANY
ENGINEERS

JOB NO. 6 6606
DATE, JAN 23, 199
DATA BY
PAGE NO. 1

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 NORTH ENTRANCE ROAD - MAINLINE

STATION	P.G. ELEV	GRADE-LVC	OFFSET	TAN ELEV
10000.0000	580.0000			
10050.0000	580.5167			
10100.0000	581.0333			
10150.0000	581.5500			
10200.0000	582.0667			
10250.0000	582.5833			
10300.0000	583.1000			
10350.0000	583.6167			
10400.0000	584.1333			
10450.0000	584.6500			
10500.0000	585.1667			
10550.0000	585.6833			
10600.0000	586.2000			
10650.0000	586.7167			
10700.0000	587.2333			
10750.0000	587.7500			
10800.0000	588.2667			
10850.0000	588.7833			
10900.0000	589.3000			
10950.0000	589.8167			
11000.0000	590.3333			
11050.0000	590.8500			
11100.0000	591.3667			
11150.0000	591.8833			
11200.0000	592.4000			
11250.0000	592.9167			
11300.0000	593.4333	PVC 1.0333		
11350.0000	593.9333			
11400.0000	594.4000			
11450.0000	594.8333			
11500.0000	595.2333	PVI 400.00	-.2667	595.5000
11550.0000	595.6000			
11600.0000	595.9333			
11650.0000	596.2333			
11700.0000	596.5000	PVT .5000		
11750.0000	596.7500			
11800.0000	597.0000			
11850.0000	597.2500			
11900.0000	597.5000			
11950.0000	597.7500			
12000.0000	598.0000			
12050.0000	598.2500			
12100.0000	598.5000			
12150.0000	598.7500			
12200.0000	599.0000			
12250.0000	599.2500			
12300.0000	599.5000			
12350.0000	599.7500			
12400.0000	600.0000			
12450.0000	600.2500			

DE LEUW, CATHER AND COMPANY
ENGINEERS

JOB NO. 6 6606
DATE, JAN 23, 199
DATA BY
PAGE NO. 2

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 NORTH ENTRANCE ROAD - MAINLINE

STATION	P.G. ELEV	GRADE-LVC	OFFSET	TAN ELEV
12500.0000	600.5000			
12550.0000	600.7500			
12600.0000	601.0000			
12650.0000	601.2500			
12700.0000	601.5000			
12750.0000	601.7500			
12800.0000	602.0000			
12850.0000	602.2500			
12900.0000	602.5000			
12950.0000	602.7500			
13000.0000	603.0000			
13050.0000	603.2500			
13100.0000	603.5000			
13150.0000	603.7500			
13200.0000	604.0000			
13250.0000	604.2500			
13300.0000	604.5000			
13350.0000	604.7500			
13400.0000	605.0000			
13450.0000	605.2500			
13500.0000	605.5000			
13550.0000	605.7500			
13600.0000	606.0000			
13650.0000	606.2500			
13700.0000	606.5000			
13750.0000	606.7500			
13800.0000	607.0000			
13850.0000	607.2500			
13900.0000	607.5000			
13950.0000	607.7500			
14000.0000	608.0000			
14050.0000	608.2500			
14100.0000	608.5000			
14150.0000	608.7500			
14200.0000	609.0000			
14250.0000	609.2500			
14300.0000	609.5000			
14350.0000	609.7500			
14400.0000	610.0000			
14450.0000	610.2500			
14500.0000	610.5000			
14550.0000	610.7500			
14600.0000	611.0000			
14650.0000	611.2500			
14700.0000	611.5000			
14750.0000	611.7500			
14800.0000	612.0000			
14850.0000	612.2500			
14900.0000	612.5000			
14950.0000	612.7500			

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DE LEUW, CATHER AND COMPANY
ENGINEERS

JOB NO. 6 6606
DATE, JAN 23, 199
DATA BY
PAGE NO. 3

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 NORTH ENTRANCE ROAD - MAINLINE

STATION	P.G. ELEV		GRADE-LVC	OFFSET	TAN ELEV
15000.0000	613.0000	PVC	.5000		
15050.0000	613.2031				
15100.0000	613.3125				
15133.3333	613.3333				
15150.0000	613.3281				
15200.0000	613.2500	PVI	400.00	-.7500	614.0000
15250.0000	613.0781				
15300.0000	612.8125				
15350.0000	612.4531				
15400.0000	612.0000	PVT	-1.0000		
15450.0000	611.5000				
15500.0000	611.0000				
15550.0000	610.5000				
15600.0000	610.0000	PVC	-1.0000		
15650.0000	609.5856				
15700.0000	609.3423	PVI	200.00	.3423	609.0000
15746.0860	609.2696				
15750.0000	609.2701				
15800.0000	609.3691	PVT	.3691		
15850.0000	609.5536				
15900.0000	609.7381				
15950.0000	609.9226				
16000.0000	610.1072				
16050.0000	610.2917				
16100.0000	610.4762				
16150.0000	610.6608				
16200.0000	610.8453				
16250.0000	611.0298				
16258.1800	611.0600				

Stop - Program terminated.

DE LEUW, CATHER AND COMPANY
ENGINEERS

JOB NO. 6 6606
DATE, JAN 23, 199
DATA BY
PAGE NO. 1

PROGRAM VRTALGN1 VERTICAL PROFILE GRADE ALIGNMENT
20 NORTH ENTRANCE ROAD - BYPASS LOOP

STATION	P.G. ELEV		GRADE-LVC	OFFSET	TAN ELEV
20000.0000	585.5000				
20050.0000	585.9500				
20100.0000	586.4000				
20150.0000	586.8500				
20200.0000	587.3000				
20250.0000	587.7500				
20300.0000	588.2000				
20350.0000	588.6500				
20400.0000	589.1000				
20450.0000	589.5500				
20500.0000	590.0000				
20550.0000	590.4500				
20600.0000	590.9000	PVC	.9000		
20650.0000	591.3961				
20700.0000	591.9843				
20750.0000	592.6647				
20800.0000	593.4373	PVI	400.00	.7373	592.7000
20850.0000	594.3020				
20900.0000	595.2589				
20950.0000	596.3079				
21000.0000	597.4491	PVT	2.3745		
21050.0000	598.6364				
21100.0000	599.8236				
21150.0000	601.0109				
21200.0000	602.1982				
21250.0000	603.3855	PVC	2.3745		
21300.0000	604.4553				
21350.0000	605.2904	PVI	200.00	-.4696	605.7600
21400.0000	605.8907				
21450.0000	606.2562	PVT	.4962		
21500.0000	606.5043				
21550.0000	606.7524				
21573.7000	606.8700				

Stop - Program terminated.

* 1 Describe Chain NE2

Chain NE2 contains:
CUR NE2-1 CUR NE2-2 CUR NE2-3 CUR NE2-4 CUR NE2-5

Beginning chain NE2 description

Curve Data

Curve NE2-1

P.I. Station	100+80.94	N	478,833.7076	E	1,350,453.5778
Delta =	34° 34' 21.63"	(LT)			
Degree =	22° 01' 48.69"				
Tangent =	80.9374				
Length =	156.9332				
Radius =	260.0785				
External =	12.3030				
Long Chord =	154.5632				
Mid. Ord. =	11.7473				
P.C. Station	100+00.00	N	478,879.7900	E	1,350,387.0400
P.T. Station	101+56.93	N	478,833.5199	E	1,350,534.5149
C.C.		N	479,093.5977	E	1,350,535.1179
Back = S	55° 17' 40.14" E				
Ahead = S	89° 52' 01.77" E				
Chord Bear = S	72° 34' 50.96" E				

Course from PT NE2-1 to PC NE2-2 S 89° 52' 01.77" E Dist 849.6701

Curve Data

Curve NE2-2

P.I. Station	113+01.91	N	478,830.8653	E	1,351,679.4850
Delta =	89° 05' 44.64"	(LT)			
Degree =	19° 05' 54.74"				
Tangent =	295.3031				
Length =	466.5055				
Radius =	300.0008				
External =	120.9557				
Long Chord =	420.9041				
Mid. Ord. =	86.2008				
P.C. Station	110+06.60	N	478,831.5500	E	1,351,384.1828
P.T. Station	114+73.11	N	479,126.1200	E	1,351,684.8300
C.C.		N	479,131.5500	E	1,351,384.8783
Back = S	89° 52' 01.77" E				
Ahead = N	1° 02' 13.59" E				
Chord Bear = N	45° 35' 05.91" E				

Course from PT NE2-2 to PC NE2-3 N 0° 38' 46.17" E Dist 3,971.7450

Curve Data

Curve NE2-3

P.I. Station	155+66.27	N	483,219.0196	E	1,351,730.9901
Delta =	22° 52' 40.98"	(LT)			
Degree =	9° 32' 55.12"				
Tangent =	121.4149				
Length =	239.5948				
Radius =	600.0410				
External =	12.1606				
Long Chord =	238.0062				
Mid. Ord. =	11.9190				
P.C. Station	154+44.85	N	483,097.6124	E	1,351,729.6208
P.T. Station	156+84.45	N	483,331.4085	E	1,351,685.0520

C.C.			N	483,104.3793	E	1,351,129.6179
Back	= N	0° 38' 46.17" E				
Ahead	= N	22° 13' 54.81" W				
Chord Bear	= N	10° 47' 34.32" W				

Course from PT NE2-3 to PC NE2-4 N 22° 13' 54.80" W Dist 73.0008

Curve Data

Curve NE2-4						
P.I. Station		159+24.27	N	483,553.4006	E	1,351,594.3145
Delta	=	31° 04' 42.98"	(RT)			
Degree	=	9° 33' 01.29"				
Tangent	=	166.8195				
Length	=	325.4182				
Radius	=	599.9332				
External	=	22.7614				
Long Chord	=	321.4434				
Mid. Ord.	=	21.9294				
P.C. Station		157+57.45	N	483,398.9825	E	1,351,657.4317
P.T. Station		160+82.87	N	483,718.2355	E	1,351,619.9700
C.C.			N	483,625.9708	E	1,352,212.7660
Back	= N	22° 13' 54.81" W				
Ahead	= N	8° 50' 48.17" E				
Chord Bear	= N	6° 41' 33.32" W				

Course from PT NE2-4 to PC NE2-5 N 8° 50' 48.17" E Dist 105.2336

Curve Data

Curve NE2-5						
P.I. Station		162+23.22	N	483,856.9221	E	1,351,641.5556
Delta	=	9° 39' 10.49"	(RT)			
Degree	=	13° 46' 27.23"				
Tangent	=	35.1229				
Length	=	70.0795				
Radius	=	415.9636				
External	=	1.4802				
Long Chord	=	69.9967				
Mid. Ord.	=	1.4750				
P.C. Station		161+88.10	N	483,822.2171	E	1,351,636.1540
P.T. Station		162+58.18	N	483,890.2301	E	1,351,652.7000
C.C.			N	483,758.2454	E	1,352,047.1690
Back	= N	8° 50' 48.17" E				
Ahead	= N	18° 29' 58.66" E				
Chord Bear	= N	13° 40' 23.42" E				

==========

Ending chain NE2 description

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GEOPAK

Project: haulii
Subject:
Job No. 660 Operator: MB
Date: Thursday January 25, 1996 12:10 pm
SYSTEM FIX 4 ASEC 2 BEAR PRI 0 NOR NE STA 2 FILE: 'NE1'

* 1 Describe Chain NE1

Chain NE1 contains:
CUR NE1-1 CUR NE1-2

Beginning chain NE1 description

		Curve Data				
Curve NE1-1						
P.I. Station		202+19.62	N	480,390.7382	E	1,350,876.1242
Delta	=	43^ 32' 30.76" (RT)				
Degree	=	10^ 25' 09.78"				
Tangent	=	219.6192				
Length	=	417.8930				
Radius	=	549.8960				
External	=	42.2342				
Long Chord	=	407.9094				
Mid. Ord.	=	39.2218				
P.C. Station		200+00.00	N	480,171.1900	E	1,350,870.5400
P.T. Station		204+17.89	N	480,546.0355	E	1,351,031.4155
C.C.			N	480,157.2078	E	1,351,420.2582
Back	= N	1^ 27' 25.25" E				
Ahead	= N	44^ 59' 56.01" E				
Chord Bear	= N	23^ 13' 40.63" E				

Course from PT NE1-1 to PC NE1-2 N 44^ 59' 56.02" E Dist 732.1871

		Curve Data				
Curve NE1-2						
P.I. Station		213+73.03	N	481,221.0869	E	1,351,707.1257
Delta	=	44^ 08' 16.48" (LT)				
Degree	=	10^ 25' 09.20"				
Tangent	=	222.9461				
Length	=	423.6200				
Radius	=	549.9045				
External	=	43.4756				
Long Chord	=	413.2227				
Mid. Ord.	=	40.2902				
P.C. Station		211+50.08	N	481,063.7800	E	1,351,549.1400
P.T. Station		215+73.70	N	481,444.0000	E	1,351,710.9600
C.C.			N	481,453.4574	E	1,351,161.1368
Back	= N	45^ 07' 24.06" E				
Ahead	= N	0^ 59' 07.58" E				
Chord Bear	= N	23^ 03' 15.82" E				

Ending chain NE1 description

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GEOPAK

Project: haulii
Subject:

Job No. 660 Operator: MB
Date: Thursday January 25, 1996 12:10 pm
SYSTEM FIX 4 ASEC 2 BEAR PRI 0 NOR NE STA 2 FILE: 'NE1'

* 1 Describe Chain NE1

Chain NE1 contains:
CUR NE1-1 CUR NE1-2

Beginning chain NE1 description

			Curve Data			
Curve NE1-1						
P.I. Station		202+19.62	N	480,390.7382	E	1,350,876.1242
Delta	=	43^ 32' 30.76"	(RT)			
Degree	=	10^ 25' 09.78"				
Tangent	=	219.6192				
Length	=	417.8930				
Radius	=	549.8960				
External	=	42.2342				
Long Chord	=	407.9094				
Mid. Ord.	=	39.2218				
P.C. Station		200+00.00	N	480,171.1900	E	1,350,870.5400
P.T. Station		204+17.89	N	480,546.0355	E	1,351,031.4155
C.C.			N	480,157.2078	E	1,351,420.2582
Back	= N	1^ 27' 25.25" E				
Ahead	= N	44^ 59' 56.01" E				
Chord Bear	= N	23^ 13' 40.63" E				

Course from PT NE1-1 to PC NE1-2 N 44^ 59' 56.02" E Dist 732.1871

			Curve Data			
Curve NE1-2						
P.I. Station		213+73.03	N	481,221.0869	E	1,351,707.1257
Delta	=	44^ 08' 16.48"	(LT)			
Degree	=	10^ 25' 09.20"				
Tangent	=	222.9461				
Length	=	423.6200				
Radius	=	549.9045				
External	=	43.4756				
Long Chord	=	413.2227				
Mid. Ord.	=	40.2902				
P.C. Station		211+50.08	N	481,063.7800	E	1,351,549.1400
P.T. Station		215+73.70	N	481,444.0000	E	1,351,710.9600
C.C.			N	481,453.4574	E	1,351,161.1368
Back	= N	45^ 07' 24.06" E				
Ahead	= N	0^ 59' 07.58" E				
Chord Bear	= N	23^ 03' 15.82" E				

Ending chain NE1 description

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GEOPAK
Project: haulii
Subject:
Job No. 660 Operator: MB
Date: Thursday January 25, 1996 12:10 pm
SYSTEM FIX 4 ASEC 2 BEAR PRI 0 NOR NE STA 2 FILE: 'NE2'

Applicable Ohio Department of Transportation Construction and Material Specifications for Haul Road and Rerouted North Entrance Road Design and Construction

Operable Unit 2
Project Order 158

January 1996

Fernald Environmental Management Project
Fernald, Ohio

Applicable Ohio Department of Transportation Construction and Material Specifications for Haul Road and Rerouted North Entrance Road Design and Construction

Operable Unit 2
Project Order 158

January 1996

Fernald Environmental Management Project
Fernald, Ohio

000124

FROM: OHIO DOT - CONSTRUCTION AND MATERIAL SPECIFICATIONS
JAN. 1, 1995

202	Lump sum	Buildings demolished
202	Each	Underground storage tank removed
202	Each	Regulated underground storage tank removed
202	Each	Septic tank removed
202	Each	Privy vault removed
202	Meter (linear foot)	Guardrail removed
202	Meter (linear foot)	Guardrail removed for re-use or storage
202	Meter (linear foot)	Fence removed for re-use or storage
202	Each	Temporary drums removed
202	Each	Raised pavement markers removed for storage
202	Each	Manhole removed
202	Each	Manhole abandoned
202	Each	Catch basin or inlet removed
202	Each	Catch basin or inlet abondoned

ITEM 203 ROADWAY EXCAVATION AND EMBANKMENT

203.01 Description
203.02 Definitions
203.03 Borrow
203.04 General
203.05 Disposal of Excavated Material
203.06 Tolerances
203.07 Embankment Construction
203.08 Requirements for Suitable Material
203.09 Construction Methods
203.10 Construction of Embankment and Subgrade with Moisture and Density Control and Treatment of Subgrade in Cut
203.11 Moisture Control
203.12 Embankment Compaction
203.13 Subgrade
203.14 Proof Rolling
203.15 Method of Measurement
203.16 Basis of Payment

203.01 Description. This work shall consist of preparation of areas upon which embankments are to be placed; excavation for the roadway and channel, including the removal of all material

encountered not being removed under some other item; constructing embankments with the excavated material and material from other sources necessary to complete the planned embankments; furnishing and incorporating all water required for compacting embankment and subgrade; disposing of unsuitable and surplus material; preparing the subgrade; testing the stability and uniformity of compaction of the subgrade for areas specifically called for on the plans; finishing shoulders, slopes and ditches; all in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses and cross sections shown on the plans. All excavation shall be considered as unclassified excavation.

Where embankment is a separate pay item, payment for roadway excavation shall be made under 203 Excavation Not Including Embankment Construction. Payment for roadway embankment shall be made under 203 Embankment, which shall include payment for furnishing suitable material from sources other than excavation if needed to complete embankments, with no separate payment for borrow for planned embankments. The Contractor shall control disposition of excavated material, using in embankment or disposing of it as he desires.

Where embankment is not a separate pay item, payment for roadway excavation shall be made under 203 Excavation Including Embankment Construction, which shall include payment for placing suitable excavated material in embankment. If borrow is needed to complete planned embankments, it shall be measured and paid for separately under 203 Borrow. No excavated material shall be disposed of without permission; and all suitable material from excavation, or an equivalent volume from other sources, shall be used for planned embankments to the extent of project requirements.

When the proposal does not contain a lump sum for 201 Clearing and Grubbing or an estimated quantity for 201 Removal of Trees and/or Stumps, or an estimated quantity for 202 Removal of Structures and Obstructions, this work shall be performed but will not be paid for directly, and shall be considered as a subsidiary obligation of the Contractor under 203.

203.02 Definitions. Embankment. A structure consisting of soil, granular material, shale, rock, or random material, constructed in layers to a predetermined elevation and cross section.

Subbase. Selected material of planned thickness placed on the subgrade as a foundation for a base or surface course. Subbase is a part of the pavement structure.

Soil. All earth materials, organic or inorganic which have resulted from natural processes such as weathering, decay, and chemi-

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cal action in which more than 35 percent by weight of the grains or particles will pass a 75 µm (No. 200) sieve. Recycled portland cement concrete (RPCC), reclaimed asphalt concrete pavement (RACP), or reclaimed bituminous aggregate base (RBAB) can be utilized, but may require blending with other materials to meet the above grading requirements and the provisions of 203.09(a). Pieces of RPCC, RACP or RBAB shall not exceed 100 mm (4 inches) in the largest dimension.

Granular Materials. Broken or crushed rock, gravel, sand, RPCC, slag, or cinders which can be readily incorporated in an 200 mm (8-inch) layer, and in which at least 65 percent by weight of the grains or particles are retained on a 75 µm (No. 200) sieve. Open hearth and basic oxygen steel slags shall conform to stockpiling and aging requirements of 703.01 and come from approved sources on file at the Laboratory.

Shale. Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered as shale: mudstone, claystone, siltstone and clay bedrock.

Rock. Sandstone, limestone, dolomite,glacial boulders, brick and RPCC which cannot readily be incorporated in an 200 mm (8-inch) layer.

Random Material. A mixture of previously defined materials suitable for use in embankment which can be readily incorporated in an 200 mm (8-inch) layer.

Optimum Moisture. The water content at which the maximum density is produced in a soil by a given compactive effort (AASHTO Designation: T 99). The appropriate curve from Ohio's typical moisture-density curves, Set C, may be used to establish optimum moisture.

Field Testing. Testing of embankment and subgrade compaction shall be in accordance with the "Manual of Procedures for Earthwork."

Laboratory Dry Weight. The maximum laboratory dry weight shall be the weight provided by the Laboratory when the sample is tested in accordance with AASHTO T 99. The appropriate curve from Ohio's typical moisture-density curves, Set C, may be used to establish maximum laboratory dry weight.

Excavation. The excavation and disposal of all materials of whatever character encountered in the work.

Borrow. Material obtained from approved sources, outside the right-of-way, required for the construction of embankments or for other portions of the work.

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203.03 Borrow. Borrow shall meet the requirements for suitable embankment material set forth in this section. Borrow shall be resorted to only when sufficient quantities of suitable materials are not available from other items of the contract. Unless otherwise designated in the contract, the Contractor shall make his own arrangements for obtaining borrow and shall pay all costs involved.

Borrow used in embankment shall be placed in accordance with all the requirements for constructing embankment.

Borrow will not be paid for as a separate item:

(a) where embankment is a pay item in the contract, or

(b) where the Contractor elects to use borrow in place of excavation.

If the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste will be deducted from the borrow volume as measured in the borrow area. All borrow areas shall be bladed and left in such shape as to permit accurate measurements after excavating has been completed.

The Contractor shall notify the Engineer sufficiently in advance of opening any borrow areas so that cross section elevations and measurements of the ground surface after stripping may be taken.

Borrow areas shall meet the requirements of 105.151 and cleaning up of all borrow areas shall meet the requirements of 104.06.

203.04 General. Excavation and embankments for the roadway, intersections and entrances shall be finished to conform to the plan cross sections within the tolerances set forth in 203.06. The Contractor shall satisfy himself as to the nature and distribution of the materials to be excavated. The unit price bid for excavation shall apply to all materials, of whatever nature, to be excavated.

Prior to beginning excavation, grading, and embankment operations in any area, all necessary clearing and grubbing in that area shall have been performed.

Limitations of areas of clearing and grubbing and of earthwork operations shall be in accordance with 108.04 and 207.

Obliteration of old roadways shall include all grading operations necessary to incorporate the old roadway into the new roadway and surroundings in order to provide a pleasing appearance. Removal of portland cement concrete pavement and portland cement concrete base course will be paid for as a contract item. Roadway obliteration will be paid for as excavation.

Where a new pavement is to be constructed on an embankment which is less than 1 meter (3 feet) over an existing pavement, the existing pavement shall be removed.

When the Contractor's excavating operations encounter remains of prehistoric people's dwelling sites or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. The Engineer will contact archaeological authorities to determine the disposition thereof. When directed by the Engineer, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper state authorities. Such excavation will be considered and paid for as extra work.

If the contractor encounters any abnormal material such as, but not limited to, drums, tanks, or stained earth or any unusual odors during construction operations, the work in this area shall be temporarily discontinued, equipment left in place, the area cordoned off and the Engineer notified. The area is considered to contain hazardous or toxic material and must be handled correctly in accordance with Department policy as directed by the Engineer. Upon notification by the Engineer to resume work, the Contractor may file for an extension of time in accordance with 108.06. Compensation for added expense will be in accordance with 108.031.

Where excavation to the finished graded section results in a subgrade of unstable soil, the Engineer may require the Contractor to remove the unstable materials and backfill to the finish graded section with approved material in accordance with 203.12. The Contractor shall conduct his operations in such a way that the Engineer can take the necessary cross-sectional measurements before the backfill is placed.

(a) Drainage. During the process of excavation, the roadway area shall be maintained in such condition that it will be well drained at all times. When trenching is done for narrow base widening, ditches of an adequate depth shall be constructed at frequent intervals across the berms. Side ditches shall be deepened, if necessary, to provide a free outlet for water to insure the thorough drainage of the subgrade at all times.

The upstream ends of all pipe lines encountered in earthwork operations shall be effectively plugged and covered.

(b) Rock and Shale Excavation. Where granular subbase is not a part of the pavement design, and rock, shale or coal is encountered, the subgrade shall be excavated to a depth of 0.6 m (2 feet) below the surface of the subgrade for the cross section width of the roadway between points 0.3 m (1 foot) beyond the shoulders. The additional excavation shall be filled with suitable embankment material. Payment will be at the contract unit price bid for excavation and embankment.

Where granular subbase is a part of the pavement design, and rock, shale or coal is encountered, the subgrade shall be excavated

to a depth of 0.5 m (18 inches) below the subbase for the cross section width of the roadway between points 0.3 m (1 foot) beyond the shoulders. The additional excavation shall be filled with suitable embankment material. Payment shall be at the contract unit price bid for excavation and embankment. The Contractor will be paid for the thickness of granular subbase material shown on the typical section for rock excavation.

(c) Drilling and Blasting in Rock Cuts. Where rock encountered in cuts requires drilling and blasting, all necessary precautions shall be exercised to preserve the rock in the finished slope in a natural undamaged condition, with the surfaces remaining reasonably straight and clean. The Contractor shall presplit rock and shale along proposed backslopes which are designed at inclinations steeper than one to one and where depths of cut in rock or shale exceed 1.5 m (5 feet).

The Contractor shall first completely remove all overburden soil along the line(s) of presplitting to expose the rock surface prior to drilling the presplitting holes. The Contractor shall then drill 60 to 80 mm (2½ to 3-inch) nominal diameter holes, spaced not more than 1 meter (3 feet) center to center along the required slope line and at the required slope inclination to the full depth of the cut or to a predetermined stage elevation. If any cut is presplit by vertical stages (lifts), the presplit drill holes for the next stage may be offset a distance of not more than 0.3 m (1 foot) inside the previously presplit face, but in no case shall any of the presplit holes be started inside of the payment line. No payment will be made for additional excavation quantities caused by these offsets.

No hole shall deviate more than 0.15 m (½ foot) at any place from the plane of specified presplit slope, or an approved offset plane as hereinabove provided. Also, no hole shall deviate more than 0.3 m (1 foot) at any place from a vertical plane through the top of the hole, normal to the plane of slope.

Before placing the charge, each hole shall be tested for its entire length to ascertain the possible presence of any obstruction. No loading will be permitted until the hole is free of all obstructions for its entire depth. All necessary precautions shall be exercised so that the placing of the charge will not cause caving of material from the walls of the hole. The charge for each hole shall consist of not less than 0.11 kg (¼ pound) nor more than 0.45 kg (1 pound) of 40 percent dynamite per 0.3 m (foot) of hole and spaced not more than 0.5 m (20 inches) center to center of charge, except that 0.25 to 1.15 kg (½ to 2½ pounds) of dynamite shall be placed in the bottom of the hole, and except near the top of the hole the charges shall be reduced sufficiently to eliminate overbreak and heaving.

The top charge shall not be less than 0.75 m (2½ feet) nor more than 1.0 m (3 feet) below the top of rock.

The spacing of the dynamite charges in each hole shall be accomplished by means of securely taping (or attaching by other approved means) each piece of dynamite to the detonating fuse at the required intervals, or by deck loading. If the latter is used, the dynamite must be in intimate contact with the detonating fuse to assure detonation of all charges.

Either of the following charges may be used as an alternate, provided the results are satisfactory and with the written permission of the Engineer:

(1) Continuous column commercial explosives manufactured especially for presplitting.

(2) Multiple strands of high strength 35 to 45 grams (175 to 200 grains) of explosive per meter (foot) detonating fuse taped together at 1 to 2 m (4 to 6 foot) intervals.

All space in each hole not occupied by the explosive charge shall be filled with No. 8 size coarse aggregate meeting the requirements of 703.01. No other material or type of stemming will be permitted.

Firing shall be by means of detonating fuse extending the full depth of each hole and attached to a trunk line of detonating fuse at the surface, which shall be fired by dynamite cap(s). Permission to use any other method of detonating must be approved by the Engineer in writing. The detonation of presplitting charges shall precede the detonation of adjacent fragmentation charges within the section by a minimum of 25 millisecond.

The cost of all material, labor and equipment necessary for presplitting and other work included herein shall be included in the unit price bid for the pertinent 203 excavation item.

Changes may be made in details of procedure outlined in the above requirements for presplitting, including hole spacing and size, provided that written permission is secured from the Director and satisfactory results can be obtained.

In rock cuts, portions of rock which would be hazardous to highway traffic if allowed to remain, shall be removed when and as directed.

(d) Slides and Breakages. All slides and breakages beyond the finished work as planned, if caused by improper methods of excavation, shall be removed by the Contractor at his own expense. Slides and breakages beyond the finished work as planned which occur due to no fault or neglect of the Contractor shall be paid for in accordance with the provisions of 104.02 and 104.03.

(e) Shoulders, Slopes and Ditches. Sod and topsoil salvaged in the scalping operations shall be placed upon areas to be seeded or sodded. With 50 mm (2 inches) of the surface in a loose condition, the shoulders shall be built at an elevation that will allow subsequent operation of seeding and sodding to conform to the lines shown on the plans within the tolerances set forth in 203.06. Shoulders, slopes and ditches which have been damaged by erosion during construction shall be reshaped by the Contractor at no additional expense to the State.

Earth or other berm materials shall not be dumped or stockpiled on the new or existing pavement or on the paved area of the berm. Such material shall be kept clear of the pavement and paved berm areas at all times.

(f) Pavement Widening Construction. For work performed under this item the Contractor shall, under the direction of the Engineer, locate the edges of sound pavement, and shall cut and trim the pavement to a neat line as established by the Engineer. Damage done to those areas designated for salvaging, by the Contractor's equipment or methods, shall be repaired and restored at the Contractor's expense. The old pavement materials resulting from this cutting and trimming operation shall be used or disposed of in accordance with the provisions of 203. The cost of cutting, trimming, and disposal of excavated material shall be included in the unit price bid for 203 Excavation.

(g) Linear Grading. This work shall include all labor and equipment necessary to produce typical sections and profile grades as detailed in the plans. This shall include embankment construction if embankment area is within 1 km (½ mile) of material source. If additional material is required to obtain conformance to plan specified grades, and if it is required at a distance of more than 1 km (½ mile) from material source, then it shall be mensured and paid for separately under 203 Borrow.

203.05 Disposal of Excavated Material. All surplus or unsuitable excavated material, including rock or large boulders, that cannot be used in embankments shall be disposed of by one of the following methods as determined by the Engineer:

(1) Wasted adjacent to or incorporated in the regular construction where and as ordered by the Engineer.

(2) Disposed of by the Contractor at his own responsibility and expense outside the limits of the right-of-way.

Material wasted outside the limits of the right-of-way shall be in accordance with the provisions of 105.151.

The Contractor shall furnish the Engineer a copy of written permission from the property owner prior to disposing of the waste materials.

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203.06 Tolerances. The Contractor shall check the work under this item with templates, slope boards or other devices satisfactory to the Engineer. The completed work shall conform to the plans within the following tolerances:

For cut slopes back of the ditch line and for fill slopes beyond the shoulder, deviations of 0.3 m (one foot) measured in a horizontal plane will be permitted. For shoulders and ditches the horizontal measurements from the centerline shall not be less than the plan dimensions and the elevations thereof shall not be higher than specified, but may vary not more than 15 mm (½ inch) at the pavement edge and 50 mm (2 inches) elsewhere, below the established grades. For subgrade, the surface shall at no place vary more than 15 mm (½ inch) from a 3.0 m (ten-foot) straight edge applied to the surface parallel to the centerline of the pavement nor more than 15 mm (½ inch) from subgrade elevation established by construction layout stakes.

For excavation and embankment beyond plan lines, measurement for payment will be made only to plan lines.

203.07 Embankment Construction. Embankment construction shall consist of preparation of the areas upon which embankments are to be placed; the placing and compacting of approved material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the roadway area. Only approved materials shall be used in the construction of embankments and backfills. Frozen material shall not be placed in the embankment nor shall embankment be placed on frozen material.

203.08 Requirements for Suitable Material. Granular materials, shale, rock, and random materials as defined in 203.02 are suitable for use in embankment, except RPCC, open hearth and basic oxygen steel slag shall be placed at least 0.3 m (one foot) below the flow line of the underdrains or other drainage items susceptible to runoff from these materials.

Soil is suitable for use in embankment provided it has the following characteristics:

Maximum laboratory dry weight shall be not less than 1450 kg/m^3 (90 pounds per cubic foot), except that soils having maximum dry weights of less than 1600 kg/m^3 (100 pounds per cubic foot) shall not be used in the top 0.3 m (12 inches) of embankment subgrade.

Silt from excavation or borrow identified as Ohio classification A-4b, RACP, and RBAB shall be considered suitable for use in

embankment only when placed at least 1 m (3 feet) below the surface of the subgrade. RPCC, RACP, and RBAB shall not be placed in any location where it would inhibit the growth of vegetation.

Soil having a liquid limit in excess of 65 or soils identified as Ohio classifications A-2-5, A-5 or A-7-5 are considered as unsuitable for use in embankment.

Soils not identifiable from preliminary soils investigation reports and appearing questionable, shall be sampled and submitted to the Laboratory for classification tests.

203.09 Construction Methods. When embankment is to be placed and compacted on hillsides or where new embankment is to be compacted against existing embankments, or where embankment is built half-width at a time, slopes that are steeper than 8:1 when measured at right angles to the roadway shall be continuously benched over those areas where it is required as the work is brought up in layers. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Materials thus cut out shall be recompacted along with the new embankment material at the Contractor's expense.

Soil, granular material, shale and random material shall be spread in successive loose layers, not to exceed 200 mm (8 inches) in thickness. The layers thus placed shall be compacted as specified in this section. Compaction of the outer 1.5 m (5 feet) of each layer measured horizontally from the face of the slope shall be obtained with a roller capable of covering the layer to the outer edge.

If embankment can be deposited on one side only of abutments, wing walls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted in a manner such that it will cause overturning of or excessive pressure against the structure. When embankment is to be placed on both sides of a concrete wall or a pipe or box type structure, operations shall be so conducted that the embankment is always at approximately the same elevation on both sides of the structure.

(a) Soil. All soil used in embankment shall be placed in accordance with provisions of 203.12.

When RPCC, RACP or RBAB is utilized, the blend shall produce a uniform and stable mixture.

The RACP or RBAB shall be placed in 150 mm (6 inch) lifts and disked with underlying lift of material until a uniform and homogeneous material is formed. The disk shall have a minimum of 0.75 m (30 inch) diameter blade. Under no circumstances shall the place-

ment of RACP or RBAB be allowed without disking. The lifts of RACP or RBAB shall be alternated with other approved materials.

RPCC, RACP, and RBAB shall be compacted in accordance with 310.03 or other methods approved by the Engineer.

(b) Granular Material. Granular material shall be compacted to the density established as satisfactory by the Engineer based on field density test. The moisture content shall be as determined by the Engineer to obtain the desired compaction.

(c) Shale. Shale which consists predominantly of fine particles which can be readily tested for compaction shall be placed and compacted in accordance with requirements for soil. Shale containing sufficient amounts of large particles to make checking of the compaction impracticable shall be broken down in placing until the voids between the shale particles are filled insofar as is practicable. When so ordered by the Engineer, water shall be used to aid in breaking down the shale. Watering of the shale shall be performed in accordance with the provisions of 203.11. The moisture content and compaction shall be directed by the Engineer.

Shale embankment, within a length of 6 times the height of the fill at an abutment, shall be sprinkled as directed by the Engineer to bring the moisture content to within a range of optimum minus 3 percent and optimum plus 2 percent. Each layer shall be rolled with at least 6 coverages of fully ballasted tamping roller, or with other rollers satisfactory to the Engineer.

Mixtures of shale and rock shall be placed in accordance with the above noted provisions for shale. Rock in such mixtures shall be reduced in size not to exceed 200 mm (8 inches) or separated from the mixture and placed as rock fill.

(d) Rock. Rock fill shall be placed in not to exceed 1 m (3-foot) lifts except that within a length of 6 times the height of the fill at an abutment, thickness of rock layers shall not be greater than 0.5 m (18 inches). Rock which cannot be incorporated into lifts of the above specified thicknesses shall be reduced in size until it can be so incorporated. Lifts made up principally of small rock shall be rolled as directed by the Engineer. Care shall be exercised in placing rock so that the side slopes will conform substantially with the requirements of the plan.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portions of the embankment as rock fill and the other material shall be incorporated into the inner portion as rolled embankment. Rolled embankment adjacent to rock fill shall be held at substantially the same elevation as the rock, but always above the rock and of sufficient width to permit the proper compaction of this portion.

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The top 0.6 m (2 feet) of all embankment shall be constructed of material other than rock or shale according to the specifications for placing that material. Material for this upper 0.6 m (2 feet) shall be reserved by the Contractor from the suitable excavation to the extent that it is available. Should this material be available and not be reserved, it shall be furnished and placed by the Contractor at his expense. In all cases where embankment material other than rock is superimposed upon rock, the top of the rock fill shall be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments or earth.

(e) Random Materials. For random materials the moisture content and compaction shall be as required by the Engineer. When random material is of such size that it cannot be readily incorporated into an 200 mm (8 inch) layer it shall be reduced in size until it can be so incorporated.

(f) Areas Inaccessible to Rollers. Embankment in areas inaccessible to rollers shall be composed of embankment material which can readily be incorporated into a 100 mm (4-inch) layer, loose depth, placed and compacted in accordance with the following provisions: Embankment material, other than granular material, shall be deposited in level layers not exceeding 100 mm (4-inch) in thickness, loose depth, and compacted by mechanical devices to the density required in 203.12. Granular material shall be compacted as required in this section except that it may be deposited in water without compaction to a height not exceeding normal water level. Compaction of granular material with water above normal water level is permitted if satisfactory drainage is provided.

Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. As the compaction of each layer progresses, continuous leveling and manipulating will be required to assure uniform density. Water shall be added or removed, if necessary, in order to obtain the required density.

203.10 Construction of Embankment and Subgrade with Moisture and Density Control and Treatment of Subgrade in Cut. All embankments, except rock embankments, shall be constructed using moisture and density control. All subgrade, except rock and shale in cut sections, shall be constructed using moisture and density control.

203.11 Moisture Control. Embankment and subgrade material which does not contain sufficient moisture to be compacted in accordance with the requirements of this subsection shall be sprinkled with water as directed by the Engineer to bring the moisture content to within the range needed to meet the density

equipped with suitable sprinkling devices and shall be thoroughly incorporated into the material which is to be compacted by means of discs or other approved equipment.

Embankment and subgrade material containing excess moisture shall be required to dry prior to or during compaction to a moisture content not greater than that needed to meet the density requirements, except that for material which displays pronounced elasticity or deformation under the action of loaded rubber tired construction equipment, the moisture content shall be reduced to secure stability. For subgrade material, these requirements for moisture shall apply at the time of compaction of the subgrade. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the Engineer.

203.12 Embankment Compaction. Soil embankment shall be placed and compacted in layers until the density is not less than the percentage of maximum dry density indicated in the following table determined by AASHTO T 99 or other approved method.

EMBANKMENT SOIL COMPACTION REQUIREMENTS

Maximum Laboratory Dry Weight Kilograms/Cubic Meter (Pounds/Cubic Foot)	Minimum Compaction Requirements Percent Laboratory Maximum
1440-1680 (90-104.9)	102
1681-1920 (105-119.9)	100
1921 and more (120 and more)	98

203.13 Subgrade. All soil subgrade shall be prepared in accordance with this subsection. Soils with a maximum dry weight of less than 1600 kg/m^3 (100 pounds per cubic foot) are considered unsuitable for use where subgrade compaction for a depth of 0.30 m (12 inches) is required, and when encountered in the upper 0.30 m (12 inches) of the subgrade shall be replaced with suitable soil or granular material.

(a) Compaction Requirements. Soil subgrade with maximum laboratory dry weight of 1600-1680 kg/m^3 (100-105 pounds per cubic foot) shall be compacted to not less than 102 per cent of maximum dry density. All other soil subgrade shall be compacted to not less than 100 percent of maximum dry density. The maximum dry density shall be as determined by AASHTO T 99 or other approved method.

Subgrade under new pavement and paved shoulders shall be compacted to a depth of 0.30 m (12 inches) below the surface of the

subgrade and to a width of 0.46 m (18 inches) beyond the edge of the surface of the pavement, paved median, paved shoulder, or to the back of the adjacent curb and gutter, and shall be paid for as a separate item under 203 Subgrade Compaction.

Subgrade under pavement widening less than 1.8 m (6 feet), driveways, mailbox turnouts, and stabilized shoulders, shall be compacted to a depth of 150 mm (6 inches) below the surface of the subgrade and to the width of the pavement or base, or to the back of adjacent curb and gutter; and shall not be paid for as a separate item. The cost of compacting subgrade to a depth of 150 mm (6 inches) shall be included in the unit price bid for 203 Excavation.

Where the combined width of pavement widening and adjacent paved shoulder is 1.8 m (6 feet) or more, the subgrade shall be compacted as under new pavement and shall be paid for as a separate item under 203 Subgrade Compaction. For method of measurement, see 203.15(f).

(b) Drainage. The surface of the subgrade shall be maintained in a smooth condition to prevent ponding of water after rains, and ditches shall be constructed and maintained in accordance with 203.04 (a) Drainage, to insure the thorough drainage of the subgrade surface at all times.

(c) Soft Subgrade. Where soft subgrade is encountered in cuts, due to no fault or neglect of the Contractor, in which satisfactory stability cannot be obtained by moisture control and compaction as provided for under 203.11 and 203.13 (a), the unstable material shall be excavated to the depth required by the Engineer. The excavation thus required shall be measured and paid for at the contract unit price bid for 203 Excavation. Material thus excavated shall be disposed of in accordance with 203.05.

Where embankment is a separate pay item, material required to replace the undercut shall be provided from 203 excavation, if available from grading operations within 1 km (½ mile) of the soft subgrade area. Suitable material shall be considered available when within 1 km (½ mile) of the soft subgrade area only when there is an excess of suitable material on the entire project, available portions of which are located within 1 km (½ mile) of the soft subgrade area. Embankment required in the undercut area shall be paid for at the contract unit price for 203 Embankment, except that if such material is not available, the excavation thus made shall be filled with any suitable material available beyond 1 km (½ mile) of the soft subgrade area, and payment shall be made in accordance with Section 104.03.

Where embankment is not a separate pay item, suitable material required for the embankment to replace the undercut shall be secured from 203 Excavation if available from grading operations

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within 1 km (½ mile) of the soft subgrade area. If such suitable material is not available, the excavation thus made shall be filled with suitable material from 203 Borrow or with any suitable material available beyond 1 km (½ mile) of the soft subgrade area in accordance with Section 104.03.

Where soft subgrade in cuts is due to the failure of the Contractor to maintain adequate surface drainage as required in 203.04 (a) Drainage, or is due to any other fault or neglect of the Contractor, the unstable condition shall be corrected as outlined above at no expense to the State.

(d) Full Width New Pavement Construction. After the surface of the subgrade has been shaped to approximate cross section grade, and before any pavement, base or subbase material is placed thereon, the subgrade and a portion of the berm for a distance of at least 0.5 m (18 inches) outside the limits of the surface of the planned pavement, shall be compacted. When the rolling is completed, the surface of the subgrade shall be shaped as necessary to conform to the grade and cross section shown on the plans within the tolerance set forth in 203.06 and shall be so maintained until the overlying course is in place.

203.14 Proof Rolling. Proof rolling shall be performed on areas described on the plans or as directed by the Engineer.

(a) Equipment. The equipment shall consist of four heavy pneumatic tire wheels mounted on a rigid steel frame. The wheels shall be evenly spaced in one line across the width of the roller and shall be arranged so that all wheels will carry approximately equal loads when operated over an uneven surface. The maximum center to center spacing between adjacent wheels shall not exceed 0.8 m (32 inches). The compacting equipment shall have a suitable body for ballast loading with such capacity that the gross load may be varied from 23 to 45 metric tons (25 to 50 tons).

The tires shall be capable of operating at inflation pressures ranging from 620 to 1040 kPa (90 to 150 pounds per square inch). From 90 to 95 percent of the volume of the tires shall be filled with liquid. The Contractor shall furnish the Engineer charts or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loading for the particular tires furnished.

Ballast to obtain the weight directed by the Engineer shall consist of ingots of known unit weight, or sand bags with a unit weight of 45 kg (100 pounds) or bags of other material of known unit weight, or other suitable material such that the total weight of the ballast used can be readily determined at all times. There shall be a sufficient amount of ballast available to load the equipment to a

(b) Construction. The designated areas of subgrade, prior to the placing of the overlying course, shall be compacted to requirements of 203.13. The subgrade shall then be rolled with one or more coverages, as directed, of the heavy pneumatic tire roller. One coverage shall be considered to represent two trips of the roller, each trip offset from the other by the width of one tire, to obtain complete area coverage. The roller shall operate in a systematic manner so that the number of coverages over all areas can be readily determined and recorded.

Moisture content of the subgrade at the time of proof rolling shall conform to the requirements of 203.11.

Within the ranges set forth above, the load and tire inflation pressure shall be adjusted as directed. It is the intent to use a contact pressure as nearly as practical to the maximum supporting value of the subgrade. The equipment shall be operated at the speed directed but in no case shall the speed exceed 8 km per hour (5 miles per hour), and the normal operating speed shall not be less than 4 km per hour (2½ miles per hour).

Where the operation of the heavy pneumatic tire roller shows the subgrade to be unstable or to have non-uniform stability, the Contractor shall correct the unstable areas in accordance with the provisions of 203.13 so that the stability of the subgrade will be uniform and satisfactory. The subgrade shall then be checked for conformance to the plan lines and any irregularities of the surface caused by operation of the heavy pneumatic tire roller shall be corrected and the subgrade shall be shaped to the plan lines within the tolerance specified in 203.06.

Proof rolling will not be required where rock or shale occurs in subgrade, or in areas where subbase has been thickened to replace frost susceptible silts or other unsuitable subgrade material.

203.15 Method of Measurement. The quantities of excavation to be paid for shall be the number of cubic meters (cubic yards) of material in the original position, acceptably excavated, measured by the method of average end areas. Excavation outside plan lines shall not be included in measurement for payment.

(a) Contract Quantity Payment. The quantities of excavation and embankment, when embankment is specified as a separate bid item, for which payment will be made will be those shown in the contract, provided the project is constructed to the lines and grades shown on the plans, within allowable tolerances, and provided the plan quantities are adjusted to correct errors and to take into account authorized changes. Check measurements or final cross sec-

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When the plans have been altered or when disagreement exists between the Contractor and the Engineer, as to the accuracy of the plan quantities, either party shall have the right to request and cause the quantities involved to be measured in accordance with "measured quantities." When the quantities are measured for payment, the original plan cross sections plotted on the plans, corrected for errors, if any, shall be used as original field cross sections. Additional original cross sections may be interpolated at points where necessary to more accurately determine quantities.

(b) Measured Quantities. When payment is specified on a volume basis, all accepted excavation shall be measured in its original position by cross-sectioning the area excavated, which measurements will include overbreakage or slides not attributable to carelessness of the Contractor. Volumes will be computed from the cross section measurements by the average end area method.

Measurement will be made for unsuitable materials actually excavated and removed at the direction of the Engineer, to obtain proper stability in cut sections and in foundations for fill sections.

Where it is impractical to measure material by the cross section method due to the erratic location of isolated deposits, acceptable methods involving three-dimensional measurements may be used.

(c) Measurement on a Linear Basis. When an item of excavation is to be measured and paid for on a linear basis, the actual length will be measured along each side of the pavement in the units specified in the contract. (A station shall equal one hundred feet). Measurement shall be continuous thru the work including intersections and other gaps.

(d) Measurement of Embankments. Where the contract does not specifically provide for payment for embankment, the work of embankment construction will not be paid for as such, but will be considered incidental to the various items of excavation.

When payment for embankment constructed with moisture and density control is specified as a separate bid item, the quantities to be paid for shall be the number of cubic meters (cubic yards) of embankment in the completed position, acceptably placed as herein described, measured by the method of average end areas. Embankment outside plan lines shall not be included in measurement for payment.

(e) Measurement of Borrow. Borrow will be measured and paid for by the cubic meter or metric ton (cubic yard or ton) in accordance with 109.

Borrow material in a natural formation shall be measured by the method of average end areas or by weight. Where measurement by the method of average end areas is used the borrow area shall be

cross-sectioned after the surface has been cleared and scalped and again after excavating in the borrow area has been completed. The volume to be paid for shall be determined from these cross sections. Where measurement by weight is used, the density of the material in its original position shall be determined by a series of representative field measurements made after clearing and scalping have been performed, and as the material in the borrow area becomes exposed by excavating operations. Acceptable material excavated from the borrow area for incorporation into the embankment shall be weighed and load slips furnished. The cubic meters (cubic yards) to be paid for shall be determined by dividing the average weight per cubic meter (cubic yard) of the undisturbed material as determined by the density tests into the total weight of borrow material as determined by the load weight slips.

Borrow material from sources other than natural formations, such as cinders, slag, processed stone or gravel, and quarry strippings shall be measured as follows: The weight per cubic meter (cubic yard) of any such material in its compacted condition in the embankment shall be determined. Ninety-five percent of the density thus determined divided into the weight of the material furnished shall be the cubic meters (cubic yards) of such material.

Where measurements show that completed embankment exists outside allowable tolerances, the quantity outside plan lines shall be multiplied by a shrinkage factor determined by the Engineer, and the resulting quantity shall be deducted from the measured borrow to determine the pay quantity for this item. Volume of roadway excavation outside plan lines will not be considered in the determination of deductions from measured borrow.

(f) Measurement of Subgrade Compaction. The quantity to be paid for shall be the number of square meters (square yards) of subgrade acceptably compacted to a depth of 0.3 m (12 inches) as herein described, measured by the number of square meters (square yards) of pavement surface, paved median, paved shoulders, and curb and gutter supported by the compacted subgrade.

(g) Measurement of Proof Rolling. The quantity shall be the actual number of hours of accepted proof-rolling time. No measurement of time will be made for idle equipment due to repairs, servicing, loading or unloading ballast, increasing or decreasing tire pressure, bad weather, wet subgrade, standing by so as to be available when next needed, or for any other reason, or for the use of the equipment at times or locations other than as directed by the Engineer. The actual rolling time shall be recorded to the nearest 0.1 hour by the Contractor and will be checked by the Engineer.

203.16 Basis of Payment. The accepted quantities will be paid for at the contract price per unit of measurement for each of

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the pay items listed below that is included in the bid schedule. Payment will be made under:

Item	Unit	Description
203	Cubic meter (cubic yard)	Excavation including embankment construction
203	Cubic meter (cubic yard)	Excavation not including embankment construction
203	Cubic meter or metric ton (cubic yard or ton)	Borrow
203	Cubic meter (cubic yard)	Embankment
203	Meter or kilometer (station or mile)	Linear grading
203	Square meter (square yard)	Subgrade compaction
203	Hour	Proof rolling

ITEM 207 TEMPORARY SOIL EROSION AND SEDIMENT CONTROL

207.01 Description
207.02 General
207.03 Construction Requirements
207.04 Performance
207.05 Method of Measurement
207.06 Basis of Payment

207.01 Description. This work shall consist of temporary control measures as detailed in the plans or ordered by the Engineer during the life of the contract to control soil erosion and sedimentation through use of straw or hay bales, dikes, slope protection, sediment pits, basins and dams, slope drains, coarse aggregate, mulches, grasses, filter fabrics, ditch lining and other erosion control devices or methods.

The permanent control provisions contained in the contract shall be coordinated with the temporary erosion control features to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period.

Temporary control may be required for construction work outside the right-of-way such as borrow pit operations, haul roads, equipment and material storage sites, waste areas, and temporary plant sites.

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207.02 General. Commercial fertilizer shall be (12-12-12) and shall conform to 659.03.

Temporary seeding and mulching shall consist of annual ryegrass (Lolium multifolium). Seed and mulching material shall be applied in accordance with 659.

Temporary ditch checks shall consist of straw or hay bales or coarse aggregate.

Temporary inlet filters and filter dikes shall consist of straw or hay bales or filter fabric fence. Filter fabric for sediment fences shall meet the requirements of 712.09, Type C.

Temporary dikes shall consist of suitable 203 material.

Temporary slope drains shall consist of pipe, coarse aggregate, riprap, rock channel protection, mats, plastic sheets, or other materials. Such materials shall be approved by the Engineer before being incorporated into the work. Sediment pits may be included as part of slope drain construction.

Temporary sediment basins and dams shall be constructed by methods described in Item 203 Excavation and Embankment or Item 601 Rock Channel Protection, Type C without filter. Sand or filter fabric may be required.

Temporary ditch lining shall meet the requirements of 667, 668 or 670.

Temporary rock check dams shall be constructed of 601.08, Type C rock channel protection.

207.03 Construction Requirements. The Contractor shall limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow, and fill operations and provide immediate permanent or temporary control measures to prevent contamination of adjacent streams or other water courses, lakes, ponds, or other areas of water impoundment. Such work will involve the construction of temporary ditch checks, filters, benches, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods necessary to control erosion and sedimentation.

The Contractor shall incorporate all permanent erosion control features into the project at the earliest possible time. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. This will require the establishing of final grades and application of Items 659 Liming, if specified on the plans, Commercial Fertilizer, and Seeding and Mulching. When directed by the Engineer, the temporary items of

302.07 Basis of Payment. Payment for accepted quantities, complete in place, will be made at the contract price for:

Item	Unit	Description
302	Cubic meter (cubic yard)	Bituminous aggregate base

ITEM 304 AGGREGATE BASE

304.01 Description
304.02 Aggregate
304.03 Placing
304.04 Compaction
304.05 Method of Measurement
304.06 Basis of Payment

304.01 Description. This work shall consist of furnishing, placing and compacting one or more courses of aggregate, including furnishing and incorporating all water required for compacting, on a prepared surface in accordance with these specifications, and in reasonably close conformity with the lines, grades, thicknesses and typical cross sections shown on the plans or established by the Engineer.

304.02 Aggregate. The aggregate shall be crushed carbonate stone, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slags, or other types of suitable materials meeting the requirements of this item and having the approval of the Director. Crushed carbonate stone, crushed gravel, crushed air-cooled slag or mixtures of crushed and granulated slags shall meet the following gradation requirements and the requirements of 703.04. In addition, open-hearth and basic-oxygen furnace slags shall conform to the stockpiling and aging requirements of 703.01.

Sieve	Total Percent Passing
50 mm (2 inch)	100
25.0 mm (1 inch)	70-100
19.0 mm (¾ inch)	50-90
4.75 mm (No. 4)	30-60
600 µm (No. 30)	9-33
75 µm (No. 200)	0-13

Granulated slag shall also meet the requirements of 703.08, sec. 1.

Aggregate acceptance shall be determined prior to incorporation into the work based on samples taken from stock piles.

Prior to placing, aggregate shall have a reasonably uniform moisture content at or near optimum for compaction.

304.03 Placing. When vibratory equipment is used in conjunction with other methods of compaction, the compacted depth of a single layer shall not exceed 150 mm (6 inches). When vibratory compaction equipment is not used, the maximum compacted thickness of one layer shall not exceed 75 mm (3 inches). When the required compacted depth of the base course exceeds 150 mm (6 inches), the base shall be constructed in two or more layers of approximately equal thickness.

The aggregate shall be placed with self-propelled spreading machines capable of placing the aggregate true to line and grade. Approved hand placing methods may be used when the total area of base course is 1700 m^2 (2,000 square yards) or less, or in small areas where machine spreading is impractical. In these areas the compaction requirement shall be in accordance with 203.12.

Unless the base course is placed in a trench section, the edges shall be backed up with an 0.5 m (18 inch) width of soil, placed to such a height that it will be consolidated to the height of the lift being compacted and furnish positive lateral support during compaction of the course.

Adequate surface drainage of the berm shall be provided at all times.

304.04 Compaction. At the beginning of the compaction operation, the density requirement shall be determined by compacting a short section, at the direction of the Engineer, until no further increase in density is obtained. The remainder of the course shall be compacted to a density not less than 98 percent of the test density. A new density requirement may be determined when the aggregate characteristics change appreciably. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the amount necessary to maintain the moisture at or near optimum.

The finished surface shall not vary more than 10 mm (⅜ inch) from a 3.0 m (10 foot) straightedge parallel to the centerline nor more than 13 mm (½ inch) from a template conforming to the required cross section. The Contractor shall furnish straightedges, templates or other devices satisfactory to the Engineer and check the surface for conformance with these requirements.

304.05 Method of Measurement. Aggregate base course will be measured by the number of cubic meters (cubic yards) computed from plan lines, compacted in place.

Where variable depth is specified, the number of cubic meters (cubic yards) of aggregate will be measured by conversion from weight on the following basis:

	kg/m^3	lbs/yd^3
Crushed stone	2375	4000
Crushed gravel	2375	4000
Crushed slag, 1450 kg/m^3 (90 lbs. per cu. ft.)*	2140	3600
Crushed slag, 1450 to 1600 kg/m^3 (90 to 100 lbs. per cu. ft.)*	2375	4000
Crushed slag more than 1600 kg/m^3 (100 per cu. ft.)*	2670	4500
Granulated slag	1660	2800

*Based on average dry rodded weight of standard sizes of slag aggregates on record at the Laboratory.

The kilograms per cubic meter (pounds per cubic yard) for mixtures of crushed and granulated slags shall be determined by use of the density of the short section required under 304.04 Compaction.

304.06 Basis of Payment. Payment for accepted quantities, complete in place, will be made at contract prices for:

Item	Unit	Description
304	Cubic meter (cubic yard)	Aggregate base

ITEM 305 PORTLAND CEMENT CONCRETE BASE

305.01 Description
305.02 Method of Measurement
305.03 Basis of Payment

305.01 Description. This work shall consist of constructing a portland cement concrete base on a prepared subgrade or base course in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by the Engineer. This

work shall conform to the same specifications and requirements as 451 except that:

(a) Fabricated steel reinforcement is not required. Load transfer devices are required only at transverse construction and expansion joints.

(b) A minimum of 1 L (one gallon) of curing membrane shall be applied for each 5 m^2 (200 square feet) of surface treated.

(c) Transverse contraction joints shall be constructed in accordance with standard drawings.

Standard longitudinal joints shall be constructed between lanes in accordance with 451.08(a).

Sealing is required for transverse joints only, using material meeting requirements of 705.04.

(d) The final surface shall have a uniform gritty texture as obtained with a broom or artificial turf drag in the longitudinal direction.

(e) Smoothness shall be as specified in 451.12 except that the specified tolerance shall be 6 mm (¼ inch).

305.02 Method of Measurement. The area under this item will be the number of square meters (square yards) completed and accepted in place. The width for measurement will be the width of the base shown on the typical cross section of the plans and additional widening where called for, or as otherwise directed in writing by the Engineer. The length will be measured horizontally along the center line of each roadway or ramp. The plan quantities as adjusted for changes, errors, and deviations in excess of allowable tolerances will be the method of measurement.

305.03 Basis of Payment. The accepted quantities of concrete base will be paid for at the contract unit price per square meter (square yard) which price and payment shall be full compensation for furnishing and placing all materials; provided, however, that for base found deficient in thickness only the reduced price stipulated in 451.16 shall be paid.

No additional payment over the unit contract bid price will be made for any base which has an average thickness in excess of that shown on the plans.

Payment will be made under:

Item	Unit	Description
305	Square meter (square yard)	Concrete base

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bratory equipment and rollers, or vibratory equipment alone only where subbase material is of such a nature that it will not support rollers. For the remainder of the work the subbase course shall be compacted until the density is at least 98 percent of the weight in the test section. During the construction of the project, if there is an appreciable change in grading of the material or a change of source of material, a new test section shall be built in order to establish a new weight for the density requirement.

In areas where normal production rollers cannot be used, the compaction requirement shall be in accordance with 203.12.

Compaction of the subbase course shall immediately follow the spreading operation.

The finished surface of this course shall have sufficient stability to support loaded construction equipment used in construction of this and the subsequent course without rutting or deflection in excess of the surface tolerance permitted herein. When material falling within a grading permitted by this specification is used and surface stability cannot be obtained, a sufficient quantity of crushed angular material shall be added to secure the stated stability.

The finished surface for the subbase shall conform to the plan requirements within the tolerances set forth under 203.06, except that when this item is used as a subbase for 451, 452 or 453 pavement, the variation shall not exceed 6 mm (¼ inch).

Any irregularities or depressions that develop in the finished surface of the subbase under rolling shall be corrected by loosening the surface and adding or removing material until the surface presents a smooth regular appearance.

310.04 Method of Measurement. The quantity measured shall be the number of cubic meters (cubic yards), computed from plan lines, of subbase material compacted in place.

310.05 Basis of Payment. Payment for accepted quantities, complete in place, will be made at contract price for:

Item	Unit	Description
310	Cubic meter (cubic yard)	Subbase

400 FLEXIBLE PAVEMENT

401 PLANT MIX PAVEMENTS — GENERAL

401.01 Description
401.02 Composition
401.021 Contractor Mix Design and Quality Control
401.022 Asphalt Content Nuclear Gauge
401.03 Materials
401.031 Use of Reclaimed Pavement
401.04 Mixing Plants
401.041 Field Laboratory
401.05 Weather Limitations
401.06 Bituminous Material Preparation
401.07 Aggregate Preparation
401.08 Mixing
401.09 Hauling
401.10 Spreading Equipment
401.11 Rollers
401.12 Conditioning Existing Surface
401.13 Spreading and Finishing
401.14 Compaction
401.15 Joints
401.16 Spreading and Surface Tolerances
401.17 Method of Measurement
401.18 Basis of Payment

401.01 Description. These specifications include general requirements applicable to all types of plant mix bituminous pavements irrespective of gradation of aggregate, kind and amount of bituminous material, or pavement use. Deviations from these general requirements will be covered in the specific requirements for each type.

This work shall consist of one or more courses of bituminous mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in reasonably close conformity with the lines, grades and typical cross sections shown on the plans or established by the Engineer.

Bituminous plant mix pavement thickness shown on the plans or stated in the proposal is for exclusive use in calculating the weight required to be placed per unit of surface area.

401.02 Composition. The bituminous plant mix shall be composed of a mixture of uniformly graded aggregate and specified type and grade of bituminous material.

The composition table for the type under contract specifies the limits within which the job-mix formula will be set by the Laboratory after examination of the materials the Contractor proposes to use. Should the Contractor propose to change the source of the materials, sufficient notice shall be given the Laboratory that samples may be taken and the job-mix formula checked prior to making the change.

The Laboratory will establish a job-mix formula which will produce a satisfactory mix and may make changes as required; no change, however, shall be made unless authorized by the Laboratory.

During production, variation from the job-mix formula, as shown by the plant inspector's analysis, of plus or minus 4 percent passing the 4.75 mm (No. 4) sieve or plus or minus 0.3 percent bitumen shall be investigated and corrected by the Contractor.

Acceptance for gradation and bitumen content will be based upon the mean of the results of all tests performed by the plant inspector during a day's production.

Production will be considered acceptable if the following tolerances are not exceeded and the remaining sieves do not exceed the limits of the applicable specification:

Mix Characteristics	Deviation of the Mean from the Design	Range
Bitumen content	± 0.5 percent	1.0
4.75 mm (No. 4) sieve	± 6 percent	12

The disposition of production exceeding these limits shall be as provided in the second paragraph of 105.03.

A variation from the job-mix formula exceeding these tolerances shall be sufficient cause for the Laboratory to order production discontinued until the cause of the variation is corrected.

401.021 Contractor Mix Design and Quality Control. When the Contractor is required to perform the mix design or quality control, the laboratory where the mix design or quality control tests are to be performed and the personnel performing the tests shall meet the requirements of Supplement 1041.

401.022 Asphalt Content Nuclear Gauge. Asphalt Content Nuclear Gauges (AC Gauge) shall be calibrated in accordance with Supplement 1043 by an employee of the Contractor with a Level 1 rating in accordance with Supplement 1041. The calibration verification sample shall be mixed and tested with a Department employee present.

The Contractor shall provide and dispose of the solvent used for cleaning the AC Gauge pans.

401.03 Materials. Materials shall be:

Aggregates	703.05
Bituminous material (301, 402, 403, 404, 412, 446, 448)	702.01
Bituminous material (401.12)	702.01, 702.02, 702.03 or 702.04

Aggregate and bituminous material shall be sampled in accordance with 106.01.

401.031 Use of Reclaimed Pavement. The Contractor may use a blend of new materials in combination with reclaimed asphalt concrete pavement or reclaimed bituminous aggregate base pavement obtained from either a Department or Ohio Turnpike Commission project. A maximum of 10 percent of reclaimed pavement may be used without adjusting the job mix formula. This percentage is based on the dry weight of all the materials used. The combined mixture shall fall within the limits of the item specified.

The Contractor shall identify the reclaimed pavement as to type, source, gradation and bitumen content. The stockpile shall be free of contamination and uniform in composition. Prior to stockpiling, the proposed sites for storing the reclaimed pavement shall be cleaned, graded and compacted to produce a firm level base. Stockpiles shall be subject to approval by the District Engineer of Tests prior to use. Additional reclaimed pavement shall not be added to an approved stockpile, except when the reclaimed pavement proposed for use is being reclaimed concurrently with the production of the recycled mixture.

The reclaimed pavement shall be of proper size to allow for complete breakdown of material in the plant. During production, a 50 mm (2-inch) screen shall be placed on the cold feed. Incomplete mixing shall be reason to require a smaller screen to be placed on the cold feed. Due to variations in the reclaimed pavement gradation, a maximum of 5 percent oversize material will be tolerated in the completed mix, provided it can he incorporated into the work with satisfactory results.

When reclaimed pavement is used in a surface course, the reclaimed pavement to be used shall be processed to a maximum size of 19 mm (¾-inch) before incorporating the reclaimed pavement into the mix. If more than 10 percent reclaimed pavement is going to be incorporated into either a 446 or 448 surface course, the processed reclaimed pavement shall be included in the mix design process to establish the JMF.

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401.04 Mixing Plants. Plants shall be approved by the Director prior to preparation of the mixtures. General requirements for bituminous concrete mixing plants are contained in Section 750.01 and 750.03.

The bitumen controls for the computerized plant shall be set at the virgin bitumen content of the JMF at all times unless change is authorized by the Laboratory.

401.041 Field Laboratory. The Contractor shall provide an approved building or room for the plant inspector to use in the performance of the required tests. This building or room shall have equipment meeting the requirements of a Level 0 Laboratory as specified in Supplement 1041. A layout sketch for a suitable field laboratory may be obtained from the Office of the Director of Transportation. The building shall be floored and provide a minimum floor area of 12 m^2 (130 square feet) of suitable working space. It shall have windows on at least three sides to provide suitable light and cross ventilation and an outside door. Windows in one wall shall provide a direct view of the mixing platform. The windows and door shall be provided with locks.

The building shall have satisfactory lighting and grounded electrical switches and outlets. An exhaust fan shall be provided and located so as to adequately ventilate areas where solvent is stored and used. The ventilation shall be such that there is no odor or solvent in the breathing zone of the plant inspector.

Heating and cooling equipment shall be provided that will maintain a temperature range of 21° to 27° C (70° to 80° F) during working hours when the exhaust fan is in operation. Open flame heaters shall not be used.

The building shall have suitable work benches for weighing, sieving and AC Gauge operations. Work benches shall have drawers. A desk or suitable table for office work shall be provided.

The site shall have conveniently accessible telephone facilities over which conversations can be plainly heard.

The above laboratory may be the Contractor's Level 1 Laboratory and may be shared with Contractor personnel. If there is a conflict between the personnel sharing the Contractor's laboratory, the Laboratory may order the Contractor to provide the plant inspector with a separate laboratory meeting the above requirements.

401.05 Weather Limitations. Bituminous plant mixtures shall only be placed when the surface is dry and when weather conditions are such that proper handling, finishing and compaction can be accomplished. In no case, however, shall bituminous

plant mixtures be placed when the surface temperature is below the minimum established in the following table:

Course Thickness	Minimum Surface Temperature
75 mm (3.0 inches) and over	2° C 36° F*
38 to 74 mm (1.5 to 2.9 inches)	5° C 40° F
25 to 37 mm (1.0 to 1.4 inches)	10° C 50° F
Less than 25 mm (1.0 inch)	16° C 60° F
Variable Intermediate, 0 to 75 mm (0 to 3.0 inches)	5° C 40° F

*In lieu of 2° C (36° F), a minimum air temperature of 5° C (40° F) shall be used when paving on an aggregate base, subbase or subgrade.

In addition to the above surface temperature requirements, no surface courses shall be placed when the air temperature is less than 5° C (40° F).

401.06 Bituminous Material Preparation. The bituminous material shall be heated and delivered to the mixer within the temperature range specified in 702.00. Bituminous material shall not be used while foaming.

401.07 Aggregate Preparation. Aggregates shall be fed to the cold elevator in their proper proportions and at a rate to permit correct and uniform control of heating and drying. All aggregates in the hot bins that will produce a mix outside the temperature limits or that contain sufficient moisture or expanding gases to cause foaming in the mixture shall be removed and returned to the proper stockpiles.

401.08 Mixing. When batch mixing is used, the order or sequence in which the several aggregates are drawn or weighed shall be determined by the Laboratory. After all of the aggregate is in the mixer, the bituminous material shall be added in an evenly spread sheet over the full length of the mixer. The mixing time shall be the interval between the start of application of the bituminous material and the opening of the mixer gate. All bituminous material required for one batch shall be discharged in not more than 30 seconds. The Laboratory will establish a minimum mixing time of not less than 30 seconds.

When continuous mixing is used the bituminous material shall be added in an evenly spread sheet over the full width of the mixer at the charging end. The Laboratory shall establish mixing time of not less than 30 seconds. The mixing time is a ratio of kg (pounds) of deadload of the mixer to the kg/s (pounds per second) delivered. The deadload shall be determined by weighing a mixer full of

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material. The kg/s (pounds per second) delivered shall be determined by timing and weighing a load of mixed material.

Temperatures of the several mixtures at the plant shall be maintained within the ranges set by the Laboratory for the mix design. The temperature of the mixture on arrival at the project site shall be as determined by the Engineer in keeping with the temperature range set for the mix design and heat losses in transit.

401.09 Hauling. Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds from which the entire quantity of mixture is discharged smoothly into the spreading equipment.

Prior to loading, a thin coating of material shall be applied to the inside surfaces of the truck bed to prevent adhesion of mixture to the bed surfaces. The use of fuel oils for this purpose is prohibited. Only material which will not contaminate and alter the characteristics of the mixture will be permitted. Truck beds shall be drained prior to loading.

Each truck shall have a securely fastened, waterproof cover of suitable material to adequately protect the mixture from the weather. At the request of the Engineer, covers shall be removed prior to dumping into the paver.

When hot mixtures are being transported at prevailing air temperatures below 10° C (50° F) or when the length of haul exceeds 32 km (20 miles), all truck beds shall be insulated to maintain workable temperature of the mixture, and all covers shall be so fastened as to exclude all wind. The maximum distance mixtures may be transported from mixing plant to paving site shall not exceed 80 km (50 miles) except by specific permission of the Director.

401.10 Spreading Equipment. Spreading equipment shall be self contained and of sufficient size, power and stability to receive, distribute and strike-off the bituminous mixture at rates and widths commensurate with the typical sections and other details shown on the plans. The spreading equipment shall have automatic control systems which maintain the screed in a constant position relative to profile and cross-slope references. These references shall be such that control of the screed position is reasonably independent of irregularities in the underlying surface and of the spreader operation. Approval of spreading equipment by the Engineer will be based on the demonstrated capability of the equipment to place the mixture to the required cross-section, profile and alignment in an acceptable, finished condition ready for compaction.

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Specialized equipment or hand methods approved by the Engineer may be employed to spread the bituminous mixture where the use of standard full scale spreading equipment is impractical due to the size or irregularity of the area to be paved.

401.11 Rollers. Rollers shall be of the steel wheel and pneumatic tire types meeting the minimum requirements of the following tables. All ballasting shall conform to manufacturer's specifications.

The maximum capacities of the rollers, in square meters (square yards) per hour, shall be: 600 (700) for three-wheel and tandem; 13 per 25 mm (15 per inch) width for trench; Vibratory—13 per 25 mm (15 per inch) width for vibrating roll, 3 per 25 mm (3 per inch) width with static roll (no vibrations); 850 (1000) for Type I pneumatic tire; and 600 (700) for Type II pneumatic tire.

STEEL WHEEL ROLLERS

Roller Type	Three Wheel	Tandem	Vibratory Static	Vibratory Trench
Total weight, metric tons (tons)	9 (10)	7-11 (8-12)	7-11 (8-12)	
Compression rolls, kN/m (pounds per inch width), min.	53 (300)	35 (200)	21 (120)	53 (300)

PNEUMATIC TIRE ROLLERS

Type I	
Tire size, minimum	229 X 508 mm (9.00 X 20)
Wheel load, minimum	2250 kg (5000 pounds)
Average tire contact pressure, minimum	590 kPa (85 psi)
Type II	
Tire size, minimum	191X 381 mm (7.50 X 15)
Wheel load, minimum	900 kg (2000 pounds)
Average tire contact pressure, minimum	380 kPa (55 psi)

Pneumatic tire rollers shall be self-propelled, reversible units with vertical oscillation on all wheels on at least one axle. Tire inflation pressure shall be determined by the Contractor to meet the specified minimum contact area and contact pressure require-

ments. The Contractor shall furnish tire manufacturer's charts or tabulations for verification of the required inflation pressure by the Engineer. Tire inflation pressure shall be checked by the Contractor as directed by the Engineer and shall be maintained within 35 kPa (5 psi) of the required pressure.

Rolls and wheels shall be provided with the necessary accessories to prevent adhesion of the mixture and shall be kept properly moistened with water or water containing a detergent or other approved additive. The use of excess liquid will not be permitted.

401.12 Conditioning Existing Surface. The surface on which the bituminous plant mix is to be placed shall be cleaned and maintained free of accumulations of materials that would, in the judgment of the Engineer, contaminate the mixture, prevent bonding or interfere with spreading operations. Where approved subgrade or pavement courses previously constructed under the contract became loosened, rutted or otherwise defective, the deficiency shall be corrected in accordance with the requirements of the item or items involved prior to the spreading of bituminous plant mix for a subsequent pavement course.

When a quantity of bituminous plant mix is specified for use in spot leveling or patching an existing pavement surface, the material needed to effect the corrections shall be spread and compacted as directed by the Engineer.

Contact surfaces of curbing, gutters, manholes, and other structures shall be painted with a thin, uniform coating of bituminous material prior to the bituminous mixture being placed against them.

Where mixture is to be placed against the vertical face of an existing pavement structure, the vertical face shall be cleaned of foreign material and given an application of bituminous material in a manner which results in a coating of approximately one L/m^2 (0.25 gallon per square yard).

When the surface course is not placed within 10 days after completion of the intermediate course, the Contractor shall provide a tack coat, 407, at his own expense, as directed by the Engineer.

401.13 Spreading and Finishing. The mixture shall be spread at a rate determined by calculation using the specified thickness and the compacted width of the pavement course being placed, and the weight to volume conversion factors given in 401.17. The actual rate of spreading the mixture shall be maintained equal to the required calculated rate within the tolerance specified in 401.16 except for pavement courses specified for the purpose of leveling an

existing pavement surface in which the actual rate of spreading the mixture may vary from the required calculated rate as approved by the Engineer to accomplish the intended purpose.

Approved equipment or methods in use shall result in the mixture being spread and finished in such condition that compaction can follow immediately. The mixture shall be contained laterally during the spreading operation by means of sufficient side plates. When paving in excess of the nominal paver width, only a permanent extension or an adjustable extension with full auger extensions shall be used when matching a previously placed pavement course. Such extensions shall have the ability to heat. Strike-off plates may be used on adjacent berm areas. Supplemental hand forming and tamping shall be performed where irregularities develop and where the mixture is placed by hand methods. The mixture as spread and finished shall be uniform in composition and surface texture. Conditions causing objectionable segregation of the mixture components or irregularities in surface texture shall be corrected and any portion of the pavement course found to be defective in surface texture or composition, before or after compaction, shall be removed and replaced or otherwise corrected in a manner satisfactory to the Engineer.

The spreading operation shall be coordinated with the rate of production and delivery of the mixture to attain uniform, continuous progress. Erratic spreader operation due to irregular contact with the hauling vehicle, surging in the feed and distribution of the mixture, or other cause shall be avoided. Sufficient control of the spreading equipment with regard to line and grade references shall be maintained that the pavement course, when compacted as specified, will be in reasonable conformance with the lines, grades and typical sections shown on the plans or established by the Engineer.

The spreading operations on bridge deck waterproofing membranes shall not displace or damage the membrane.

401.14 Compaction. Immediately after the bituminous mixture has been spread and any surface irregularities adjusted, the mixture shall be compacted uniformly using rollers meeting the requirements of 401.11. The rate at which the mixture is spread shall not exceed the total of the specified capacities of the rollers in use, except that the rate of spreading shall not exceed twice the total capacity of the rollers in use for the compaction of mixture spread as an intermediate or pre-leveling course less than 25 mm (one inch) thickness.

The Contractor shall coordinate the spreading of the mixture with the application of the required roller coverage, giving consid-

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eration to the rate of cooling of the mixture as affected by lift thickness and environmental conditions. The required roller coverage shall be completed during the period of time in which the temperature of the mixture is sufficient for the roller coverage to be effective in compacting the mixture.

Base mixtures shall be compacted using a combination of both steel and Type I pneumatic tire rollers except in small areas where these mixtures may be compacted as approved by the Engineer using any one of the specified rollers.

Intermediate and surface mixtures shall be compacted using rollers which shall include either a three-wheel or a pneumatic-tire type except in small areas where these mixtures may be compacted as approved by the Engineer using any one of the specified roller types.

Variable depth courses shall be compacted using a combination of both steel and pneumatic tire rollers, except in small areas where these mixtures may be compacted as approved by the Engineer using any one of the specified rollers.

Vibratory rollers shall not be used on courses with a thickness under 38 mm (1½ inches).

When vibratory rollers are used, they shall be supplemented by three-wheel or pneumatic tire rollers.

Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the centerline at a slow, uniform speed. After each coverage or complete round trip, the roller shall progress toward the crown of the road by overlapping the previous pass by at least one half the width of the compression roll. On superelevated curves, the rolling shall begin at the low side and progress toward the high side. In all cases where a longitudinal joint is being made, it shall be rolled first and then followed by the applicable rolling procedure.

Rolling shall be continued until full coverage of the course has been completed and all roller marks are eliminated. Care shall be taken to prevent displacement of the edge line and grade. Where displacement occurs, the area shall be corrected immediately in a manner satisfactory to the Engineer.

Along curbs, headers, walls and in other areas not accessible to rollers, the mixture shall be thoroughly compacted with hot, hand tampers or with mechanical tampers. On depressed areas, trench rollers or rollers fitted with compression strips may be used.

Mixture that becomes loose, broken, contaminated or otherwise defective shall be replaced with fresh, hot mixture compacted to conform with the surrounding area.

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401.15 Joints. Placing of the bituminous paving shall be as continuous as possible. Longitudinal and transverse joints shall be made in a careful manner. Joints shall be "set up" at the proper height above the adjacent construction to receive maximum compaction. Where the edge of the new surface has been significantly rounded by the action of traffic, it shall be trimmed to a vertical face prior to placing the adjacent pavement. On projects where traffic is permitted to cross the edge of the new pavement lane, the longitudinal joint of the adjacent lane or berm shall be completed within 24 hours. A well bonded and sealed joint is required.

Hot longitudinal joints shall be formed using bituminous pavers operating in contiguous lanes, one just ahead of the other. The distance between pavers in adjacent lanes shall not exceed the distance that a normal size load of mixture will cover. The loads of mixture as they arrive shall be alternated between the pavers. Rollers performing the initial rolling operation in one lane shall in no case be allowed closer than 0.3 m (12 inches) to the longitudinal joint until the adjacent lane is placed.

In lieu of hot joint construction using multiple pavers, full width construction with a single unit paver may be used.

All cold joints on surface courses, and any bituminous concrete course that is open to traffic for more than 30 days, shall be sealed by coating the vertical face of the cold joint with bituminous material 702.01, 702.02, or 702.04, applied at a rate of one L/m^2 (0.25 gallon per square yard).

The bituminous material used will be measured by the liter (gallon) and payment for accepted quantities complete in place will be made at the unit bid price for 407 tack coat. If there is no pay item provided for 407 tack coat, the cost of sealing joints as described above shall be included in the unit price bid for the asphalt concrete courses.

401.16 Spreading and Surface Tolerances. When a uniform course is specified, the Contractor shall make checks and adjustments as indicated to maintain the rate of spreading within a tolerance of plus or minus 5 percent of the required calculated weight per unit of area.

When variable depth courses are specified, the Contractor shall place the mixture at rates established by the Engineer, in accordance with the intent of the plans.

When a longitudinal profile is specified by elevations on the plans, the longitudinal profile of the completed pavement surface shall not deviate from parallel with the specified profile by more than 21

mm in 15 m (0.07 feet in 50 feet). Prior to placing the surface course, the Contractor shall check the profile of the preceding course at 15 m (50-foot) intervals along the outside edge of each traffic lane and along any additional line described in superelevation tables and shall submit a tabulation of the results to the Engineer for approval. Corrective work necessary for compliance with the profile tolerance shall be performed prior to placing the surface course. This requirement shall not apply to small incidental areas of pavement less than 150 m (500 feet) in length.

The transverse slope of the surface of the completed course shall not vary from the specified slope by more than 10 mm in 3.0 m (⅜ inch in 10 feet).

The surface of each completed course shall not vary from the testing edge of a 3.0 m (10 foot) straightedge by more than the tolerance specified for the type under contract. The Contractor shall furnish straightedges and straightedges equipped with levels or other devices satisfactory to the engineer and shall check the surface for conformance with requirements.

401.17 Method of Measurement. The Contractor shall be responsible for recording the gross, tare, and net weight of each truck load of mixture to the nearest 50 kg (100 pounds) in triplicate on plant ticket forms approved by the Director. The Contractor shall provide a tare weight for each truck at the beginning of each day's operation. In addition, where the pay quantities are established by truck scales, the Contractor shall provide a tare weight for each truck a minimum of every four hours of operation each day. The Engineer may require additional tare weight measurements at any time and shall have the right to monitor all weighing operations and may require reweighing trucks at any time or location. Any discrepancies shall be corrected immediately. Continued non-compliance will result in the Department taking necessary and appropriate action, such as, but not limited to, assigning a Department ticket writer to the plant. All costs incurred by the Department as a result of taking such necessary and appropriate action will be assessed against the Contractor.

One copy of the plant ticket shall accompany each load delivered to the paver and shall be presented to the Engineer.

The total of the weights recorded on the plant tickets representing mixture finished in accordance with contract requirements shall be converted to cubic meters (cubic yards) for payment using the conversion factors in the following table. However, when there is a mix design available on the project, the Laboratory shall establish the conversion factor to be used from the approved mix design.

When uniform courses are specified, the number of cubic meters (cubic yards) to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

Aggregate	Kilograms Per Cubic Meter	Pounds Per Cubic Yard
Gravel and stone	2370	4000
Slag, less than 1450 kg/m^3 (90 lbs. per cu. ft.)*	2135	3600
Slag, 1450 to 1600 kg/m^3 (90 to 100 lbs. per cu. ft.)*	2370	4000
Slag, more than 1600 kg/m^3 (100 lbs. per cu. ft.)*	2550	4300

*Based on average dry rodded weight at the Laboratory.

401.18 Basis of Payment. All work performed and measured as prescribed above will be paid for as provided in the respective items for each type.

ITEM 402 ASPHALT CONCRETE

402.01 Description
402.02 Composition
402.13 Spreading and Finishing
402.16 Surface Tolerances
402.18 Basis of Payment

402.01 Description. This work shall consist of constructing an intermediate course of aggregate and asphalt cement mixed in a central plant and spread and compacted on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades and typical sections shown on the plans or established by the Engineer.

The requirements of 401 shall apply; deviations from these are as follows.

The Contractor may use 448 Asphalt Concrete Intermediate Course, Type 2 in lieu of this item if he notifies the District Engineer of Tests in writing.

402.02 Composition. Coarse aggregate (No. 57, No. 67, No. 6, No. 8 or a combination thereof) and fine aggregate shall be combined in such proportions that the resulting blend shall be as directed by the Laboratory but within the following limits.

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Sieve	Total Percent Passing
37.5 mm (1½ inch)	100
25.0 mm (1 inch)	95-100
12.5 mm (½ inch)	60-90
4.75 mm (No. 4)	35-65
1.18 mm (No. 16)	15-45
300 µm (No. 50)	3-22
75 µm (No. 200)	0-8

Bitumen content shall be as directed by the Laboratory within the following limits.

Bitumen (Percent of total mix)	4.0 to 12.0

402.13 Spreading and Finishing. Where the mixture is placed for correcting irregularities in the existing pavement, the maximum compacted depth of any one layer shall be 75 mm (3 inches).

402.16 Surface Tolerances. The variation of the surface from the testing edge of the 3.0 m (10 foot) straightedge shall not exceed 6 mm (¼ inch). Variations in excess of slope or surface tolerances shall be corrected by adding or removing material in a manner satisfactory to the Engineer.

402.18 Basis of Payment. Payment for accepted quantities, complete in place, will be made at the contract price for:

Item	Unit	Description
402	Cubic meter (cubic yard)	Asphalt concrete

ITEM 403 ASPHALT CONCRETE

403.01 Description
403.02 Composition
403.13 Spreading and Finishing
403.16 Surface Tolerances
403.18 Basis of Payment

403.01 Description. This work shall consist of constructing an intermediate course of aggregate and asphalt cement mixed in a central plant and spread and compacted on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades and typical sections shown on the plans or established by the Engineer.

The requirements of 401 shall apply; deviations from these are as follows.

The Contractor may use 448 Asphalt Concrete Intermediate Course, Type 1 in lieu of this item if he notifies the District Engineer of Tests in writing.

403.02 Composition. Course aggregate (No. 8) and fine aggregate shall be combined in such proportions that the resulting blend shall be as directed by the Laboratory but within the following limits.

Sieve	Total Percent Passing
12.5 mm (½ inch)	100
9.5 mm (⅜ inch)	90-100
4.75 mm (No. 4)	45-75
1.18 mm (No. 16)	15-45
300 µm (No. 50)	3-22
75 µm (No. 200)	0-8

Bitumen content shall be as directed by the Laboratory within the following limits.

Bitumen (Percent of total mix)	4.5—12.0

403.13 Spreading and Finishing. Where the mixture is placed for correcting irregularities in the existing pavement, the maximum compacted depth of any one layer shall be 75 mm (3 inches).

403.16 Surface Tolerances. The variation of the surface from the testing edge of the 3.0 mm (10 foot) straightedge shall not exceed 6 mm (¼ inch). Variations in excess of slope or surface tolerances shall be corrected by adding or removing material in a manner satisfactory to the Engineer.

403.18 Basis of Payment. Payment for accepted quantities, complete in place, will be made at the contract price for:

Item	Unit	Description
403	Cubic meter (cubic yard)	Asphalt concrete

ITEM 404 ASPHALT CONCRETE

404.01 Description
404.02 Composition
404.12 Conditioning Existing Surface
404.13 Spreading and Finishing
404.15 Joints

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404.16 Surface Tolerances
404.18 Basis of Payment

404.01 Description. This work shall consist of constructing a surface course of aggregate and asphalt cement mixed in a central plant and spread and compacted on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades and typical sections shown on the plans or established by the Engineer.

The requirements of 401 shall apply; deviations from these are as follows.

The Contractor may use 448 Asphalt Concrete Surface Course, Type 1 in lieu of this item if he notifies the District Engineer of Tests in writing.

404.02 Composition. Coarse aggregate (No. 8) and fine aggregate shall be combined in such proportions that the resulting blend shall be as directed by the Laboratory but within the following limits.

Sieve	Total Percent Passing
12.5 mm (½ inch)	100
9.5 mm (⅜ inch)	90-100
4.75 mm (No. 4)	45-75
1.18 mm (No. 16)	15-45
300 µm (No. 50)	3-22
75 µm (No. 200)	0-8

Bitumen content shall be as directed by the Laboratory within the following limits.

Bitumen (Percent of total mix)	4.5—12.0

404.12 Conditioning Existing Surface. In areas where the surface is required to be feathered to meet an adjoining surface, the existing surface shall be coated uniformly with a thin coat of asphalt cement as specified.

404.13 Spreading and Finishing. Traffic shall not be permitted on the compacted mixture until it has cooled sufficiently to prevent glazing as determined by the Engineer.

After completion of the surface course, gutters shall be sealed with asphalt cement as directed by the Engineer. The material shall be applied at a uniform width of approximately 100 mm (4 inches) and at a rate just sufficient to fill surface voids.

404.15 Joints. Transverse construction joints shall be formed or cut to a vertical face and coated in accordance with 401.15.

404.16 Surface Tolerances. The completed surface course will be checked with straightedges and/or rolling straightedges by the Engineer. The variation of the surface course from the testing edge of the 3.0 m (10 foot) straightedge shall not exceed 6 mm (¼ inch). Variations in excess of slope or surface tolerance shall be corrected by removal of mixture to neat lines and replacement or by surface grinding in a manner satisfactory to the Engineer.

404.18 Basis of Payment. Payment for accepted quantities, complete in place, will be made at the contract price for:

Item	Unit	Description
404	Cubic meter (cubic yard)	Asphalt concrete

ITEM 405 BITUMINOUS COLD MIX

405.01 Description
405.02 Composition
405.03 Materials
405.04 Mixing Plants
405.05 Weather Limitations
405.06 Bituminous Material Preparation
405.07 Aggregate Preparation
405.08 Mixing
405.09 Hauling
405.10 Bituminous Pavers
405.11 Rollers
405.12 Conditioning Existing Surface
405.13 Spreading and Finishing
405.14 Compaction
405.15 Joints
405.16 Spreading and Surface Tolerances
405.17 Method of Measurement
405.18 Basis of Payment

405.01 Description. This work shall consist of constructing one or more courses of aggregate and bituminous material mixed in a central or traveling plant, spread and compacted on a prepared surface in accordance with these specifications and in reasonably close conformity with the line, grades, quantity per square meter (square yard) and typical sections specified or established by the Engineer.

Cover aggregate shall conform to 703.06.

407.03 Equipment. Equipment shall consist of adequate cleaning equipment, spreader boxes, and bituminous distributors.

Bituminous distributors shall be designed, equipped, maintained and operated so that bituminous material is applied at the specified rate per m^2 (square yard) with uniform pressure over the required width of application. The distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank. An accurate thermometer with a range covering the specified application temperature for bituminous material shall be mounted at approximately center height of the tank with the stem extending into the bituminous material. The distributor shall have a full-circulating system with a spray bar which is adjustable laterally and vertically. The spray bar shall be maintained at a constant height above the pavement under variable load conditions. Each distributor shall have suitable charts showing truck and pump speeds and other pertinent application data necessary to obtain the required results.

Distributors shall meet the following requirements: The actual application in l/m^2 (gallons per square yard) shall be determined by a check on the project. The application shall be considered satisfactory when the actual rate is within plus or minus 10 percent of the required rate and the material is applied uniformly with no visible evidence of streaking or ridging.

407.04 Preparation of Surface. The surface shall be thoroughly clean and dry when the bituminous material is applied. Material cleaned from the surface shall be removed and disposed of as directed by the Engineer.

407.05 Application of Bituminous Material. The bituminous material shall be uniformly applied with a bituminous distributor. For irregular areas such as driveways and intersections, the method of application shall be approved by the Engineer.

The tack coat shall be applied in a manner that offers the least inconvenience to traffic and permits one-way traffic without pickup or tracking.

The bituminous material shall not be applied when the surface temperature is below the minimum placement temperature for the pavement course to be placed, as specified in 401.05.

The quantity, rate of application, temperature, and areas to be treated, shall be approved prior to application. The tack coat application shall be limited to areas that will be covered by a pavement course during the same day.

407.06 Application of Cover Aggregate. Immediately following the application of the bituminous material in areas which will be exposed to traffic, sufficiently dry cover aggregate shall be applied uniformly to form a bonded layer which, after curing, will not be picked up by traffic. Excessive application resulting in an unbonded layer of cover aggregate will not be accepted. The cover aggregate shall be included in the bid price for the tack coat.

407.07 Method of Measurement. Bituminous material will be measured by the liter (gallon) in accordance with 109.

407.08 Basis of Payment. Payment for accepted quantities complete in place will be made at the contract price for:

Item	Unit	Description
407	Liter (gallon)	Tack coat

ITEM 408 PRIME COAT

408.01 Description
408.02 Bituminous Material
408.03 Cover Aggregate
408.04 Weather Limitations
408.05 Equipment
408.06 Preparation of Surface
408.07 Application of Bituminous Material
408.08 Application of Cover Aggregate
408.09 Method of Measurement
408.10 Basis of Payment

408.01 Description. This work shall consist of preparing and treating an existing surface with bituminous material, and cover aggregate if required, in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the Engineer.

408.02 Bituminous Material. The bituminous material shall meet the applicable requirements of 702 and shall be one of the following: 702.02 RC-70, RC-250, MC-30, MC-70, or MC-250; or 702.03 Primer 20.

408.03 Cover Aggregate. Cover aggregate shall be No. 9 size 703.05 or 703.06.

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408.04 Weather Limitations. Bituminous material shall not be applied on a wet surface. Prime coats for road mix or surface treatment work shall not be applied when the atmospheric temperature is below 10° C (50° F) or when the air temperature within the preceding 24 hours has been 5° C (40° F) or lower. Prime coats on new macadam, stabilized and granular base courses, may be applied when the atmospheric temperature is 5° C (40° F) or higher.

408.05 Equipment. Equipment shall conform to 407.03.

408.06 Preparation of Surface. The surface to be primed shall be shaped to the required grade and section, shall be free from all ruts, corrugations, segregated material or other irregularities and shall be smooth and uniformly compacted at the time of application of the bituminous material. The cleaning shall be done in such manner as to thoroughly remove all mud, earth and other foreign material. The sweeping on a waterbound surface shall be just sufficient to expose the pattern of the coarse aggregate. Special care shall be taken to clean the edges of road to be primed in order to insure uniform application of the bituminous material directly on the existing base or pavement surface. Material cleaned from the surface shall be removed and disposed of as directed by the Engineer.

408.07 Application of Bituminous Material. Bituminous material shall be applied in a uniform continuous spread to the width of the section to be primed by means of a pressure distributor conforming to 407.03. When traffic is maintained, not more than one half of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at the junction of spreads is not in excess of the specified amount. Excess bituminous material shall be squeegeed from the surface. Skipped areas or deficiencies shall be corrected.

When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the road bed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed. The quantity, rate of application, temperatures and areas to be treated, shall be approved before application of the prime coat.

408.08 Application of Cover Aggregate. If after the application of the prime coat, the bituminous material fails to penetrate within the required time and the roadway must be used by traffic, cover aggregate shall be spread in the amounts required to absorb any excess bituminous material. The cover aggregate shall be included in the bid price for the bituminous prime coat.

408.09 Method of Measurement. Bituminous material shall be measured by the liter (gallon) in accordance with 109.

408.10 Basis of Payment. Payment for accepted quantities complete in place will be made at the contract price for:

Item	Unit	Description
408	Liter (gallon)	Bituminous prime coat

ITEM 409 SEAL COAT

409.01 Description
409.02 Bituminous Material
409.03 Cover Aggregate Material
409.04 Weather Limitations
409.05 Equipment
409.06 Preparation of Surface
409.07 Applying Bituminous Material
409.08 Cover Aggregate
409.09 Method of Measurement
409.10 Basis of Payment

409.01 Description. This work shall consist of the construction of a wearing surface composed of one or more applications of bituminous material and cover aggregate, in place and compacted, in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the Engineer.

409.02 Bituminous Material. The bituminous material shall meet the applicable requirements of 702 and shall be one of the following: 702.02 RC-250, RC-800, RC-3000, MC-800 or MC3000; or 702.03 CBAE-800; or 702.04 RS-1, RS-2, CRS-1, or CRS-2. Cut-back asphalts 702.02 and cut-back asphalt emulsions 702.03 may only be used after September 15 and before May 15.

409.03 Cover Aggregate Material. The cover aggregate shall conform to 703.05. The sizes of aggregate shall be No. 6, No. 67, No. 8 or No. 9, as specified. The surface moisture of the cover aggregate shall not exceed that which will permit the proper coating and adhesion of the type of bituminous material specified, except that the bituminous material may be treated with some agent that will assist in obtaining sufficient coating to hold the aggregate in place, provided such treatment is approved by the Director. When a con-

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sary materials, shall be completed and paid for in accordance with 603.

657.08 Method of Measurement. Measurement of riprap for tree protection shall be the number of square meters (square yards) of riprap of the specified thickness, in place, completed and accepted. Measurement shall be made parallel to the face of the wells or walls.

657.09 Basis of Payment. Payment for accepted quantities will be made at contract price for:

Item	Unit	Description
657	Square meter (square yard)	Riprap for tree protection

ITEM 658 TREE ROOT AERATION

658.01 Description
658.02 Aggregate
658.03 Tile
658.04 Preparation
658.05 Aeration for Trees Not Welled
658.06 Aeration with Tree Wells
658.07 Earth Embankment
658.08 Method of Measurement
658.09 Basis of Payment

658.01 Description. This item shall consist of furnishing and placing the necessary aggregate and tile for the protection and aeration of the roots of trees and shrubs as specified or directed by the Engineer.

658.02 Aggregate. The aggregate for tree root aeration and protection shall be No. 4 or No. 467 limestone or gravel.

658.03 Tile. Tile shall be 100 mm (4 inch) drain tile conforming to 706.07, 706.09, or 707.15.

658.04 Preparation. The feeding root area to be protected and aerated shall be the ground surface area lying within the periphery of the tree or shrub not marked for removal. Such areas shall be first thoroughly cleared of all vegetation, wood, brush and debris.

658.05 Aeration for Trees Not Welled. Where the earth fill is less than 300 mm (12 inches) and more than 100 mm (4 inches)

over the feeding root area, an aggregate aeration course of one-half the height of fill, but not less than 75 mm (3 inches) shall be spread loosely over such area, except that at the tree trunk the thickness shall be increased to the height of the fill and extended outward from the tree trunk in collar form for a distance of 0.4 m (15 inches). A 50 mm (2 inch) layer of straw or hay shall be placed over the aggregate.

658.06 Aeration with Tree Wells. An aeration course of aggregate shall be placed in connection with tree wells and previous to any other filling. The aggregate over the entire feeding root area outside of the tree wells shall have a total thickness of depth of 150 mm (6 inches) for each 300 mm (12 inches) of earth fill, or proportion thereof, but there shall be a minimum depth of 150 mm (6 inches) regardless of depth of overlying fill. Straw or hay cover over aeration course shall be placed according to 658.05. No aggregate shall be placed inside the tree well (between the wall and the tree trunk).

658.07 Earth Embankment. Any necessary earth embankment shall be performed in accordance with 203 using the material from the excavation. In the event borrow is necessary, same shall be completed and paid for in accordance with 203.

658.08 Method of Measurement. The volume of aggregate for tree root aeration to be paid for shall be the number of cubic meters (cubic yards), measured in the carrier, of aggregate furnished, placed, completed and accepted.

658.09 Basis of Payment. Payment for accepted quantities will be made at contract price for:

Item	Unit	Description
658	Cubic meter (cubic yard)	Tree root aeration

ITEM 659 SEEDING AND MULCHING

659.01 Description
659.02 Agricultural Liming Materials
659.03 Commercial Fertilizer
659.04 Seeds
659.05 Inoculating Bacteria
659.06 Mulching Material
659.07 Inoculating Legumes
659.08 Fertilizing

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659.09 Seeding and Mulching
659.10 Wildlife Seeding
659.11 Method of Measurement
659.12 Basis of Payment

659.01 Description. This item shall consist of furnishing all seed, agricultural liming materials, commercial fertilizer, mulching material, and water and placing and incorporating as specified; and mowing the resulting cover as directed. Seeding and mulching shall be performed in stages, per 108.04 and 207.

The areas to be seeded and paid for under this item shall include all areas designated by the Engineer within the right-of-way line and as described on the plans. All areas outside of specified limits where the vegetative growth has been injuriously disturbed or destroyed by the Contractor including those areas defined in 104.06 shall be restored and seeded in accordance with these specifications by the Contractor at no additional cost to the Department.

When the proposal contains an estimated quantity of "659 Repair Seeding and Mulching," such work shall be performed on damaged or eroded areas of seeding and mulching which have previously been acceptably completed, at the times and locations ordered by the Engineer.

A second application of commercial fertilizer at three quarters of the specified rate shall be applied to selected grass areas when and as ordered by the Engineer.

Commercial fertilizers and agricultural liming materials shall be obtained by the Contractor from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Ohio, Department of Agriculture.

659.02 Agricultural Liming Materials. For the basis of quality control agricultural ground limestone, with a minimum total neutralizing power (TNP) of 90 percent and at least 40 percent passing a 150 µm (No. 100) sieve, and at least 95 percent passing a 2.35 mm (No. 8) sieve, and with a 100 percent application rate of 256 kg/1000 m^2 (46 pounds per 1000 square feet) shall be standard grade. Other grades of agricultural liming materials will be applied at rates which are dependent on the TNP and fineness of the sample. These rates are determined from the table "Equivalent Amounts of Liming Materials" found in Bulletin 472, "Agronomy Guide", published by the Cooperative Extension Service, The Ohio State University.

No payment adjustment shall be made for the equivalent quantity required by the Agronomy Guide. The payment rate shall be based on the percentage of the standard in 659.08 or the rate stated in the plans.

659.03 Commercial Fertilizer. Commercial fertilizer may be dry or liquid in analysis specified or in the same ratio as specified.

659.04 Seeds. All seeds specified shall meet the current specifications on file with the Department as to percentage purity, weed seed and germination.

All seeds proposed to be used under this item shall be on an approved list on file at the Laboratory, and shall meet the requirements of these specifications.

The Department reserves the right to test, reject or approve all seed after delivery on the project.

All seeds are to be furnished in separate varieties, separately packaged or bagged, and shall be labeled, tagged or marked in accordance with 907.03, ORC.

659.05 Inoculating Bacteria. The inoculant for treating leguminous seeds shall be a pure culture of nitrogen-fixing bacteria selected for maximum vitality, not more than one year old. All cultures shall be subject to the approval of the Engineer.

659.06 Mulching Material. Materials used for mulching shall be straw or hay. They shall be reasonably free of weed seed and such foreign materials as may detract from their effectiveness as a mulch or injurious to desired plant growth.

659.07 Inoculating Legumes. All leguminous seeds shall be inoculated or treated with the proper amount of approved culture mixed with sufficient water to thoroughly wet the seed with the solution. When seed is sown hydraulically, four times the amount of inoculant required above shall be placed directly into the slurry and thoroughly mixed immediately before seeding. Seed shall be sown within 24 hours after treatment with the inoculant.

659.08 Fertilizing and Liming. The standard application of fertilizer shall be at the rate of 0.1 kg/m^2 (20 pounds per 1000 square feet) of 12-12-12. Another analysis, in the same ratio, may be used by varying the application rate to produce the same values specified. Either dry or liquid fertilizer may be used and shall be distributed in an even pattern over the specified area, then thoroughly disked, harrowed or raked into the soil to a depth of not less than 50 mm (2 inches) unless otherwise directed by the Engineer.

When agricultural liming material is required, it shall be applied on the surface at 220 percent of the standard rate stated in 659.02, and thoroughly disked, harrowed or raked into the soil to

a depth of not less than 50 mm (2 inches) unless otherwise directed by the Engineer.

Other agricultural liming materials may be used and the rate of application shall be varied according to the percent required of the standard rate of application specified under 659.02.

Fertilizer and liming materials when required shall be applied separately but can be disked or otherwise incorporated into the soil in the same operation. If the seed bed becomes compacted prior to seeding, it shall be redisked or loosened to a friable condition before seeding. If the fertilizer or lime has been washed or otherwise lost from the seed bed, the areas so depleted shall be retreated as directed by the Engineer at no cost to the project.

Areas of the project which were seeded and mulched during preceding seasons (three months or more) shall be refertilized. The fertilizer shall be applied to the surface without incorporation into soil at one half the normal rate. This operation shall be performed after repair seeding and mulching operations have been completed

659.09 Seeding and Mulching. All areas to be seeded shall be free of rock and other foreign material 75 mm (3 inches) or greater in any dimension and shall be satisfactorily shaped and finished as provided in 203. Areas in front of residences, between curb and sidewalks, and other areas indicated on the plans, shall be free of all stones 25 mm (1 inch) or greater in any dimension and shall have a smooth surface. In such areas, hand raking will be required if inaccessible to machines, and may be required if machines do not provide results equivalent to hand raking. Payment for the work necessary for proper preparation of the seed bed shall be included in the unit price for 203.

The seed shall be thoroughly mixed and then evenly sown over the prepared areas at the rate of 15 g/m^2 (3 pounds per 1000 square feet). Seed shall be sown dry or hydraulically.

All areas to be seeded which are considered to be urban in character, and any area immediately in front of a residence, shall be seeded with the following mixture: (Percentages are by weight).

40 percent Kentucky Bluegrass (Poa pratensis)

40 percent Creeping Red Fescue (Festuca rubra)

20 percent Annual Ryegrass (Lolium multiflorum)

All other areas except those areas defined in 104.06 shall be seeded with the following mixture:

30 percent Kentucky Bluegrass (Poa pratensis)

60 percent Kentucky 31 Fescue (Festuca arundinacea var. Ky. 31)

10 percent Perennial Ryegrass (Lolium perenne)

All areas defined in 104.06 shall be seeded at the rate of not less than 10 g/m^2 (2 pounds per 1000 square feet) with the above mixture or the following mixture:

90 percent Perennial Ryegrass (Lolium perenne)

10 percent Alsike Clover (Trifolium hybridum)

All areas to be seeded with Crown Vetch shall be seeded at a rate of 7 g/m^2 (1½ pounds per 1000 square feet) with the following mixture:

33 percent Crown Vetch (Coronilla varia)

67 percent Perennial Ryegrass (Lolium perenne)

Immediately after sowing, the area shall be raked, dragged or otherwise treated so as to cover the seed to a depth of approximately 6 mm (¼ inch).

The operation of seed sowing shall not be performed when the ground is frozen or muddy, or when the soil or weather conditions would prevent the proper soil preparation and subsequent operations as specified. All seeding performed between October 15 and March 15 shall be temporary seeding in accordance with 207. However, for projects which will be completed in the same calendar year, permanent seeding may be performed with permission of the Engineer. Sowing of Crown Vetch shall not be permitted during September or October.

Seeding shall be done prior to or concurrently with 660, 667, 668 or 670.

Within 48 hours after any given area is seeded, vegetative mulch material conforming to 659.06 shall be evenly placed over all seeded areas at the rate of approximately 0.5 t/1000 m^2 (2 tons per acre) for straw, or 0.7 t/1000 m^2 (3 ton per acre) for hay, when seeding is performed between the dates of March 15 and October 15, and at the approximate rate of 0.7 t/1000 m^2 (3 tons per acre) for straw, or 1.0 t/1000 m^2 (4½ tons per acre) for hay, when seeding is performed between the dates of October 15 and March 15 of the succeeding year.

Mulching materials shall be kept in place with asphalt emulsion applied at a minimum rate of 250 L/t (60 gallons per ton) of mulch or by methods or tackifiers as are approved. An additional application at a rate of 125 L/t (30 gallons per ton) of mulch shall be applied to the shoulder area, starting at the berm edge and extending out for a distance of 3 m (10 feet). Asphalt emulsion for vegetative mulch shall conform to 702.04. Emulsion shall be nontoxic to plants and shall be so prepared that it will not change in transportation or storage. Mulching which is displaced shall be replaced at

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once but only after the seeding or other work which preceded the mulching and which work was damaged as a result of displacement of mulching material has been acceptably repaired.

The Contractor shall maintain all seeded and mulched areas until final inspection. Maintenance shall also include repairing any areas damaged following the seeding or mulching operation due to wind, water, fire or other causes. Such damaged areas shall be repaired to re-establish the condition and grade of the area prior to seeding and shall then be refertilized, reseeded and remulched as directed by the Engineer.

When an estimated quantity of "659 Repair Seeding and Mulching" is listed in the proposal, it is to provide for repair of damages or erosion where the regular seeding and mulching operations have been acceptably performed in stages on significant portions of the project. Such repairs of these areas shall be made at the direction of the Engineer when the damage or erosion is not due to fault or negligence of the Contractor. The repairs shall be made prior to completion of the project by reworking or reshaping to grade and then refertilizing, reseeding and mulching. Reworking or reshaping of slope shall include bringing in additional material, if necessary, and using whatever equipment is necessary to restore slopes to grade. Such work will be measured and paid for as "Repair Seeding and Mulching." When damage or erosion of these areas occurs as a result of the fault or negligence of the Contractor, the areas shall be satisfactorily repaired and refertilized, reseeded, and mulched at no additional cost to the State.

Unless otherwise directed by the Engineer, the seed bed shall be thoroughly watered, as soon as the seed is covered, at the rate of 5 m^3/1000 m^2 (120 gallons per 1000 square feet). The water shall be applied by means of a hydro-seeder or a water tank under pressure with a nozzle that will produce a spray that will not dislodge the mulching material. A second water application shall be made no sooner than 7 days or later than 10 days after the first application, providing significant rainfall has not occurred within 7 days after the first application. When significant rainfall occurs within 7 days after the first application, the Engineer may delay or omit entirely the second application, depending on weather conditions. The rate of the second application shall be 5 m^3/1000 m^2 (120 gallons per 1000 square feet). Water shall be measured and paid for separately.

Mowing of excess growth on seeded areas shall be performed when and as directed by the Engineer. The vegetation shall be cut to approximately 150 mm (6 inches) in height by acceptable methods.

659.10 Wildlife Seeding. When areas of the project are designated to be seeded for wildlife, the following mixture shall be

used at the rate of 10 g/m^2 (2 pounds per 1000 square feet):

60 percent Brome grass (Bromas inermis).

18 percent Red Clover (Trifolium pratense).

22 percent Perennial Ryegrass (Lolium perenne).

659.11 Method of Measurement. Commercial fertilizer and agricultural liming to be paid for shall be the number of kilograms (tons) of each calculated to standard, furnished, spread and incorporated. Seeding and mulching to be paid for shall be the number of square meters (square yards) of the area seeded and mulched in accordance with these specifications. Repair seeding and mulching to be paid for shall be the number of square meters (square yards) of damaged or eroded areas reshaped, seeded, and mulched at the direction of the Engineer on portions of the project where seeding and mulching had previously been acceptably completed and where the damage was due to no fault or negligence of the Contractor. The quantity of water shall be the amount in cubic meters (thousands of gallons) applied in accordance with the requirements of this item and measured in tanks, tank wagons or trucks of predetermined capacity, or by means of meters of a type satisfactory to the Engineer and furnished and installed by the Contractor at his own expense, or determined by weight conversion.

Mowing satisfactorily performed at the direction of the Engineer will be measured in square meters (1000 square foot units).

659.12 Basis of Payment. Payment for accepted quantities will be made at contract prices for:

Item	Unit	Description
659	Kilogram (ton)	Commercial fertilizer
659	Kilogram (ton)	Agricultural liming
659	Square meter (square yard)	Seeding and mulching
659	Square meter (square yard)	Seeding and mulching for wildlife
659	Square meter (square yard)	Repair seeding and mulching
659	Cubic meter (M gallons)	Water
659	Square meter (M square feet)	Mowing

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conform to the current AWPA standards and the requirements of this specification. However, the minimum retention for blocks shall be 6.4 kg/m^3 (0.40 lbs. per cu. ft.).

Material treated within the State of Ohio shall either be inspected by an authorized inspector of the Department or, where such inspection is waived, the company treating the material shall submit for each charge: (1) charts from automatic recording instruments showing conditions within the treating cylinder at all times during treatment; (2) computations showing the volume of wood in the charge, the volume of preservative material used and the final net retention of each charge; and (3) approximately one dozen representative cores taken from the material with an increment borer. The Department shall be notified at least 72 hours (exclusive of Saturdays, Sunday and holidays) in advance of the treating of the material.

Material treated outside the State of Ohio shall bear the identification mark of the inspection agency and a certificate of inspection for treatment shall be forwarded to the Department. An agency qualified and approved by the Department for such inspection shall make the required inspection and the cost of this inspection and furnishing the reports shall be included in the price bid for material. The supplier shall furnish a Notarized Certificate of Conformance with each shipment of material stating the size, species, quantity shipped, project number, source of material, where treated, type of treatment, date treated, retention in kg/m^3 (lbs. per cu. ft.), charge number, inspection agency, inspection report number and date issued.

When guardrail offset blocks are furnished by an Ohio supplier, a Notarized Certificate of Conformance shall be furnished by the supplier with each shipment of material stating the size, species, quantity shipped, project number, vendor's order number, type of treatment and retention in kg/m^3 (lbs. per cu. ft.).

Materials. Timber preservatives shall conform to AASHTO M 133 and shall include creosote oil, creosote coal-tar solution, ammoniacal copper arsenate (ACA), chromated copper arsenate (CCA), Types A, B or C, and pentachlorophenol.

Preparation for Treatment. Sorting. Whenever it is practicable the material shall be sorted into one kind or designated group of kinds of wood and into pieces of approximately equal size and moisture and sapwood content, and so separated as to insure contact of treating medium with all surfaces.

Framing. So far as practicable, all adzing, boring, chamfering, framing, graining, mortising, surfacing, etc., shall be done prior to treatment.

Incising. All Douglas fir, except rails and rail posts, the least dimension of which is 50 mm (2 inches) or over shall be incised by a suitable power-driven machine before treatment. Lumber having a thickness of 75 mm (3 inches) and over, shall be incised on all four sides. Lumber less than 75 mm (3 inches) thick shall be incised on the wide faces only, except where indicated on the plans. The spacing and shape of the cutting teeth and the method of incising shall be such as to produce a uniform penetration. The depth of the incisions shall be not less than the following:

Size	Minimum depth of incision, mm (in.)
50 x 300 (2 x 12)	9 (3/8)
75 x 300 (3 x 12)	11 (7/16)
100 x 300 (4 x 12)	13 (1/2)
200 x 250 (8 x 10)	14 (9/16)
250 x 300 (10 x 12)	16 (5/8)
300 x 300 (12 x 12)	19 (3/4)

Intermediate Sizes in proportion.

Amount of Preservative. The net retention in any charge shall be not less than 90 percent of the quantity of preservative specified; but the average retention by the material treated under any contract or order and the average retention of any five consecutive charges shall be at least 100 percent of the quantity specified. The minimum amounts of preservative retained shall be as specified by AASHTO M 133 which are those set forth in the referenced American Wood-Preservers' Association Standard. All species of structural timber, lumber, piling, posts and blocks shall be treated according to the current AWPA standard specifications.

712.09 Geotextile Fabrics. The fabric shall be composed of strong rot-proof polymeric fibers formed into a woven or non-woven fabric which meets the following requirements:

Type A: Underdrains and Slope Drains.

Minimum Tensile Stength[1]	355 N (80 lbs.)
Minimum Puncture Strength[2]	110 N (25 lbs.)
Minimum Tear Strength[3]	110 N (25 lbs.)
Minimum Burst Strength[4]	900 kPa (130 psi)
Apparent Opening Size[5]	
Soil Type-1: Soils with 50% or less passing 75 µm (No. 200) sieve	AOS ≤ 0.6mm.
Soil Type-2: Soils with 50%-85% passing 75 µm (No. 200) sieve	AOS ≤ 0.3mm.
Minimum permeability[6]	1X10^{-2} cm/sec.

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Type B: Filter Blankets for Rock Channel Protection.

Minimum Tensile Stength[1]	890 N (200 lbs.)
Minimum Puncture Strength[2]	355 N (80 lbs.)
Minimum Tear Strength[3]	220 N (50 lbs.)
Minimum Burst Strength[4]	2200 kPa (320 psi)
Minimum Elongation[1]	15%
Apparent Opening Size[5]	AOS ≤ 0.6mm.
Minimum Permeability[6]	$1X10^{-3}$ cm/sec.

Type C: Sediment Fences.

Minimum Tensile Stength[1]	535 N (120 lbs.)
Maximum Elongation at 265 N (60 lbs.)[1]	50%
Minimum Puncture Strength[2]	220 N (50 lbs.)
Minimum Tear Strength[3]	180 N (40 lbs.)
Minimum Burst Strength[4]	1380 kPa (200 psi)
Apparent Opening Size[5]	AOS ≤ 0.84mm.
Minimum Permittivity[6]	$1X10^{-2}$ sec.$^{-1}$
Ultraviolet Exposure Strength Retention[7]	70%

Type D: Subgrade—Subbase Separation or Stabilization.

Minimum Tensile Stength[1]	800 N (180 lbs.)
Maximum Elongation at 755 N (170 lbs.)[1]	35%
Minimum Tear Strength[3]	310 N (70 lbs.)
Minimum Burst Strength[4]	2590 kPa (375 psi)
Minimum Puncture Strength[2]	310 N (70 lbs.)
Apparent Opening Size[5]	Same as Type A
Permeability[6]	$1X10^{-3}$ cm/sec.

1. ASTM D 4632
2. ASTM D 4833.
3. ASTM D 4533.
4. ASTM D 3786; 125 x 125 mm (5" x 5") or 125 mm (5") diameter minimum size sample; 75 mm (3") diameter clamping surface opening; 1.80 mm ± 0.05 mm (0.070" ± 0.002") diaphragm thickness 170 (± 15) ml. per minute fluid displacement.
5. ASTM D 4761.
6. ASTM D 4491.
7. ASTM D 4355.

All minimum strengths shown are average roll minimum values in the weakest principle direction.

The fabric shall be free of any treatment which might significantly alter its physical properties. During the shipment and storage, the fabric shall be wrapped in a heavy-duty protective covering to protect it from direct sunlight, dirt, dust and other debris.

For fabric Types A, B and C, the manufacturer shall submit a certification with each shipment of material stating that it meets

specification requirements. For Type D material, the manufacturer shall submit certified test data to cover each shipment of material:

713 LIGHTING AND ELECTRICAL MATERIALS

713.00 General. Lighting and electrical materials covered by these specifications shall be inspected and certified as follows:

1. Inspection. Lighting and electrical materials are subject to inspection at the project site. Such inspection will include but is not limited to the identification of the item, type, size and manufacturer's markings, and documentation of these data. When required by the Laboratory, random samples will be selected from the material delivered or at the place of manufacture or warehouse prior to delivery.

2. Certification. When required by the Laboratory, certified test data shall be furnished.

In the case of light poles and light towers, certified test data in triplicate covering the specified requirements for all materials incorporated in the poles, towers and accessories and the results obtained from the deflection tests shall be furnished the Laboratory.

713.01 Light Poles. 1. Scope. These specifications cover materials and manufacturing methods to be used in the fabrication of light poles used to support luminaires at heights of less than 20 m (70 feet) above the foundation. Any aluminum or steel material permitted by the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" may be used in this item. Pole designs shall conform to minimum requirements of the AASHTO specifications cited, except that the design wind load shall, in all cases, be based on a wind speed of 145 km/h (90 miles per hour).

2. Shafts. (a) There shall be not more than one longitudinal, automatically electrically welded seam and no transverse seams or welds, except as permitted hereinafter. The longitudinal welded seam shall be neat and uniform in appearance, the weld shall not be less than the thickness of the base material, and the bead height shall not exceed 2 mm (1/16 inch). The wall shall be of uniform thickness throughout, except at the weld bead. The cross section of the shaft shall be circular, or multisided with no less than eight sides, and the diameters or cross sectional dimensions, measured at any point along the longitudinal axis, shall not vary from each other more than 5 mm (3/16 inch). Poles may consist of not more than two vertical shafts joined by overlapping the sections at least 1½ diameters of the bottom of top section, and by use of a ⅝-inch

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700 MATERIAL DETAILS

MINIMUM REQUIREMENTS FOR SAMPLING MATERIALS

For small quantities see 106.031

Material	Specification Section Number	Quantity Represented by Sample	Size of Sample
Aggregate and aggregate soil mixtures			
Coarse; gravel, slag or stone	703.02, 703.04, 703.05 703.08, 703.10	Each 2360 t (2600 tons) or fraction thereof	
		Sizes Nos. 3 thru 10	27-32 kg (60-70 pounds)
		Sizes Nos. 1, 2 & 24	45 kg (100 pounds)
Fine	703.02, 703.03, 703.05 703.06	Each 1180 t (1300 tons) or fraction thereof	14-18 kg (30-40 pounds)
Aggregate base	304.02	Each 2360 t (2600 tons) or fraction thereof	32 kg (70 pounds)
Stabilized crushed aggregate	411.02, 617.03	Each 3550 t (3900 tons) or fraction thereof	32 kg (70 pounds)
Subbase	310.02	Each 2360 t (2600 tons) or fraction thereof	Coarse particles included—32 kg (70 pounds) Sand—14-18 kg (14-18 pounds)
Traffic compacted surface	410.02	Each 3550 t (3900 tons) or fraction thereof	27-32 kg (60-70 pounds)
Mineral filler	703.07	First shipment, each company	2 L (½ gallon)
Agricultural limestone	659.02	First shipment, each company	1 L (1 quart)
Bearing pads; preformed and elastomeric	711.21	Each shipment, each thickness	One piece, 150 x 150 mm (6 x 6 inch).
	711.23		Certified or mill certificates for steel and test requirements described in 711.23.
Bituminous concrete	301, 402, 403, 404, 412	Field inspected and tested: one for each time interval designated by the schedule established by the Central Laboratory.	2.0 - 2.5 kg (4-5 pound) briquette

Material	Specification Section Number	Quantity Represented by Sample	Size of Sample
	301, 402, 403. 404, 405, 412	Not field inspected and tested: a minimum of one sample for each purchase order. Where the purchase order exceeds 450 t (500 tons), one sample for each 450 t (500 tons) except where more than 450 t (500 tons) is produced in one day, one sample for each day's production, or use procedure outlined in SOP PH-C-302.	1 L (.32 oz.) tin filled or 2.0-2.5 kg (4-5 pound) briquette
Bituminous materials	702.01	Certified asphalt cement: At refinery, random sample as directed by the Laboratory. At bituminous concrete plant, one sample for each project, except for inconsequential quantities.	0.5 L (1 pint)
		Non-certified asphalt must be sampled and approved by the Department before use.	0.5 L (1 pint)
	702.02, 702.03, 702.04, 702.05, 702.06, 702.10, 702.11	Field or plant storage each tank. Not inspected at refinery: each tank car, tank truck, distributor and shipment of packages.	Solid or semi-solid 0.5 L (1 pint) Liquids—1 L (1 quart)
		Inspected at refinery or certified: as directed by the Laboratory.	
Bituminous pipe joint filler	706.10	Each batch No. or lot No. in shipment	0.5 L (1 pint)
Bolts. high-strength steel, nuts & washers	711.09	150 or less each dia., each length	2 bolts. nuts and washers
		151 to 280 each dia.. each length	3 bolts. nuts and washers
		281 to 500 each dia., each length	4 bolts. nuts and washers
		501 to 1200 each dia., each length	6 bolts. nuts and washers
		1201 to 3200 each dia.. each length	9 bolts. nuts and washers
		3201 to 10,000 each dia.. each length	14 bolts, nuts and washers

Material	Specification Section Number	Quantity Represented by Sample	Size of Sample
		10,001 and over each dia., each length	21 bolts, nuts and washers
		Note: The Size of Sample shall be increased 3 bolts, nuts and washers when the material is galvanized. Where production lot data is available the Size of Sample may be based on the production lot method. Certified test data or proof of domestic origin shall be submitted.	
Borrow	203.03	Sampled only when requested by the Engineer.	Soil, 9 kg (20 pounds) Granular material, 18 kg (40 pounds)
Brick, clay or shale, and concrete	704.01 and 704.02	First 10,000 units or fraction there of, subsequently each 50,000 units.	12 brick each size
Bronze, phosphor, cast and leaded.	711.16, 711.17, 711.18	When requested by Bureau of Bridges	
Calcium chloride	712.02	Each shipment	Solid: 0.5 L (1 pint) Liquid: 1 L (1 quart)
Castings, iron or steel	711.07, 711.12, 711.13	For bridges: When requested by Bureau of Bridges Other: Each lot of castings.	Test bars, coupons, and certification referencing the casting to a particular date of test bar if the casting is not marked.
Cement, hydraulic	701.01 through 701.06, 701.08, 701.09, 701.10	Certified Cement: Each 600 t (600 tons) used with a minimum of one sample per calendar month, or per project.	2 L (½ gallon)
		Non-Certified Cement: Each 100 t (100 tons) or fraction thereof from cars or trucks.	2 L (½ gallon)
		Partial Plant Inspection: Each 100 t (100 tons) or fraction thereof from cars and trucks.	2 L (½ gallon)
	701.07	Each 1000 bags or fraction thereof.	4 L (1 gallon)
Chemical admixtures for concrete	705.12	Liquid—10 000 L (2500 gals.) Dry—2 t (2 tons) Each shipment, each material, each company	0.5 L (plastic container) (1 pint)

Material	Specification Section Number	Quantity Represented by Sample	Size of Sample
Concrete beams	305. 451, 452. 453	6500 m² (7500 sq. yds.) or less	Two beams
Concrete curing agents	705.05, 705.06, 705.07	Each shipment, each material, each company	Liquids—0.5 L (1 pint) Paper. polyethylene sheeting. burlap or plastic coated burlap blankets. 1 piece 1.0 x 1.0 m (4 x 4 ft.)
510 Concrete cylinders			
Structures	499 & 511	Over 6.1 m (20 ft.) span, each day. each 150 m³ (200 cu. yd.) or less. 6.1 m (20 ft.) span and under, each 40 m³ (50 cu. yd.) or less.	2 cylinders
Concrete masonry blocks	704.03	First 10,000 units or fraction thereof subseq. ea. 50,000 units.	10 pieces. each type.
Copper. sheet	711.15	Each shipment, each thickness.	1 piece. 300 x 300 mm (12 x 12 inch)
Delineators	720	When requested by Laboratory	5 units each type
Embankment	203. 503	Sampled only when requested by the Engineer	Soil. 9 kg (20 pounds) Granular material. 18 kg (40 pounds)
Expansion shield anchors	712.01	Each shipment. each size.	3 of each size and certified test data: documented proof of domestic origin.
Fence			
Barbed wire	710.01	Each 50 rolls or fraction thereof	1 piece 1.0 m (3 ft.) long*
511 Steel woven wire fabric	710.02	Each 50 rolls or fraction thereof	1 piece 1.0 m (3 ft.) long full height*
Posts	710.11	Each shipment	3 for each 1000 or smaller quantity*
Chain-link fabric	710.03	Each 50 rolls or fraction thereof	1 piece, 0.3 m (1 ft.) long, full height from each of two rolls, plus certified copies of chemical and physical properties of the fabric.*

701.07 Masonry Cement. ASTM C 91.

701.08 Expansive Hydraulic Cement. ASTM C 845, Type K.

701.09 Portland Pozzolan Cement. ASTM C 595 Type IP except that the pozzolan constituent (fly ash) shall not exceed 20 percent by weight and the loss on ignition of the pozzolan constituent shall not exceed 6 percent. This cement may be used provided 705.10 Admixture is added at the mixer.

701.10 Air-Entraining Portland Pozzolan Cement. ASTM C 595 Type IPA except that the pozzolan constituent (fly ash) shall not exceed 20 percent by weight and the loss on ignition of the pozzolan constituent shall not exceed 6 percent.

702 BITUMINOUS MATERIAL

Acceptance: Asphalt cements meeting the requirements of 702.01 and liquid asphalts 702.02, 702.03 and 702.04 may be acceptable for shipment to and immediate use in construction projects by asphalt manufacturer's certification, at the option of the Contractor in lieu of sampling by Departmental Inspectors at manufacturing plants, when requested by an asphalt manufacturer and agreed to by both the requesting asphalt manufacturer and the department. The procedure for this type of acceptance is set forth in Supplement 1032 on file in the Office of the Director.

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702.00 Application Temperatures. Bituminous materials for the several applications in the specifications shall be applied within the temperature ranges indicated in the following table.

Type and Grade of Material	Application Temperature, Range, °C (°F)	
	Spray	Mix
RT 1-2-3	16-54 (60-130)	—
RT 4-5-6	29-66 (85-150)	29-66 (85-150)
RT 7-8-9	66-107 (150-225)	66-107 (150-225)
RT 10-11-12	79-121 (175-250)	79-121 (175-250)
RC-70	24-66 (75-150)	—
RC-250	38-79 (100-175)	27-66 (80-150)
RC-800	66-107 (150-225)	66-93 (150-200)
RC-3000	93-135 (200-275)	79-107 (175-225)
MC-30	10-49 (50-120)	—
MC-70	24-66 (75-150)	—
MC-250	38-107 (100-225)	38-107 (100-225)
MC-800	66-121 (150-250)	66-107 (150-225)
MC-3000	107-135 (225-275)	93-121 (200-250)
All Emulsions	10-71 (50-160)	10-60 (50-140)
Creosote for Priming Coat	10-27 (50-80)	—
Coal-Tar Pitch	121-177 (250-350)	—
Asphalt Primer for Waterproofing	10-27 (50-80)	—
Asphalt for Waterproofing	149-177 (300-350)	—
CBAE 350, CBAE 350 Sp.	38-66 (100-150)	38-66 (100-150)
CBAE 800, CBAE 800 Sp.	52-79 (125-175)	52-79 (125-175)
Primer 20	16-49 (60-120)	—
Primer 100	24-52 (75-125)	—
Asphalt Cements	177 (350) Max.	163 (325) Max.

702.01 Asphalt Cements. AASHTO M 226, Table 2.

702.02 Cut-Back Asphalt. Rapid curing, AASHTO M 81, medium curing AASHTO M 82. In lieu of viscosity on the residue, the penetration in note 3 (AASHTO M 81) or note 4 (AASHTO M 82) shall govern.

702.03 Cut-Back Asphalt Emulsions. These emulsions shall be prepared by compounding a suitable volatile solvent and water with 702.01 asphalt to produce emulsions meeting requirements of the following table.

702.04 Emulsified Asphalts. AASHTO M 140 or AASHTO M 208.

702.05 Asphalt Primer for Waterproofing. AASHTO M 116.

702.06 Asphalt for Waterproofing. AASHTO M 115, Type II.

702.10 Creosote for Priming Coat. AASHTO M 121.

702.11 Coal-Tar Pitch for Waterproofing. AASHTO M 118, Type II, except that the softening point shall be determined by the Ring and Ball Method.

703 AGGREGATE

703.01 General. Soundness. When the major portion of the unsound material in a coarse aggregate acquires a mud-like condition when tested for soundness, the maximum loss shall be 5 percent for all uses.

Stockpiles. Stockpiling and loading methods shall be such as to permit ready identification of the aggregates and to minimize segregation. Sites for stockpiles shall be clean prior to storing materials. Aggregates shall not be removed from stockpiles within 0.3 m (1 foot) of the ground until final cleanup of the work and no material which has become mixed with foreign matter or other sizes or grades of aggregates shall be used.

Aggregates shall be handled in such a manner that the moisture content will be reasonably uniform for each days run. If necessary, in order to secure uniformity of moisture content of the aggregates, stockpiling will be required.

Open-hearth and Basic-oxygen Furnace Slags. All open-hearth and basic oxygen furnace slags shall be furnished to a size meeting the specified grading requirements of the use item to which it will be incorporated, and stockpiled for a period of not less than 6 months prior to use. New material shall not be added to the stockpile during the 6 month aging period, or prior to or during delivery from the stockpile to the project. Any addition of new material to a stockpile will require initiation of a new aging period before any material from that stockpile may be used. Prior or during the stockpiling operation, these materials shall have water added to provide a uniform moisture content not less than their absorbed moisture and the stockpile shall be maintained in a moist condition during the required stockpiling period.

	CBAE-350	CBAE-350 Special	CBAE-800	CBAE-800 Special	Primer	Primer
Kinematic Viscosity at 60 C, Centistokes	350-700	350-700	800-1600	800-1600	20-40	100-200
Water Content, %[2]	4-12	4-12	4-12	4-12	3-8	3-8
Volatile Solvent, %[2]	12-25	12-25	10-20	10-20		
Asphalt Content, %[2]	67+	67+	72+	72-	45+	60-
Adhesion Test*	**	**	**	**	**	**
Wet Stone Coating Test*		**		**		
Stripping Test*		**		**		
Tests on Residue From Distillation						
Penetration at 25 C	80-150	80-150	80-150	80-150	100-200	100-200
Ductility at 25 C, in cm	100+	100+	100+	100-	100+	100+
Total Bitumen Sol. in CS_2, %	99+	99+	99+	99+	99+	99+

* These tests shall be in accordance with Supplement 1014 on file in the Office of the Director.

** Shall meet.

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The Contractor shall furnish the Engineer with a certificate stating that the slag material stockpiling requirements have been complied with for all such material furnished to the work. This certificate shall include the estimated volume, the detailed location, and the beginning the ending dates of the aging periods, of each stockpile. The certification shall be submitted with sufficient lead time, prior to intended use, to allow for inspection, sampling, and testing.

Size. Aggregate shall conform to the size specified in the material specification, the construction item or as shown in AASHTO M 43.

Method of Test. Aggregate shall be tested by the following methods:

Amount finer than 75 µm (No. 200) sieve	S1004*
Clay lumps	S1017*
Coal and lignite	AASHTO T113
Crushed pieces	S1021*
Deleterious materials	S1029*
Effect of organic impurities on strength of mortar	AASHTO T71
Liquid limit	AASHTO T89
Percentage of wear, Los Angeles abrasion test	AASHTO T96 or ASTM C535
Plasticity index	AASHTO T90
Sieve analysis	S1004*, S1005*
Sieve analysis of mineral filer	AASHTO T37
Sodium sulfate soundness test, 5 cycle	AASHTO T104
Specific Gravity and percent absorption for fine and coarse aggregate	S1031*
Unit weight	AASHTO T19

*Supplement on file in the Office of the Director.

TABLE 703-1
SIZES OF COARSE AGGREGATE
(AASHTO M 43)

Size number	Nominal size square openings (1)	Amounts finer than each laboratory sieve (square openings), percentage by weight																							
		4	3-1/2	3	2-1/2	2	1-1/2	1	3/4	1/2	3/8	No. 4	No. 8	No. 16	No. 50	No. 100									
1	3-1/2 to 1-1/2	100	90 to 100		25 to 60		0 to 15		0 to 5																
2	2-1/2 to 1-1/2			100	90 to 100	35 to 70	0 to 15		0 to 5																
24	3-1/2 to 3/4																								
3	2 to 1				100	90 to 100	35 to 70	0 to 15																	
357	2 to No. 4				100	95 to 100	35 to 70	0 to 15																	
4	1-1/2 to 3/4																								
467	1-1/2 to No. 4					100	95 to 100		35 to 70		0 to 15														
5	1 to 1/2																								
56	1 to 3/8						100	90 to 100	20 to 55	0 to 10															
57	1 to No. 4						100	90 to 100	40 to 75	15 to 35	0 to 15	0 to 5													
6	3/4 to 3/8							100	90 to 100	20 to 55	0 to 15	0 to 5													
67	3/4 to No. 4							100	90 to 100	20 to 55	0 to 15	0 to 5													
68	3/4 to No. 8								100	90 to 100	20 to 55	0 to 15	0 to 5												
7	1/2 to No. 4								100	90 to 100	40 to 75	0 to 15	0 to 5												
78	1/2 to No. 8								100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5											
8	3/8 to No. 4									100	85 to 100	10 to 30	0 to 10	0 to 5											
89	3/8 to No. 8									100	85 to 100	10 to 30	0 to 10	0 to 5											
9	No. 4 to No. 16										100	65 to 100	40 to 70	0 to 30	0 to 10	0 to 5									
10	No. 4 to 0 (2)										100	55 to 100	40 to 70	0 to 30	0 to 10	0 to 5									
59	3/8 to No. 16											100	40 to 75	0 to 30	0 to 10	0 to 5									
5	3/8 to No. 8											100	85 to 100	10 to 30	0 to 10	0 to 5									

(1) Inches, except where otherwise indicated. Numbered sieves are those of the United States Standard Sieve Series.
(2) Screenings
Where standard sizes of coarse aggregate designated by two or three digit numbers are specified, the specified gradation may be obtained by combining the appropriate single digit standard size aggregates by a suitable proportioning device which has a separate compartment for each coarse aggregate combined. The blending shall be done as directed by the Laboratory.

TABLE 703-1
SIZES OF COARSE AGGREGATE
(AASHTO M 43)

Size number	Nominal size square openings (1)	100	90	75	63	50	37.5	25.0	19.0	12.5	9.5	4.75	2.36	1.18	300 µm	150 µm
1	90 to 37.5	100	90 to 100		25 to 60		0 to 15		0 to 5							
2	63 to 37.5			100	90 to 100	35 to 70	0 to 15		0 to 5							
24	63 to 19.0			100	90 to 100		25 to 60		0 to 10	0 to 5						
3	50 to 25.0				100	90 to 100	35 to 70	0 to 15		0 to 5						
357	50 to 4.75				100	95 to 100		35 to 70		10 to 30		0 to 5				
4	37.5 to 19.0					100	90 to 100	20 to 55	0 to 15		0 to 5					
467	37.5 to 4.75					100	95 to 100		35 to 70		10 to 30	0 to 5				
5	25.0 to 12.5						100	90 to 100	20 to 55	0 to 10	0 to 5					
56	25.0 to 9.5						100	90 to 100	40 to 75	15 to 35	0 to 15	0 to 5				
57	25.0 to 4.75						100	95 to 100		25 to 60		0 to 10	0 to 5			
6	19.0 to 9.5							100	90 to 100	20 to 55	0 to 15	0 to 5				
67	19.0 to 4.75							100	90 to 100		20 to 55	0 to 10	0 to 5			
68	19.0 to 2.36							100	90 to 100		30 to 65	5 to 25	0 to 10	0 to 5		
7	12.5 to 4.75								100	90 to 100	40 to 70	0 to 15	0 to 5			
78	12.5 to 2.36								100	90 to 100	40 to 75	5 to 25	0 to 10	0 to 5		
8	9.5 to 2.36									100	55 to 100	10 to 30	0 to 10	0 to 5		
89	9.5 to 1.18									100	90 to 100	20 to 55	5 to 30	0 to 10	0 to 5	
9	4.75 to 1.18										100	85 to 100	10 to 40	0 to 10	0 to 5	
10	4.75 to 0 (2)										100	55 to 100				10 to 30

Columns 100 through 150 µm: Amounts finer than each laboratory sieve (square openings), percentage by weight

(1) In millimeters except where otherwise indicated
(2) Screenings
Where standard sizes of coarse aggregate designated by two or three digit numbers are specified, the specified gradation may be obtained by combining the appropriate single digit standard size aggregates by a suitable proportioning device which has a separate compartment for each coarse aggregate combined. The blending shall be done as directed by the Laboratory

703.02 Aggregate for Portland Cement Concrete. Fine aggregate. 1. The fine aggregate shall be natural sand or sand manufactured from stone. Natural sand is required in 451, 452, 453, 611, and 511 deck slabs.

2. Sieve analysis.

Sieve Size	Total Percent Passing
9.5 mm (⅜ inch)	100
4.75 mm (No. 4)	95-100
2.36 mm (No. 8)	70-100
1.18 mm (No. 16)	38-80
600 µm (No. 30)	18-60
300 µm (No. 50)	5-30
150 µm (No. 100)	1-10
75 µm (No. 200)	0-5

Should the fineness modulus of a job control sample of sand from any source vary by more than 0.20 from that of the representative sample from that source, the sand may be rejected.

3. Soundness, sulfur, etc.

	Maximum Percent
Loss, sodium sulfate soundness test, Sec. 305	12
Secs. 451, 452, 511, 515, 519, 603, 604, 608, 609, 611, 612, 622, 704 and 706	10

Where the sand has more than 0.3 percent by weight of sulfur compounds, the service record of the sand when exposed to weathering in concrete will be examined before classifying the material as satisfactory or unsatisfactory for use.

When tested for the effect of organic impurities on strength of mortar, the compressive strength at 3 and 7 days of mortar made with untreated sand shall be not less than 95 percent of the compressive strength of mortar made with treated sand.

Aggregations of soil, silt etc., maximum percent, by weight, 0.5.

Coarse Aggregate. 1. The coarse aggregate shall be washed gravel, crushed carbonate stone, or crushed air-cooled blastfurnace slag.

2. Physical properties.

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Percent of wear, Los Angeles test, maximum (stone or gravel) 40
Unit weight, compacted, minimum kg/m³ (lbs/cu. ft.) (slag)..32 (70)
Loss, sodium sulfate soundness test, percent, maximum:
305 15
451, 452, 511, 519, 603, 622, 704 & 706 12
515 10
Deleterious substances shall not exceed the following:

	Percent by Weight	
	Super-structure	All Other Concrete
Soft pieces	2.0	3.0
Coal and lignite	0.25	1.0
Clay lumps	0.25	0.25
Pieces having a length greater than 5 times the average thickness	15	15
Shale and shaly material	0.5	1.0
Other deleterious substances, such as limonitic concretions, alkali, metallic particles and chert which disintegrates in 5 cycles of the soundness test	0.5	1.0

3. Amount finer than 75 µm (No. 200) sieve. The percentage of material finer than the 75 µm (No. 200) sieve in the aggregate portion of the concrete mix shall not exceed the following:

	Percent by Weight	
	Super-structure	All Other Concrete
Where the finer than 75 µm (No. 200) sieve material from the coarse aggregate consists of the dust of fracture essentially free from clay and shale ...	3.4	3.8
Where the finer than 75 µm (No. 200) sieve material from the coarse aggregate may consist of or include material other than dust of fracture ..	2.0	2.2

703.03 Fine Aggregate for Mortar or Grout. 1. The fine aggregate shall be natural sand or sand manufactured from stone or air-cooled blast furnace slag.

2. Sieve analysis.

Sieve Size	Total Percent Passing
4.75 mm (No. 4)	100
2.36 mm (No. 8)	95-100
300 µm (No. 50)	10-40
150 µm (No. 100)	0-10
75 µm (No. 200)	0-5

3. Soundness, sulfur, etc.
Loss, sodium sulfate soundness test, percent, maximum 10

When the sand has more than 0.3 percent by weight of sulfur compounds, the service record of the sand when exposed to weathering in mortar or grout will be examined before classifying the material as satisfactory or unsatisfactory for use.

When tested for the effect or organic impurities on strength of mortar, the compressive strength of mortar made with untreated sand shall be not less than 95 percent of the compressive strength of mortar made with treated sand.

Aggregations of soil, silt, etc., maximum percent, by weight, 0.5.

703.04 Aggregate for:

(1) Bituminous aggregate base, 301, 302

(2) Aggregate base 304

(3) Slope and channel protection, 601

1. The coarse aggregate for bituminous aggregate base used in combination with rigid pavement shall be of crushed carbonate stone, crushed gravel or crushed air-cooled blast furnace slag. The coarse aggregate for bituminous aggregate base used in flexible pavements shall be of crushed carbonate stone, crushed gavel or crushed air-cooled slag. The fine aggregate for bituminous aggregate base shall be natural sand or sand manufactured from stone, gravel or air-cooled slag.

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2. Physical properties	301	304	601
Percentage of wear, Los Angeles test, maximum (stone or gravel)	50	50	50
Unit weight, compacted, kg/m^3 (pounds per cu. ft.) minimum (slag)	29 (65)	—	29 (65)
Loss, sodium sulfate soundness test, percent maximum	15	15	15
Percentage of fractured pieces, minimum	40	90	90

Deleterious substances shall not exceed the following:

	Percent by Weight	
	301	304
Soft pieces	3.0	
Coal and lignite	1.0	
Clay lumps	0.25	
Pieces having a length greater than 5 times the average thickness	15	
Shale, shaly material, and chert which disintegrates in 5 cycles of the soundness test	2.5	5

Gravel used under 304 shall be crushed from material retained on the 12.5 mm (½ inch) sieve.

Under 304, the portion of aggregate passing the 425 µm (No. 40) sieve shall have a maximum liquid limit of 25 percent and a maximum plasticity index of 6.

703.05 Aggregate for:

(1) Asphalt concrete, 402, 403, 404 and 412

(2) Bituminous cold mix, 405

(3) Prime coat, 408

(4) Seal coat, 409

Fine Aggregate. 1. The fine aggregate shall be natural sand or sand manufactured from stone, gravel or air-cooled slag.

2. Sieve analysis Sieve size	Total Percent Passing
9.5 mm (⅜ inch)	100
4.75 mm (No. 4)	90-100
2.36 mm (No. 8)	65-100
1.18 mm (No. 16)	40-85

600 µm (No. 30)	20-60
300 µm (No. 50)	7-40
150 µm (No. 100)	0-20
75 µm (No. 200)	0-10

3. Soundness, etc.

Loss, sodium, sulfate soundness test, percent maximum	15
Aggregate of soil, silt, etc., maximum percent by weight	0.5

Coarse Aggregate. 1. The coarse aggregate shall be crushed carbonate stone, crushed air-cooled slag or washed crushed gravel.

2. Physical Properties.

Percentage of wear. Los Angeles test maximum (stone or gravel)	40
Unit weight, compacted, minimum kg/m^3 (lbs. per cu. ft.) (slag) 402, 403, 404, 405, 407, 408, 409 and 412	32 (70)
Loss, sodium sulfate soundness test, percent. maximum:	
402, 403, 404 and 412	12
405 and 409	15
Percent by weight of fractured pieces, minimum	40

Deleterious substances shall not exceed the following:

	Percent by Weight
Soft pieces	3.0
Coal and lignite	1.0
Clay lumps	0.25
Amount finer than 75 µm (No. 200) sieve	3.0
Pieces having a length greater than 5 times the average thickness	15
Shale, shaly material and other deleterious substances, such as limonite concreations, alkali, and chert which disintegrates in 5 cycles of the soundness test	2.5

703.06 Sand Cover, 407, 408. 1. The sand shall be natural sand or sand manufactured from stone or air-cooled slag.

2. Sieve analysis.

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Sieve Size	Total Percent Passing
4.75 mm (No. 4)	90-100
300 µm (No. 50)	7-40
75 µm (No. 200)	0-10

703.07 Mineral Filler. 1. The mineral filler shall be limestone dust, portland cement, or other inert mineral matter. It shall be thoroughly dry and free from lumps.

2. Sieve analysis.

Sieve Size	Total Percent Passing
600 µm (No. 30)	100
300 µm (No. 50)	95-100
75 µm (No. 200)	65-100

703.08 Granulated Slag. 1. The granulated slag shall be the glassy, granular materials formed when molten blast-furnace slag or electric-furnace slag is rapidly chilled, as by immersion in water. Material containing mill waste, cinders, large pieces of ungranulated slag, or other matter foreign to the production of slag in the normal operation of the blast furnace or electric furnace may be rejected.

The material shall be of such nature that it will compact to the satisfaction of the Engineer.

2. Sieve analysis.

Sieve Size	Total Percent Passing
50 mm (2 inch)	100
25 mm (1 inch)	85-100
150 µm (No. 100)	0-15

703.10 Screenings. 1. The screenings shall be No. 10 size gravel, stone, or air-cooled slag. Where crushed material is specified, it shall be crushed from material larger than the 12.5 mm (½-inch) sieve.

2. Loss, sodium sulfate soundness, percent, maximum 15

704 MASONRY UNITS

704.01 Clay or shale Brick. ASTM C 32 with the following exceptions:

4.1 Size. The units shall be of such and shape as to permit their incorporation in the structure in conformance with the specified dimensions of the structure.

7.1 Sampling and Testing. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site or at other locations designated by the Laboratory.

704.02 Concrete Brick. ASTM C 55 Type II Grade N-11 or S-11, with following exceptions and additions:

4. Materials. 4.1.1 and 4.1.2, Cement shall conform to 701 Portland Cement. 4.2 Aggregate, shall conform to the quality requirements of 703.02.

Size and Shape. The units shall be of such size and shape as to permit their incorporation in the structure in conformance with the specified dimensions of the structure. They shall be of a rectangular cross section with square corners. The ends, edges and one face shall be plain surfaces.

8. Methods of Sampling and Testing 8.1. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site or at other locations designated by the Laboratory.

8.2. Brick shall be sampled and tested in accordance with ASTM C 140 except that each sample shall consist of 12 full sized brick.

704.03 Concrete Masonry Blocks. ASTM C 139, with the following exceptions and additions:

4. Dimensions and Permissible Variations. In addition the units shall be of such size and shape as to permit their incorporation in the structure in conformation with the specified dimensions of the structure.

5. Sampling and Testing. 5.1 Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site or at other locations designated by the Laboratory.

705 CONCRETE PAVEMENT INCIDENTALS

705.02 Silicone Joint Sealant. 1. General. The sealant shall be furnished in a one part silicone formulation which does not

748.11 Tapping Sleeve, Valve and Valve Box. Tapping valves have the same gate and seating assembly as AWWA C500 gate valves. The material shall include a two piece sleeve for assembly around the main, the valve, and a valve box meeting 748.08. Tapping sleeves shall be cast iron, epoxy-coated steel or stainless steel. Equipment necessary to drill the main wall through the valve in accordance with the manufacturer's recommendations shall be provided by the Contractor.

748.12 Tapping Saddle and Corporation Stop. Tapping saddles shall be iron, bronze, brass or stainless steel. They shall be band-type or double strap type, with International Pipe Standard (IPS) tapping or AWWA tapered thread inlet.

Corporation stops for use with saddles shall be bronze alloy with IPS inlet thread of AWWA tapered thread, and outlet thread compatible with connecting pipe, without special adapters. Corporation stops for direct tapping shall be bronze alloy with AWWA tapered inlet thread, and with outlet thread compatible with connecting pipe, without special adapters.

748.13 Service Stop and Service Box. Service stops shall be bronze with coupling threads conforming to AWWA C800. The stop shall be so designed that water pressure from the inlet side of the body shall provide additional sealing action. Service stops shall open counter-clockwise.

Service boxes shall be Buffalo type. Covers shall have the word "WATER" cast in raised letters and shall be securely fastened by a bronze or brass bolt.

748.14 Meter, Setting, Stop and Chamber. The meter setting yoke shall permit the meter to be readily installed without disturbing piping. Meter stops shall be angle pattern with lock wings and shall be for the street side of the meter piping. Check valves shall be for the customer side of the meter piping. Chambers shall be concrete, vitrified clay, PVC, or PE. Lids shall be double wall and fit tightly.

748.15 Fire Hydrant. Fire hydrants shall be dry-barrel post type made of cast iron, and shall conform to AWWA C502, with the following exceptions and additions.

Hydrants shall incorporate an approved groundline breakable flange and valve stem coupling.

The hydrant shall be of the compression type with the valve opening against the pressure. The valve end of the valve stem shall be designed to eliminate contact of dissimilar metals. The valve stem shall be at least 30 mm (1¼-inch) diameter steel between the

hydrant operating nut and the valve, except for the valve stem coupling located at the point corresponding to the breakable flange. The thread used between the operating nut and the stem shall be US Standard Pipe thread.

The main valve port shall be at least 108 mm (4¼-inch) diameter. The valve shall be rubber faced.

The hydrant shall be so designed that the nozzles may be oriented to point in any direction. The hydrant connection to the pipe shall be at least 150 mm (6 inches) inside diameter. Joints shall be push-on type or mechanical type conforming to ANSI/AWWA C111/A21.11.

The hydrant shall have one center-front pumper nozzle of 100 mm (4-inch) internal diameter with male threads to match the fire apparatus of the maintaining agency. Two hose or streamer nozzles of 63 mm (2½-inch) internal diameter with male threads shall be provided to match apparatus of the maintaining agency. Nozzle sections shall be designed to screw into the hydrant body casting using US Standard Pipe threads. Nozzles shall be supplied with threaded cast iron caps having an integral nut of the same design as the hydrant operating nut.

The Contractor shall contact the maintaining agency to determine their desired color and number of coats of enamel for the hydrants.

750 BITUMINOUS CONCRETE MIXING PLANTS

750.01 General. General requirements for bituminous concrete mixing plants shall conform to AASHTO M 156 except as follows:

Central Plants.

2.2.2.2 In addition,

Where electrical impedance heating is used, all pipe lines and fittings shall be insulated.

All line valves shall have clear and permanent markings to indicate all open and closed positions.

2.2.3 In addition,

Where more than one kind of bituminous material is required for the project concurrently, there shall be separate storage for each kind.

2.3 In addition,

The adjustments for total and proportional feed shall be continuously variable and capable of being locked at any position.

2.5.2 Delete. Replace with

Plant Screens shall be of the shaker or vibrating type having square openings. The size of the openings and arrangement of the separate sections shall be such that material will be deposited in the hot bins within one of the following tables of maximum tolerances at the option of the Contractor.

TABLE NO. 1

Mixture compositions: 402 (Bins 1, 2 and 3)
403, 404 (Bins 1 and 2)

Bin No.	1	2	3	4
Ret. 4.75 mm (No. 4) 5%				
Pass. 4.75 mm (No. 4) 15%				
Ret. 12.5 mm (½") 10%				
Pass. 12.5 mm (½") 25%				
Ret. 25 mm (1") 5%				
Pass 25 mm (1") 25%				
Ret. 50 mm (2") 0%				

TABLE NO. 2

Mixture compositions: 402 (Bins 1, 2, 3 and 4)
403, 404 (Bins 1, and 2 and 3)

Bin No.	1	2	3	4
Ret. 4.75 mm (No. 4) 5%				
Pass. 4.75 mm (No. 4) 10%				
Ret. 9.5 mm (⅜") 10%				
Pass. 6.3 mm (¼") 20%				
Ret. 12.5 mm (½") 5%				
Pass 12.5 mm (½")) 25%				
Ret. 25 mm (1") 0%				

TABLE NO. 3

Mixture compositions: 412 (Bins 1 and 2)

Bin No.	1	2
Ret. No. 4 (4.75 mm) ... 10%		
Pass. No. 4 (4.75 mm) 25%		

The bin shall have a pipe for oversize material of not less than 150 mm (6 inches) in diameter. The pipes shall discharge material at points outside the plant operation and shall not create a hazard or discomfort.

2.6.1 Delete. Replace with

The plant shall have a hot bin storage of sufficient capacity to ensure uniform and continuous operation. The bin shall have at least two compartments for compositions having a maximum aggregate size of 12.5 mm (½ inch), three for compositions having a maximum aggregate size of 25 mm (1 inch) and four for compositions having a maximum aggregate size of 50 mm (2 inches). The intersections of adjacent sides of bottoms of compartments shall have sufficient slope to result in complete and continuous self-cleaning during plant operations. Bin gates shall cut off quickly and completely.

2.6.4 Delete reference to automatic shutoff.

2.7. Delete. Replace with 2.7 **Scale Requirements.**

2.7.1 Delete. Replace with

Plant scales. All scales and test weights shall conform to the regulations of the Ohio Department of Agriculture. Scales shall be sealed as often as the Laboratory may direct to assure their continued accuracy. Test weights shall be sealed at least every three years at places designated by the Ohio Department of Agriculture. The plant shall be equipped with one 20 kg (50-pound) test weight for each 200 kg (400 pounds) of the maximum batch weight with a minimum of ten test weights.

2.7.2 Delete. Replace with

Bituminous mixture scales. The Contractor shall provide a truck scale or recording batch plant scales for the purpose of obtaining the next weight of each load of bituminous mixture as required in 401.17.

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Truck scales shall indicate the total weight within 10 kg (20 pound) increments and shall have a rated capacity of not less than 10 percent in excess of the largest load weighed. The platform shall be large enough to receive the largest truck used for a single weighing. The contractor shall provide a weighman to operate the truck scale or an approved automatic truck scale equipped with an automatic date, time and weight printer. The indicating mechanism shall be housed in a suitably weatherproofed and heated building of such size, arrangement, and lighting that the Department ticket writer may readily view the truck and the weighing operation. A table and chair shall be provided for the use of the ticket writer. Where the scale is not located at the plant site, telephone service shall be provided for the use of the ticket writer in the discharge of his duties.

Where recording batch plant scales are provided in lieu of a truck scale, they shall be equipped with a digital printer controlled by the scale dial indicator and actuated by a manual or automatic signal to record the weights for each load on a tape or ticket. The approved printer shall record weights within the specified scale accuracy and the tape or ticket for each load shall bear the following:

The date and time,

The weight of the empty bituminous material weigh bucket,

The weight of the empty aggregate weigh box,

The actual weight of bituminous material in each batch,

The actual total weight of aggregate in each batch,

The total weight of batches loaded.

The empty weigh box and weigh bucket weights shall be recorded prior to each batch weight. The tape or ticket shall be directly available to the Department ticket writer at a location with facilities as required for truck scales and shall become the property of the Department.

2.7.3 Delete.

2.8 through 2.8.2 Delete. Replace with

The plant shall be equipped to monitor the temperature of the bituminous material with an adequate thermometric instrument clearly legible from the mixer operator's station. The sensing element or unit shall be located in the feed line near the charging valve at the mixer. Where a pyrometer is used, the indicator shall be connected to the thermocouple by a weatherproof extension wire.

The plant shall also be equipped with either an approved dial-scale, mercury-actuated thermometer, an electric pyrometer, or

other approved thermometric instrument so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregates.

The Laboratory may require replacement of any thermometer with an approved temperature-recording apparatus for better regulation of aggregate temperature.

Batching Plants.

3.2 Delete. Replace with **Scales.**

3.2.1 through 3.2.7 Delete. Replace with

Scale shall be of the springless dial type and shall be free from vibration during plant operation. The scale shall be substantially constructed, and those which easily get out of adjustment shall be replaced when directed by the Laboratory.

The scale shall have a capacity of at least 10 percent in excess of the largest weight required for any one batch.

Dials shall be completely in view of the operator at all times and at right angles to his line of vision. The dials shall be of sufficient size that the numerals can be read at a distance of at least 7 m (25 feet). Aggregate scales shall be of the compounding type and shall have a full complement of index pointers. Index pointers that result in parallax shall not be used.

3.3 through 3.4 Delete. Replace with

Bituminous material control. The plant shall be equipped with either a bituminous material bucket and dial scales or an automatic volumetric meter for measuring the bituminous material.

When a bituminous material bucket is used it shall be a nontilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve or valves, and spray bar shall be fully jacketed or heated. Jackets shall be efficiently drained and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous material scales. The capacity of the bituminous material bucket shall be at least 10 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated quick-acting, nondrip, charging valve located directly over the bituminous material bucket.

The use of electric heat for the bituminous material bucket shall be subject to approval by the Laboratory.

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When a volumetric meter is used, the meter shall be designed and constructed to automatically meter the bituminous material into each batch within a maximum error of ±2 percent of the required weight of bituminous material. The dial which indicated the amount of bituminous material shall have a sensitivity of 1⅝ movement of the pointer per 4 liters (gallon) or 5mm/450 g (0.2 inch per pound). The meter shall have a capacity of at least 10 percent in excess of the weight or volume of bituminous material required in the mixture. The meter shall be constructed so that any dial setting may be locked and it will automatically reset to this setting after the addition of bituminous material to each batch. The dial shall be in full view of the mixer operator.

Any part of the meter which is also a part of the bituminous material line shall be jacketed. The bituminous material shall be delivered to the mixer through one or more jacketed spray bars whose individual lengths shall be not less than three-fourths the length of the mixer. The size and spacing of the spray bar openings shall provide a uniform application of bituminous material the full length of the spray bar. The section of the bituminous material line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the meter.

Platform scales having a minimum capacity of 70 kg (150 pounds) shall be provided to check the delivery of the volumetric meter.

3.5.2.2 Revise 3 min. to 2 min. In addition,

The setting of time intervals shall be performed in the presence and at the direction of the inspector who shall then lock the case covering the timing device until such time as a change is to be made in the timing periods.

3.6 through 3.7.5 Delete.

Continuous Mixing Plants

4.1.1 In addition,

The proportioning unit shall have a control that will automatically and instantaneously stop the flow of all materials into the mixer whenever the level of aggregate in any bin is at or below the level of the gate opening.

The proportioning unit shall have such accuracy that combined errors will not result in a difference between weight delivered and theoretical weight greater than ± 1 percent.

4.2 through 4.2.3 Delete. Replace with

Weight calibration of aggregate feed. The Contractor shall provide qualified personnel to calibrate the plant to produce the specified composition of mixture within the accuracy and uniformity tolerances specified.

The plant shall be calibrated at the beginning of each project and whenever there is any change in source, size, or specific gravity of aggregate. The plant shall be recalibrated whenever the actual weight of bituminous mixture varies from its theoretical weight by more than the specified limit or when the tolerances set forth for the specified type are exceeded.

The plant shall afford quick and easy access for calibration and shall have all necessary containers, equipment for handling loaded containers, and springless scales for calibration of gate openings and bituminous material proportioning device. The equipment shall accommodate samples up to 140 kg (300 pounds). The individual weights of the containers used for catching the dried aggregate during calibration shall all fall within 40 g (0.1 pound) range. Where it is necessary to add weight to a can to meet this requirement, the weight shall be added in such a manner that it will not be susceptible to breakage or excessive wear under normal use.

4.3 In addition,

The amount of total mix per revolution of the apron feeder counter shall be calculated directly from the average weight of bituminous material per revolution determined from three checks of the pump delivery. The largest of the three checks shall not be more than 1 percent greater than the smallest. Any pump not capable of delivery within this range shall be corrected or replaced.

The plant shall have a jacketed or heated positive displacement bituminous material pump to supply the spray bar. The pump shall be driven at a constant speed for a given calibration and positively interlocked with the aggregate proportioning unit. The bituminous material shall be delivered to the mixer through a jacketed or heated spray bar located at the aggregate charging end of the mixer and shall extend not less than 85 percent of the width of the mixer. The size and spacing of the spray bar openings shall produce a uniform distribution of the bituminous material across the mixer.

4.4 In addition,

The mixer shall have a variable height cutoff gate at its discharge end to provide for control of the level of material inside the mixer.

4.4.1 In addition,

The mixer shall be operated at a constant speed. It shall be

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equipped with a discharge hopper with dump gates which will permit rapid and complete discharge of the hopper.

4.4.3 through 4.4.7 Delete.

4.5 through 4.6.4 Delete.

5.1 Delete. Replace with,

Storage of bituminous concrete. Surge bins or storage bins may be used for temporary storage of hot bituminous concrete mixtures. The system for conveying the hot mixture from the plant to the bin and for drawing the hot mixture from the bin shall be capable of maintaining the required temperature range and preventing any discernable segregation. Hauling units shall not be loaded through the surge or storage bins when they are not being used for storage. Mixtures which have been stored in surge bins in excess of 8 hours or in storage bins longer than 24 hours shall not be used in the work. Open graded friction courses shall not be permitted in either surge or storage bins.

5.1.1 Delete. Replace with,

Surge bins. Surge bins shall be capable of temporarily storing hot bituminous concrete mixtures for short intervals of time while awaiting discharge into hauling units. Surge bins are not required to be heated. However, the bituminous mixture must be maintained within the required temperature range.

Storage bins. Storage bins shall be capable of storing hot bituminous concrete mixtures for intervals of time up to 24 hours. Storage bins shall be insulated and/or heated if mixtures are stored for more than 8 hours. The system shall be capable of maintaining the required temperature without creating hot spots within the stored mixture. In addition, hot bituminous mixtures stored from 8 to 24 hours shall have a silicone admixture introduced into the asphalt cement at the rate of 1 mL/640L (one fluid ounce per 5000 gallons).

5.2 through 5.5.1 Delete.

6.2.1 Delete reference to automatic shutoff.

6.2.3 Revise from 0.5 percent to 2 percent.

6.3.3 Revise from 1 percent to 2 percent.

6.4.1 In addition,

Calibration of the plant shall be performed by the Contractor fo each aggregate combination and asphalt content for the mixture to be produced.

Before the start of production of any mixture, the accuracy of th indicators and controls used in the calibration of the plant shall b demonstrated by the Contractor.

750.02 Exceptions. The requirements of 750.01 shall appl with the following exceptions:

2.5.2 Delete through Table No. 3.

2.8 Delete "The Laboratory may require replacement of an thermometer with approved temperature-recording apparatus fo better regulation of aggregate temperature."

2.11.4 Delete "A ladder or platform shall be located at the truck loading space to permit easy and safe inspection of the mixture a it is delivered into the trucks."

5.1 through 5.5.5 Delete.

750.03 Computerized Plant System. All asphalt concret shall be produced in a plant with a computerized plant syster approved by the Laboratory. The device the computerized plan system uses to monitor the bitumen content shall be capable o being locked or sealed. After initial calibration of the plant, thi monitoring device may be locked or sealed by a representative o the Laboratory.

For batch plants the following information shall be printed o each weight ticket when the batch plant's asphalt concrete is di rectly loaded into the truck or on a separate printout for every 1 t (16 tons) or less of production when the batch plant's aspha concrete is loaded into a storage silo:

a. date
b. time
c. JMF Number
d. tare weight of the bitumen scale
e. tare weight of the aggregate scale
f. kg (pounds) of virgin bitumen
g. kg (pounds) of virgin aggregate
h. kg (pounds) of reclaimed pavement measured by a batch scal

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i. metric tons/hour (tons/hour) of reclaimed pavement measured by a belt scale

j. moisture content of the reclaimed pavement

k. percent bitumen in the reclaimed pavement to the nearest 0.1 percent

l. percent virgin bitumen to the nearest 0.1 percent

m. percent total bitumen calculated to the nearest 0.01 percent

For drum mix plants the following information shall be printed every five (5) minutes of production:

a. date

b. time

c. JMF Number

d. metric tons/hour (tons/hour) of virgin bitumen

e. metric tons/hour (tons/hour) of virgin aggregate

f. metric tons/hour (tons/hour) of reclaimed pavement

g. moisture content of the virgin aggregate

h. moisture content of the reclaimed pavement

i. percent bitumen in the reclaimed pavement to the nearest 0.1 percent

j. percent virgin bitumen to the nearest 0.1 percent

k. percent total bitumen calculated to the nearest 0.01 percent

All printouts shall be preapproved by the Laboratory and shall be turned over to the District Engineer of Tests at the end of the project or the end of the production year.

The computerized plant system shall print "SIMULATE" on the ticket or printout whenever the computerized plant system is only simulating asphalt concrete production.

The computerized plant system shall also have an audible alarm system which notifies the plant operator when the amount of bitumen, aggregate, or reclaimed pavement being mixed into the asphalt concrete is outside the tolerances established by the Contractor's quality control supervisor. The plant operator shall make appropriate adjustments when production is outside the tolerances.

0034.0

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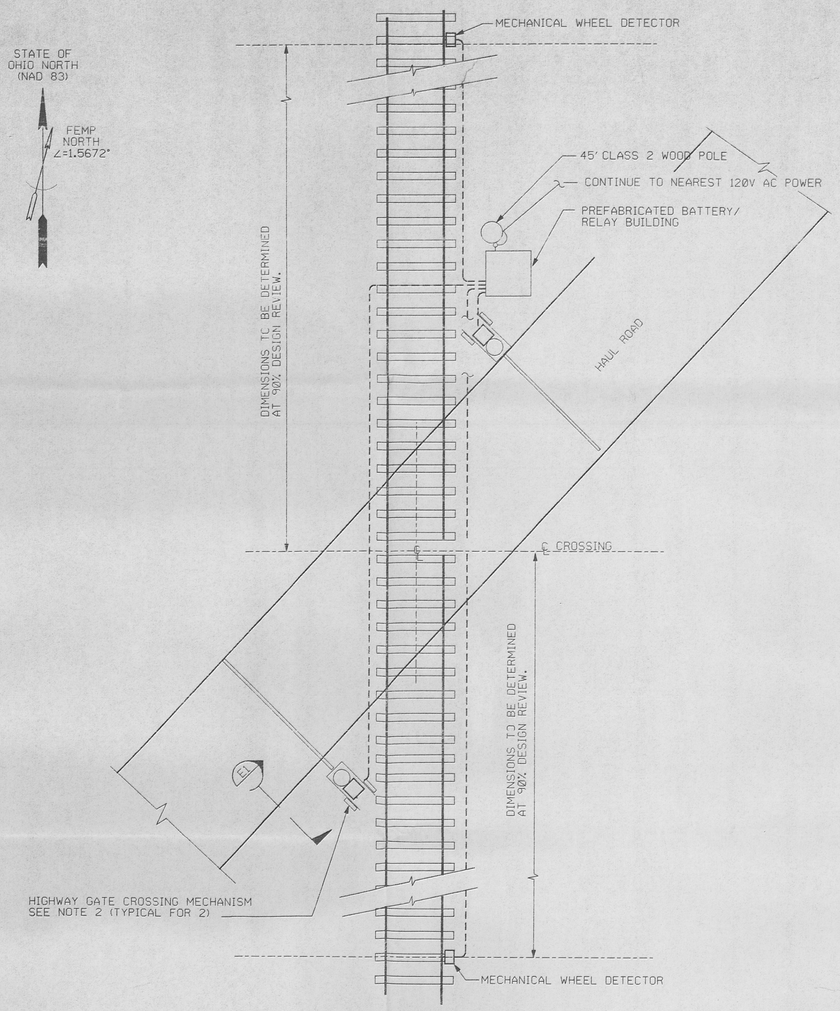
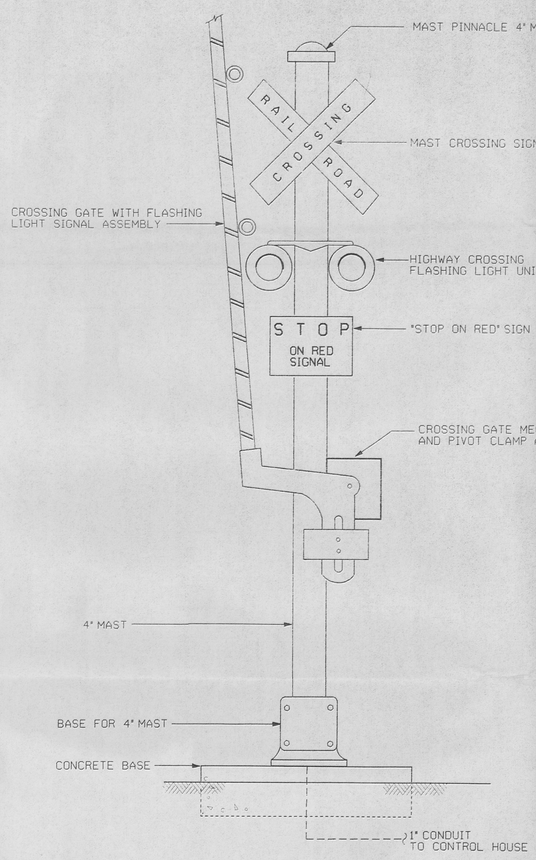


PLAN AT RAILROAD CROSSING

NOTE:
THIS PLAN IS TO CONVEY DESIGN CONCEPT AND INTENDED INSTALLATION. DETAILED DIMENSIONS WILL BE GIVEN WHEN CONFIGURATION OF THE HAUL ROAD IS FINALIZED.



ELEVATION E1
NTS

NOTES 211

1. SEE DRAWING 92X-5900-X-00178 FOR DRAWING INDEX.
2. HIGHWAY CROSSING GATE MECHANISM SHALL INCLUDE GATE ARMS, TWO FLASHING LIGHTS, FLASHING LIGHTS ON CROSSARM, MAST AND MAST COVER. JB BASE AND BELLS, PIVOT CLAMP ASSEMBLY AND SIGNS.
3. SEE CIVIL PLAN AND PROFILE SHEETS FOR SPECIFIC HAUL ROAD INFORMATION

REF DWG NO.	DRAWING TITLE
92X-9500-X-00178	DRAWING INDEX
92X-5900-E-00246	SITE PLAN - HAUL ROAD

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% REVIEW		N/A
A	ISSUED FOR 30% REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD
CONSTRUCTION

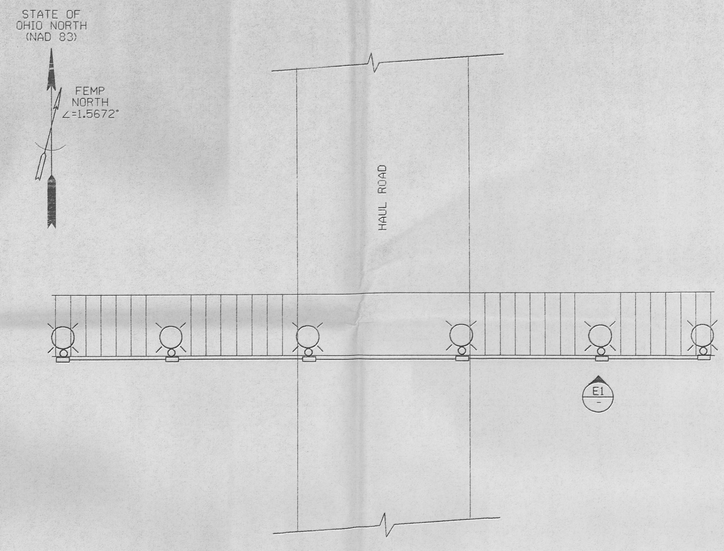
DRAWING TITLE
ELECTRICAL
PLAN AND DETAILS
RAILROAD CROSSING

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. PROSKI	12/12/95			J.L. COOPER	12/19/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

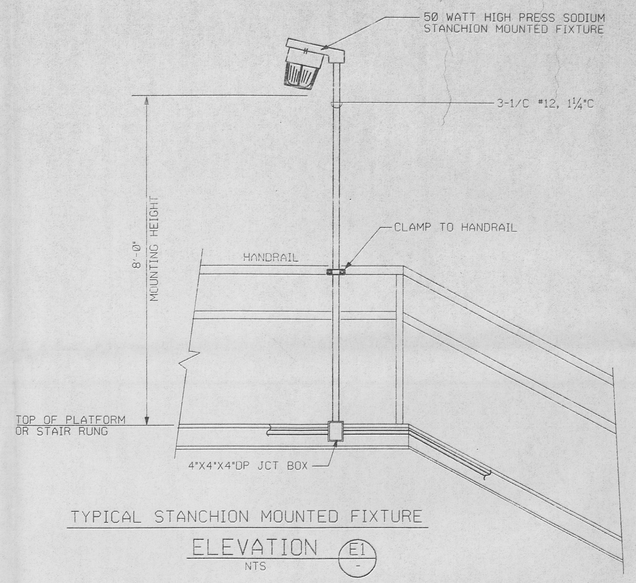
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	N/A 00825

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.2.3.6 00-90701	92X-5900-E-00248	E0004	C



PLAN
HAUL ROAD PEDESTRIAN CROSSING
NTS

NOTE:
THIS PLAN IS TO CONVEY DESIGN CONCEPT AND INTENDED INSTALLATION, DETAIL AND DIMENSIONS FOR PLAN WILL BE GIVEN WHEN CONFIGURATION OF THE HAUL ROAD IS FINALIZED.



TYPICAL STANCHION MOUNTED FIXTURE
ELEVATION E1 -
NTS

NOTES

1. SEE DRAWING 92X-5900-X-00178 FOR DRAWING INDEX.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-E-00246	SITE PLAN - FORMER PRODUCTION AREA

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% REVIEW		N/A
A	ISSUED FOR 30% REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
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THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD
CONSTRUCTION

DRAWING TITLE
ELECTRICAL
PLAN AND DETAILS
PEDESTRIAN CROSSING

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. PROSKI	12/13/95			J.L. COOPER	12/19/95

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	000295

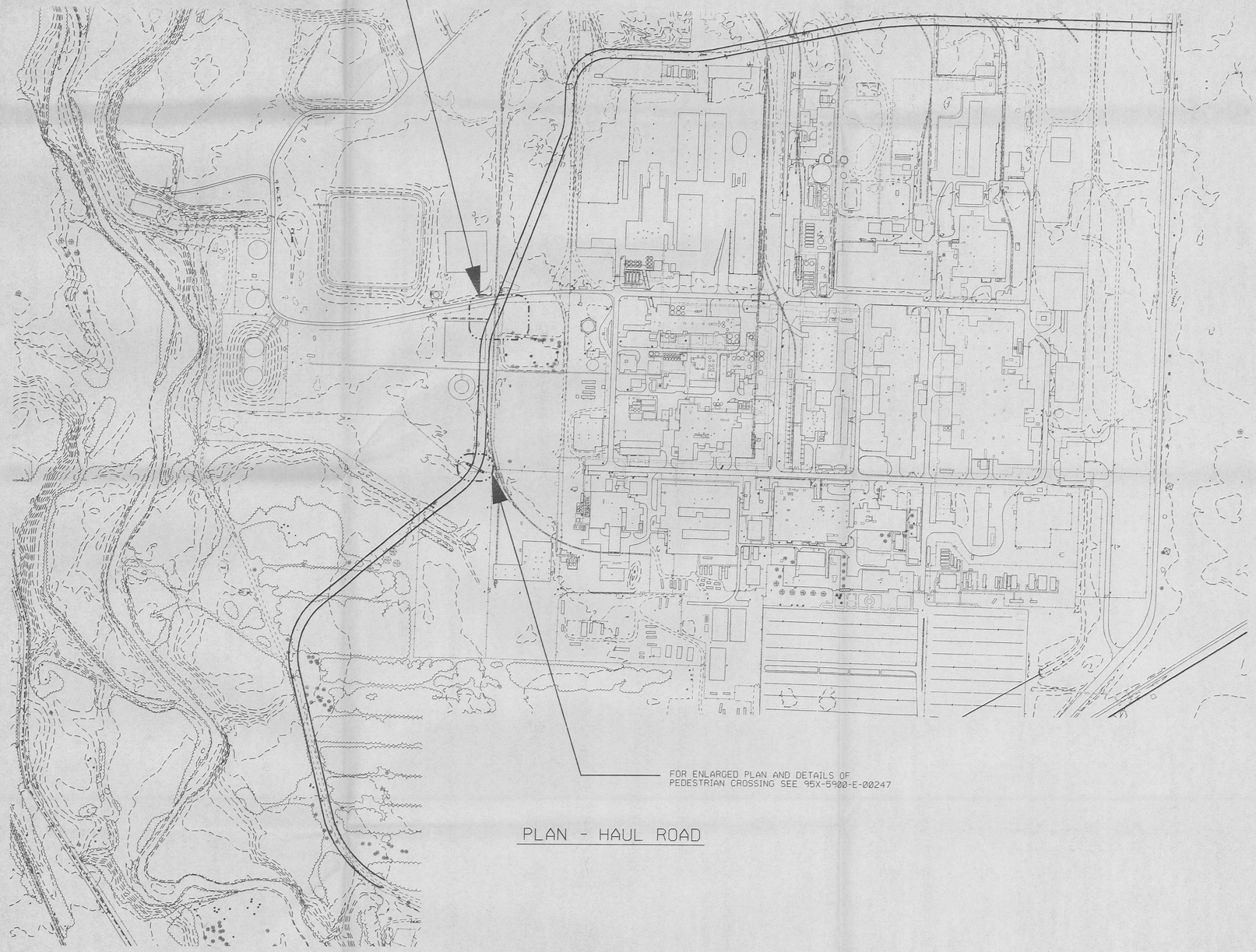
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-E-00247	E0003	C

0" 1" 2"

STATE OF OHIO NORTH (NAD 83)

FEMP NORTH ∠=1.5672°

FOR ENLARGED PLAN AND DETAILS OF RAILROAD CROSSING SEE 95X-5900-E-00248



FOR ENLARGED PLAN AND DETAILS OF PEDESTRIAN CROSSING SEE 95X-5900-E-00247

PLAN - HAUL ROAD

NOTES

1. SEE DRAWING 92X-5900-X-00178 FOR DRAWING INDEX
2. SEE CIVIL PLAN AND PROFILE SHEETS FOR SPECIFIC HAUL ROAD ALIGNMENT INFORMATION.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-E-00247	PLAN AND DETAILS- PEDESTRIAN CROSSING
92X-5900-E-00248	PLAN AND DETAILS- RAILROAD CROSSING

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% REVIEW		N/A
A	ISSUED FOR 30% REVIEW		N/A

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CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

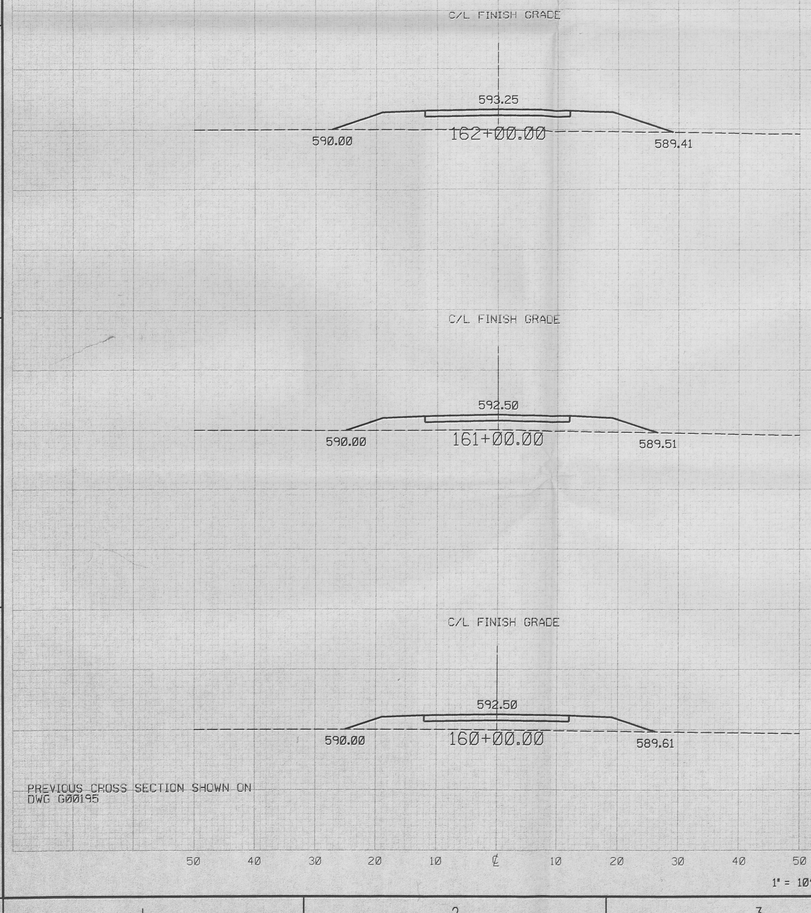
DRAWING TITLE
ELECTRICAL SITE PLAN HAUL ROAD

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. PROSKI	12/14/95			J.L COOPER	12/19/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 200'	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	000267

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-E-00246	E0002	C



NOTES **211**

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00184.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00189 AND 92X-5900-G-00190.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.
6. THE HAUL ROAD WILL BE EXTENDED TO TIE INTO THE EXISTING NORTH ENTRANCE ROAD. THE SECTION FOR THE EXTENSION WILL BE INCLUDED IN THE 90% SUBMITTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00189	PLAN & PROFILE - SHEET 5 OF 6
92X-5900-G-00190	PLAN & PROFILE - SHEET 6 OF 6
92X-5900-G-00195	CROSS SECTIONS - SHEET 5 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
			INITIALS AND DATE	
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

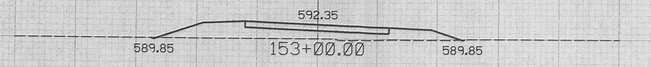
DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 6 OF 6

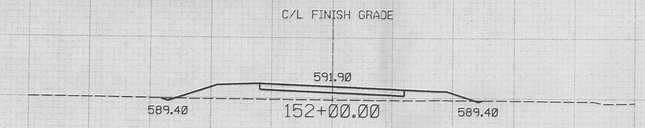
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

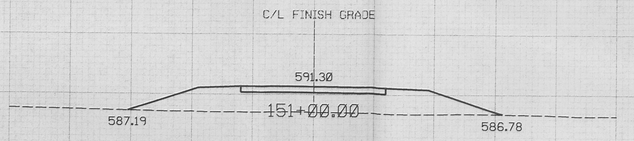
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

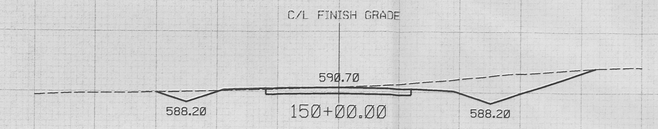
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	N/A

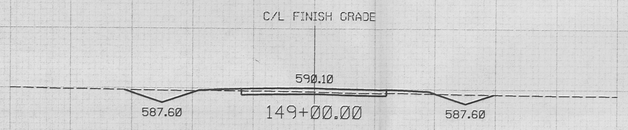
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00196	G0017	C

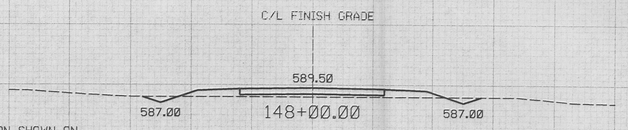




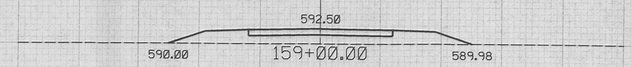




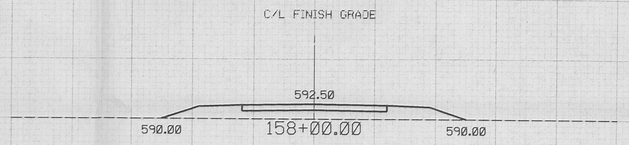


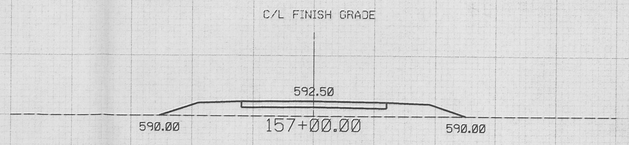


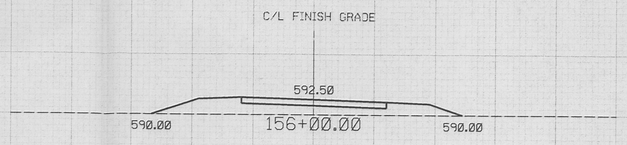
PREVIOUS CROSS SECTION SHOWN ON DWG G00194

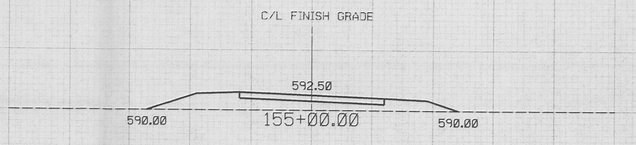


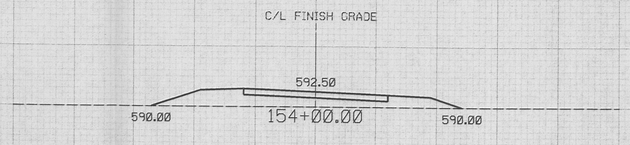
NEXT CROSS SECTION SHOWN ON DWG G00196











50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10' - 0" VERTICAL

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10' - 0" HORIZONTAL

NOTES

211

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00184.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00188 AND 92X-5900-G-00189.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00188	PLAN & PROFILE - SHEET 4 OF 6
92X-5900-G-00189	PLAN & PROFILE - SHEET 5 OF 6
92X-5900-G-00194	CROSS SECTIONS - SHEET 4 OF 6
92X-5900-G-00196	CROSS SECTIONS - SHEET 6 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS	FERMCO INITIALS	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

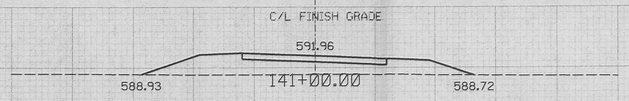
DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 5 OF 6

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

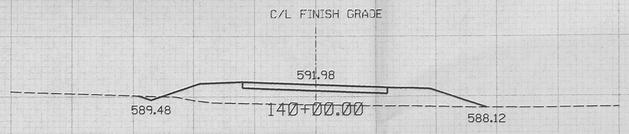
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" =10'	

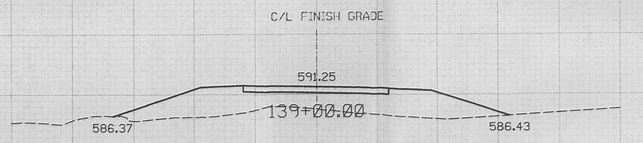
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	000205
	N/A	

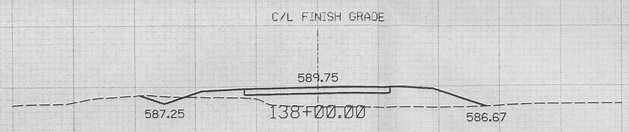
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00195	G0016	C

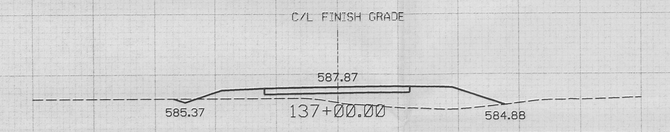


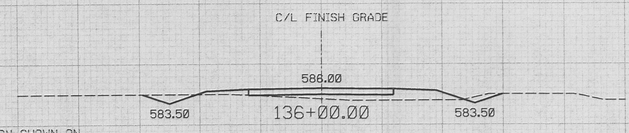
NEXT CROSS SECTION SHOWN ON G00195



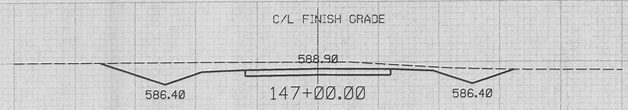




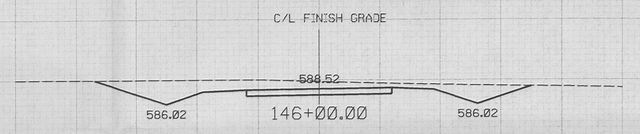


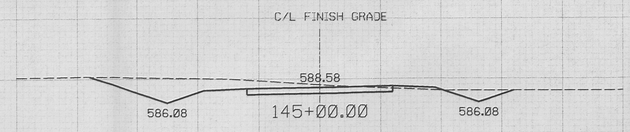


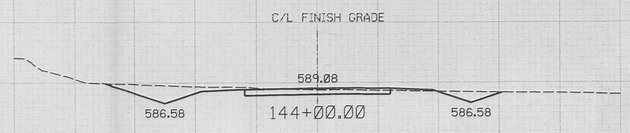
PREVIOUS CROSS SECTION SHOWN ON DWG G00193

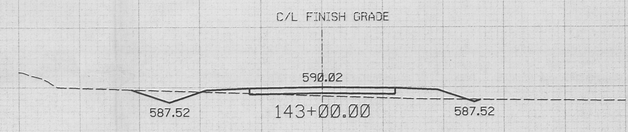


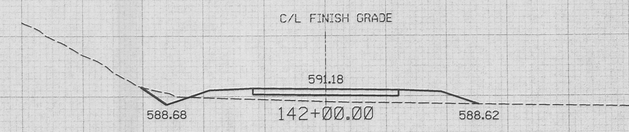
NEXT CROSS SECTION SHOWN ON DWG G00195











50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10' - 0" VERTICAL

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10' - 0" HORIZONTAL

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00184.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00187 92X-5900-G-00188.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00187	PLAN & PROFILE - SHEET 3 OF 6
92X-5900-G-00188	PLAN & PROFILE - SHEET 4 OF 6
92X-5900-G-00193	CROSS SECTIONS - SHEET 3 OF 6
92X-5900-G-00195	CROSS SECTIONS - SHEET 5 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 4 OF 6

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	000207

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00194	G0015	C

0" 1" 2"

C/L FINISH GRADE
577.64
575.14 129+00.00 575.14

C/L FINISH GRADE
577.31
574.81 128+00.00 574.81

C/L FINISH GRADE
578.98
574.48 127+00.00 574.48

C/L FINISH GRADE
576.65
574.15 126+00.00 574.15

C/L FINISH GRADE
576.32
573.77 125+00.00 573.82

C/L FINISH GRADE
575.99
573.49 124+00.00 573.49

PREVIOUS CROSS SECTION SHOWN ON DWG G00192

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10' - 0" VERTICAL

C/L FINISH GRADE
584.12
581.62 135+00.00 581.62

NEXT CROSS SECTION SHOWN ON DWG G00194

C/L FINISH GRADE
582.25
579.75 134+00.00 579.75

C/L FINISH GRADE
580.37
577.87 133+00.00 577.87

C/L FINISH GRADE
578.50
576.00 132+00.00 576.00

C/L FINISH GRADE
577.62
575.12 131+00.00 575.12

C/L FINISH GRADE
577.74
575.24 130+00.00 575.24

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10' - 0" HORIZONTAL

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00184.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00186 AND 92X-5900-G-00187.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00186	PLAN & PROFILE - SHEET 2 OF 6
92X-5900-G-00187	PLAN & PROFILE - SHEET 3 OF 6
92X-5900-G-00192	CROSS SECTIONS - SHEET 2 OF 6
92X-5900-G-00194	CROSS SECTIONS - SHEET 4 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 3 OF 6

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

SUBMITTED FOR APPROVAL — A-E DATE
FERMCO CRU APPROVAL — N/A — DATE
009263

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.2.3.6 00-90701	92X-5900-G-00193	G0014	C

0" 1" 2"

C/L FINISH GRADE
573.68
571.18 117+00.00 571.18

C/L FINISH GRADE
573.35
570.85 116+00.00 570.85

C/L FINISH GRADE
573.02
570.52 115+00.00 570.52

C/L FINISH GRADE
572.69
570.19 114+00.00 570.19

C/L FINISH GRADE
572.36
569.86 113+00.00 569.86

C/L FINISH GRADE
572.03
569.53 112+00.00 569.53

PREVIOUS CROSS SECTION SHOWN ON DWG G00191

50 40 30 20 10 ℄ 10 20 30 40 50
1" = 10' - 0" VERTICAL

C/L FINISH GRADE
575.66
573.16 123+00.00 573.16

NEXT CROSS SECTION SHOWN ON DWG G00193

C/L FINISH GRADE
575.33
572.83 122+00.00 572.83

C/L FINISH GRADE
575.00
572.50 121+00.00 572.50

C/L FINISH GRADE
574.67
571.22 120+00.00 571.26

C/L FINISH GRADE
574.34
565.43 119+00.00 568.14

C/L FINISH GRADE
574.01
571.51 118+00.00 571.51

50 40 30 20 10 ℄ 10 20 30 40 50
1" = 10' - 0" HORIZONTAL

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00184.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00185 AND 92X-5900-G-00186.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00185	PLAN & PROFILE - SHEET 1 OF 6
92X-5900-G-00186	PLAN & PROFILE - SHEET 2 OF 6
92X-5900-G-00191	CROSS SECTIONS - SHEET 1 OF 6
92X-5900-G-00193	CROSS SECTIONS - SHEET 3 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 2 OF 6

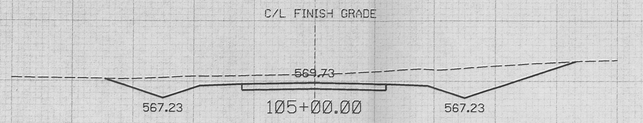
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

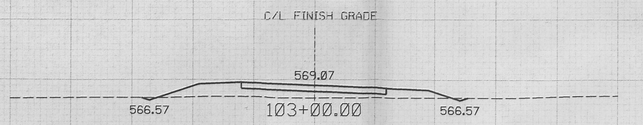
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

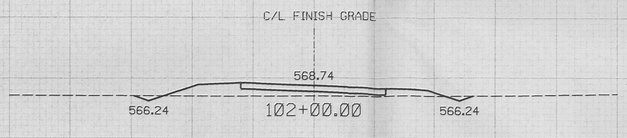
SUBMITTED FOR APPROVAL — A-E DATE
FERMCO CRU APPROVAL — N/A — DATE
009202

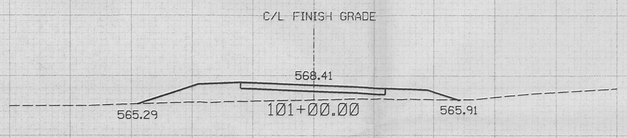
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00192	G0013	C

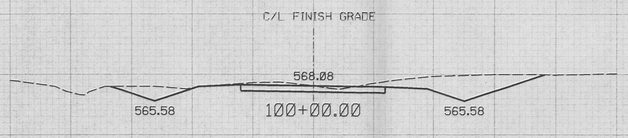
0" 1" 2"

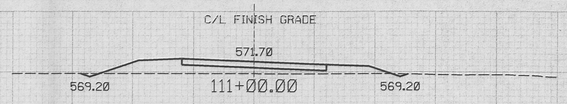




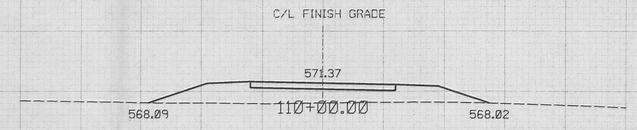


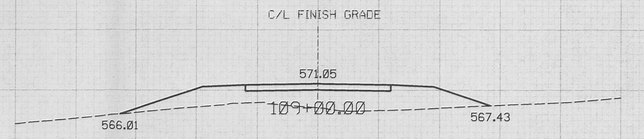


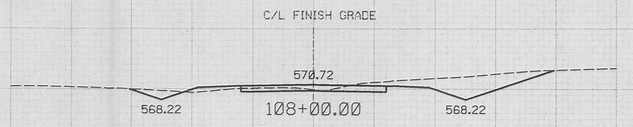


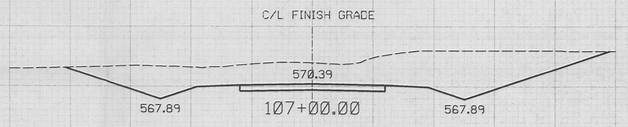


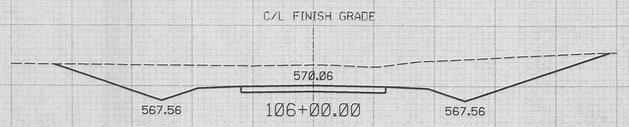
NEXT CROSS SECTION SHOWN ON DWG G00192











50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" VERTICAL

1" = 10'- 0" HORIZONTAL

NOTES

211

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00184.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWING 92X-5900-G-00185.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00185	PLAN & PROFILE - SHEET 1 OF 6
92X-5900-G-00192	CROSS SECTIONS - SHEET 2 OF 6

PRELIMINARY

NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

PARSONS

THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.

CINCINNATI, OHIO

PROJECT NAME

HAUL ROAD CONSTRUCTION

DRAWING TITLE

CIVIL
CROSS SECTIONS
SHEET 1 OF 6

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

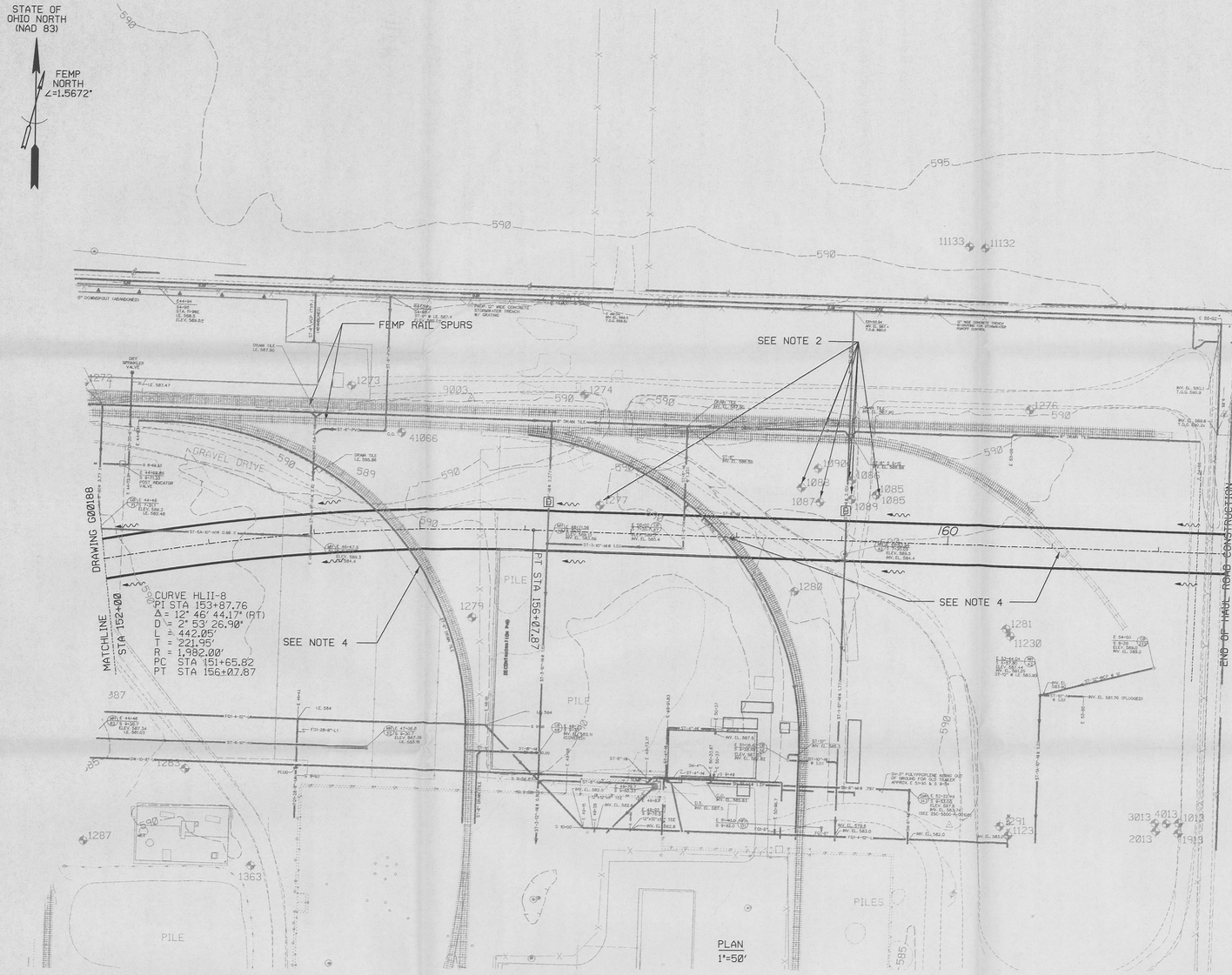
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009201

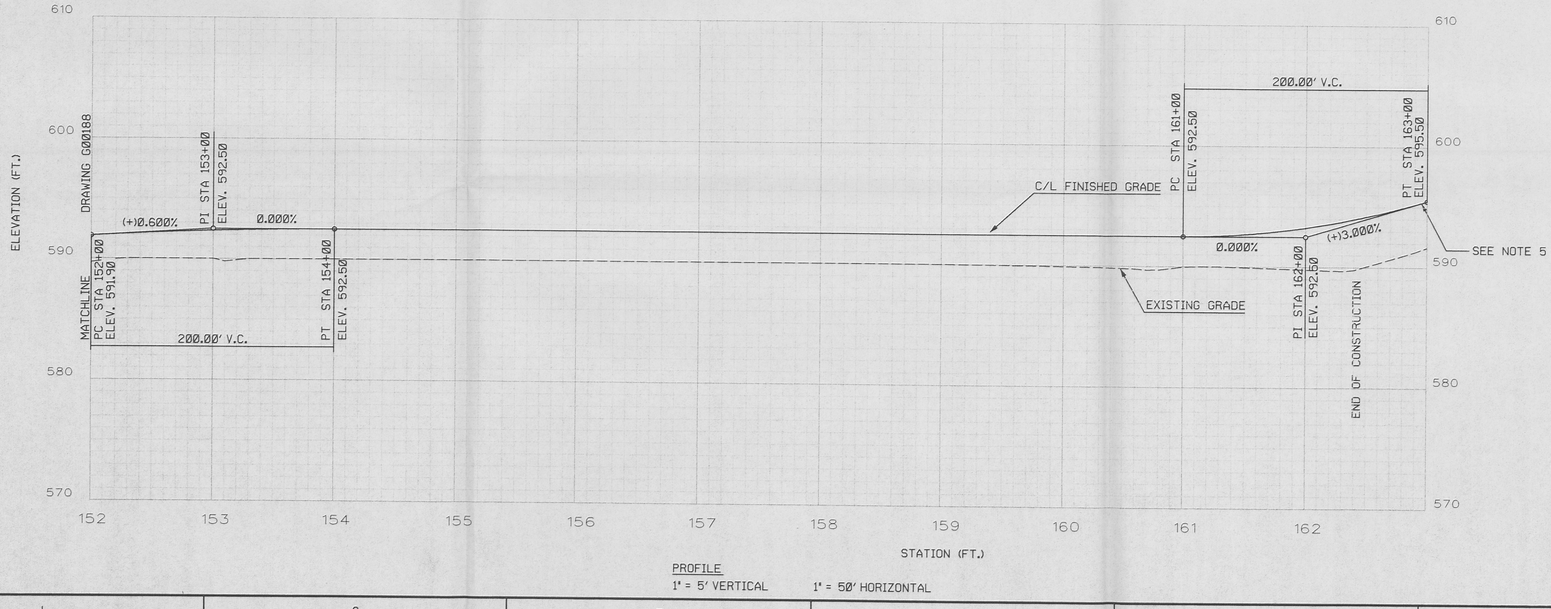
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00191	G0012	C

0" 1" 2"

STATE OF OHIO NORTH (NAD 83)

FEMP NORTH ∠=1.5672°





PROFILE
1" = 5' VERTICAL 1" = 50' HORIZONTAL

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. EXISTING MONITORING WELL TO BE ABANDONED BY FERMCO.
3. END OF CONSTRUCTION OF HAUL ROAD WHICH SHALL TIE INTO PROPERTY DISPOSAL FACILITY BY OTHERS.
4. RAIL SPUR TO BE REMOVED AND TRACK ABANDONED BY OTHERS.
5. THE HAUL ROAD WILL BE EXTENDED TO TIE INTO THE EXISTING NORTH ENTRANCE ROAD. THIS DRAWING WILL BE INCLUDED IN THE 90% SUBMITTAL.
6. THE STORM DRAINAGE SHOWN IS CONCEPTUAL.
7. FOR CROSS SECTIONS, SEE DRAWINGS 92X-5900-G-00195 AND 92X-5900-G-00196.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00184	TYPICAL SECTIONS
92X-5900-G-00188	PLAN & PROFILE - SHEET 4 OF 6
92X-5900-G-00195	CROSS SECTIONS - SHEET 5 OF 6
92X-5900-G-00196	CROSS SECTIONS - SHEET 6 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 5 OF 6

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009200

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00189	G0010	C

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. EXISTING MONITORING WELL TO BE ABANDONED BY FERMCO.
3. THESE RAILROAD SPURS ARE TO BE REMOVED AND ABANDONED BY OTHERS.
4. ADJUSTMENT TO THE FENCE AND DRAINAGE ON THE RA-17 SOIL AND RUBBLE PILE PROJECT IS TO BE MADE FOR THE 90% REVIEW.
5. STORM DRAINAGE SHOWN IS CONCEPTUAL.
6. FOR CROSS SECTIONS, SEE DRAWINGS 92X-5900-G-00194 AND 92X-5900-G-00195.

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REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00187	PLAN & PROFILE - SHEET 3 OF 6
92X-5900-G-00189	PLAN & PROFILE - SHEET 5 OF 6
92X-5900-G-00194	CROSS SECTIONS - SHEET 4 OF 6
92X-5900-G-00195	CROSS SECTIONS - SHEET 5 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME

DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 4 OF 6

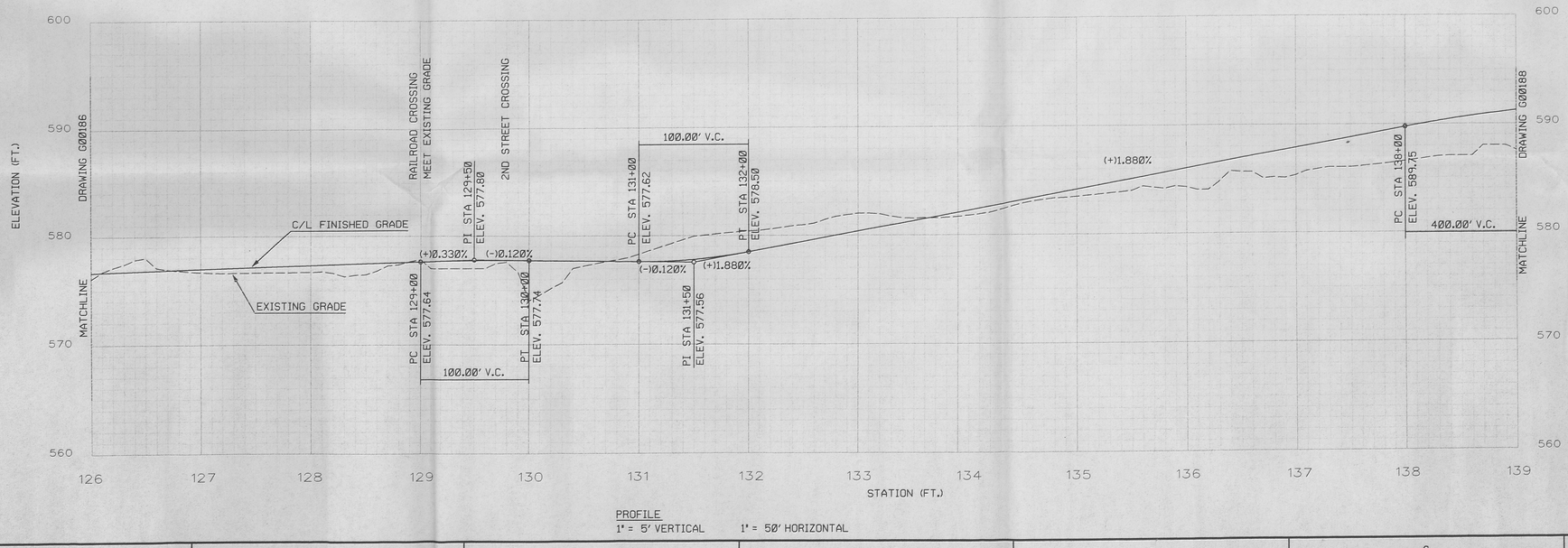
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009159

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-9701	92X-5900-G-00188	G0009	C

PLAN
1"=50'



PROFILE
1" = 5' VERTICAL 1" = 50' HORIZONTAL

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. EXISTING MONITORING WELL TO BE ABANDONED BY FERMCO.
3. ADDITIONAL INFORMATION IN THIS AREA TO BE SHOWN AT 90% REVIEW (FROM FIELD RUN TOPOGRAPHY).
4. THE SITE IMPROVEMENT PACKAGE FOR THIS AREA IS CURRENTLY UNDER DESIGN AND SHALL BE COORDINATED WITH THIS PROJECT. THE MOST CURRENT REVISION OF THE OU-1 REMEDIATION SYSTEM WILL BE SHOWN FOR THE 90% ISSUE.
5. STORM DRAINAGE SHOWN IS CONCEPTUAL.
6. FOR SIGNALIZATION AT RAILROAD CROSSING, SEE DRAWING 92X-5900-E-00248.
7. DRAINAGE/GRADING ISSUES SHALL BE RESOLVED AND ADDRESSED AS PART OF THE 90% SUBMITTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00186	PLAN & PROFILE - SHEET 2 OF 6
92X-5900-G-00188	PLAN & PROFILE - SHEET 4 OF 6
92X-5900-G-00193	CROSS SECTIONS - SHEET 3 OF 6
92X-5900-G-00194	CROSS SECTIONS - SHEET 4 OF 6
92X-5900-E-00248	PLAN AND DETAILS - RAILROAD CROSSING

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

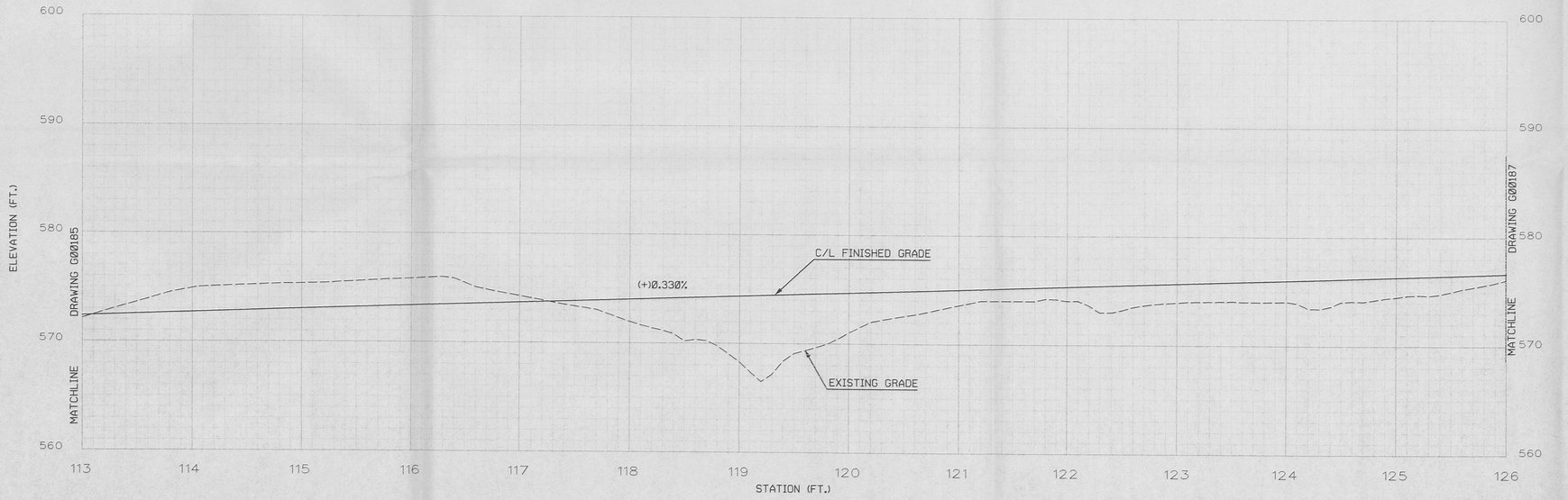
DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 3 OF 6

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009198

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00187	G0008	C



PROFILE
1" = 5'- 0" VERTICAL 1" = 50'- 0" HORIZONTAL

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. THE FUTURE OU-4 FERNALD RESIDUES VITRIFICATION PLANT INFORMATION IS TAKEN FROM CERTIFIED FOR CONSTRUCTION DRAWINGS.
3. STORM DRAINAGE SHOWN IS CONCEPTUAL.
4. FOR CROSS SECTIONS, SEE DRAWINGS 92X-5900-G-00192 AND 92X-5900-G-00193.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00185	PLAN & PROFILE - SHEET 1 OF 6
92X-5900-G-00187	PLAN & PROFILE - SHEET 3 OF 6
92X-5900-G-00192	CROSS SECTIONS - SHEET 2 OF 6
92X-5900-G-00193	CROSS SECTIONS - SHEET 3 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
		INITIALS AND DATE		
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 2 OF 6

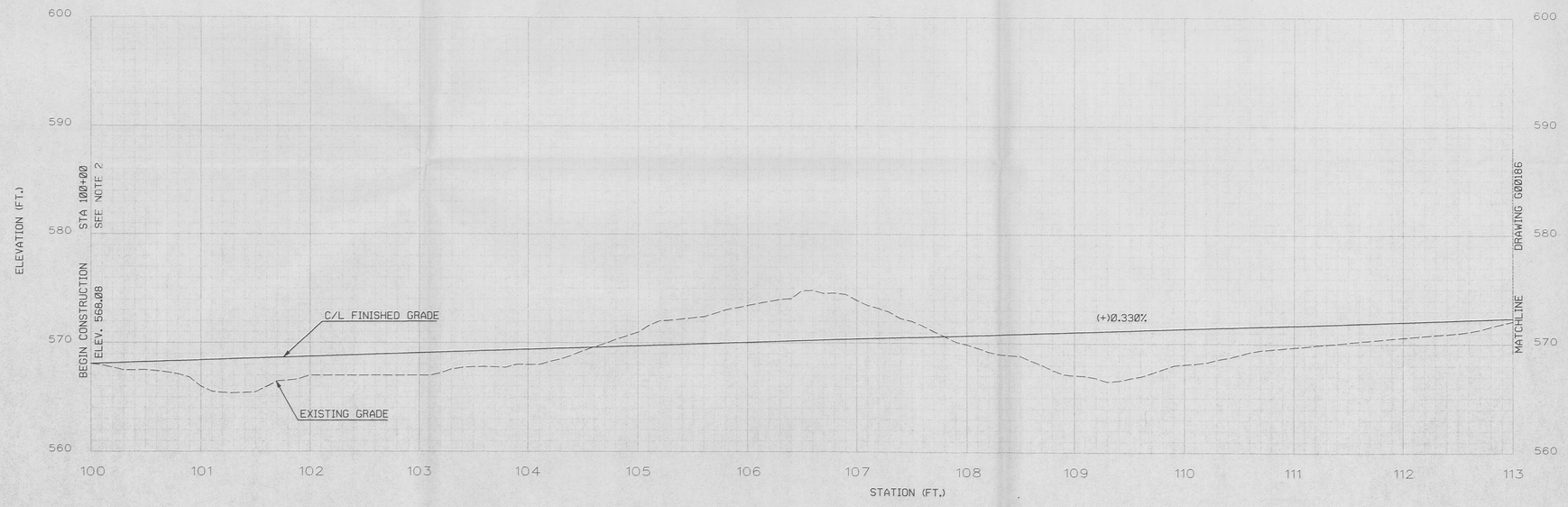
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	009197

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00186	G0007	C

PLAN
1"=50'



PROFILE
1" = 5'- 0" VERTICAL 1" = 50'- 0" HORIZONTAL

NOTES

21T

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. TIE-IN TO THE ROAD WILL BE SHOWN AT 90% REVIEW.
3. UTILITIES WILL BE ADDED TO THE PLANS FOR THE 90% SUBMITTAL. THE LOCATION AND DEPTH WILL BE VERIFIED BY FIELD SURVEY.
4. STORM DRAINAGE SHOWN IS CONCEPTUAL.
5. FOR CROSS SECTIONS, SEE DRAWINGS 92X-5900-G-00191 AND 92X-5900-G-00192.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00186	PLAN & PROFILE - SHEET 2 OF 6
92X-5900-G-00191	CROSS SECTIONS - SHEET 1 OF 6
92X-5900-G-00192	CROSS SECTIONS - SHEET 2 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
		INITIALS AND DATE		
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 1 OF 6

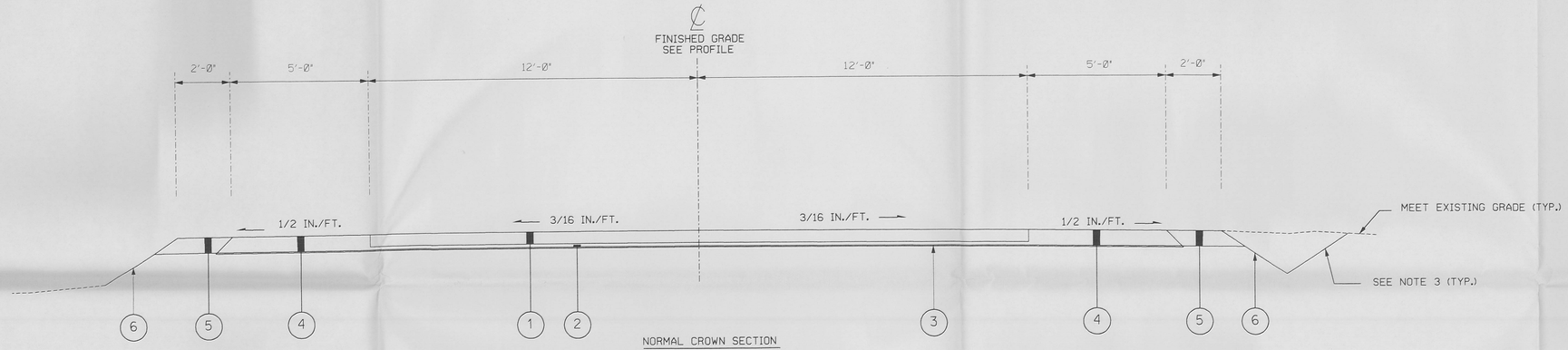
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009196

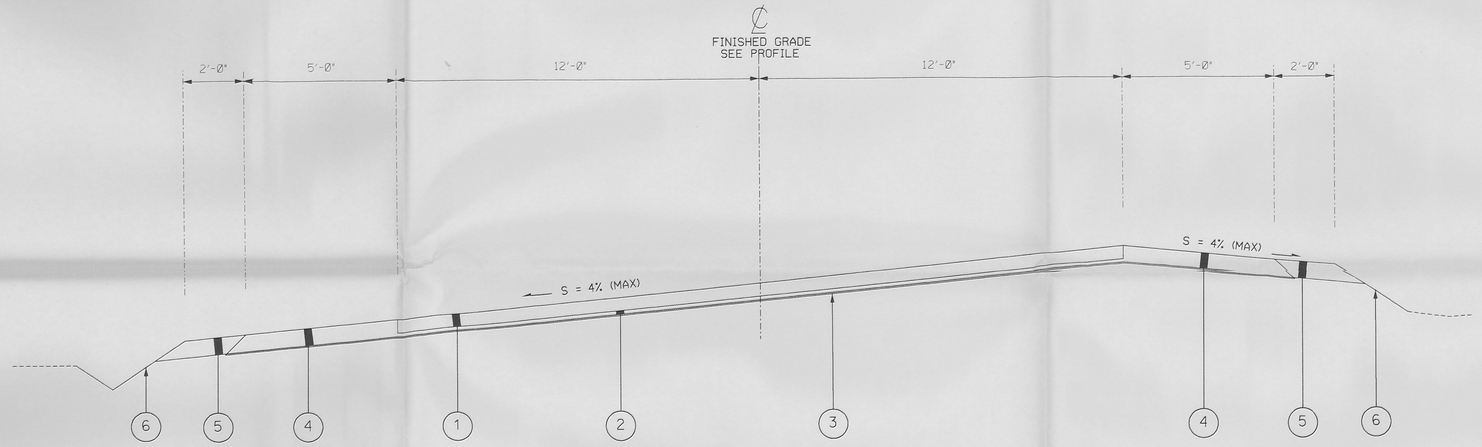
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-9070	92X-5900-G-00185	G0006	C

0" 1" 2"



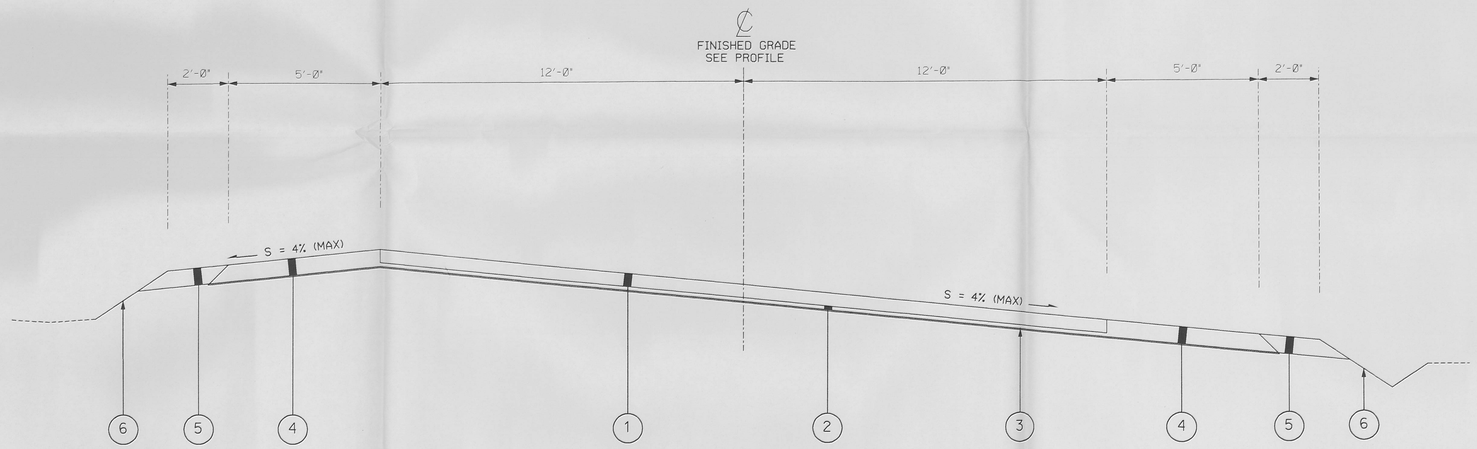
NORMAL CROWN SECTION

STA. 104+80 TO 109+07
STA. 114+07 TO 120+15
STA. 124+40 TO 126+10
STA. 129+40 TO 135+80
STA. 142+75 TO 143+80
STA. 147+30 TO 150+50
STA. 157+20 TO 162+65



SUPERELEVATED SECTION - LEFT

STA. 120+15 TO 124+40
STA. 135+80 TO 138+50
STA. 143+80 TO 147+30



SUPERELEVATED SECTION - RIGHT

STA. 100+00 TO 104+80
STA. 109+07 TO 114+07
STA. 126+10 TO 129+40
STA. 138+50 TO 142+75
STA. 150+50 TO 157+20

3H:1V TYPICAL FORESLOPE AND BACKSLOPE FOR ALL SIMILAR USES

NOTES

1. TRANSITION FROM EXISTING CROSS SECTION TO STA 100+00 AS SHOWN ON DRAWING 92X-5900-G-00191.
2. SEE DRAWING 92X-5900-G-00201 FOR SUPERELEVATION TABLES. STATIONS SHOWN FOR SUPERELEVATED SECTIONS INCLUDE TRANSITION. THE SUPERELEVATION TRANSITION IS DEVELOPED BY ROTATING PAVEMENT ABOUT THE CENTERLINE.
3. SEE PLAN & PROFILE AND CROSS SECTION SHEETS FOR DETAILS OF GRADING AND DRAINAGE.

LEGEND

1. 10 -1/2 " ASPHALT CONCRETE (AC-20) BASE COURSE (ODOT ITEM 402)
2. 3" AGGREGATE BASE (ODOT ITEM 304)
3. NON-WOVEN GEOTEXTILE
4. AGGREGATE SHOULDER (ODOT ITEM 304)
5. EMBANKMENT
6. SEEDING AND MULCHING

REF DWG NO.	DRAWING TITLE
92X-5900-G-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS
92X-5900-G-00191	CROSS SECTIONS - SHEET 1 OF 6
92X-5900-G-00201	SUPERELEVATION TABLES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
TYPICAL SECTIONS

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1"=2' H 1"=4'	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	000195

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00184	G0005	C

0" 1" 2"

ITEM	ITEM EXT.	GRAND TOTAL	UNIT	DESCRIPTION
203	12000	----	CU YD	EXCAVATION NOT INCLUDING EMBANKMENT
203	20000	----	CU YD	EMBANKMENT
203	50000	----	CU YD	SUBGRADE COMPACTION
304	20000	3406	CU YD	SAGGREGATE BASE
402	20000	4850	CU YD	ASPHALT CONCRETE, AC-20
659	10000	----	SQ YD	SEEDING AND MULCHING
---		27,700	SQ YD	NON-WOVEN GEOTEXTILE

NOTES

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REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS & SYMBOLS

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
GENERAL SUMMARY

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL A-E DATE	FERMCO CRU APPROVAL N/A DATE	00019-1

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00182	G0003	C

1. UTILITIES

THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THE PLANS ARE AS OBTAINED FROM FERMCO AS REQUIRED BY SECTION 153.64 O.R.C.
UTILITIES WILL BE ADDED TO THE PLANS FOR THE 90% SUBMITTAL.
THE LOCATION AND DEPTH WILL BE VERIFIED BY FIELD SURVEY.

2. CONTINGENCY QUANTITIES

THE CONTRACTOR SHALL NOT ORDER MATERIALS OR PERFORM WORK FOR ITEMS DESIGNATED BY PLAN NOTE TO BE USED 'AS DIRECTED BY THE FEMCO CONSTRUCTION MANAGER' UNLESS AUTHORIZED BY THE FERMCO CONSTRUCTION MANAGER. THE ACTUAL WORK LOCATIONS AND QUANTITIES USED FOR SUCH ITEMS SHALL BE INCORPORATED INTO THE FINAL CHANGE ORDER GOVERNING COMPLETION OF THIS PROJECT.

3. ELEVATION DATUM

ALL ELEVATIONS ARE BASED ON U.S.G.S. DATUM.

4. WORK LIMITS

THE WORK LIMITS SHALL BE DETERMINED BY THE FERMCO CONSTRUCTION MANAGER. THE INSTALLATION AND OPERATION OF ALL TEMPORARY TRAFFIC CONTROL AND TEMPORARY TRAFFIC CONTROL DEVICES REQUIRED BY THESE PLANS SHALL BE PROVIDED BY THE CONTRACTOR WHETHER INSIDE OR OUTSIDE THE WORK LIMITS, SUBJECT TO FERMCO CONSTRUCTION MANAGER APPROVAL.

5. PAVING AT RAILROAD CROSSING

THE CROWN SHALL BE WORKED OUT OF THE NEW PAVEMENT ON EACH SIDE OF THE RAILROAD CROSSING, BEGINNING 50 FEET FROM THE NEAREST RAIL, BY RAISING THE EDGES OF THE NEW PAVEMENT TO MEET THE PLATFORM ELEVATION.

6. MAINTENANCE OF TRAFFIC

NOTICE OF CLOSURE SIGNS, AS DETAILED IN THESE PLANS, SHALL BE ERECTED BY THE CONTRACTOR AT LEAST ONE WEEK IN ADVANCE OF THE SCHEDULED ROAD OR RAMP CLOSURE. THE SIGNS SHALL BE ERECTED ON THE RIGHT HAND SIDE OF THE ROAD/RAMP FACING TRAFFIC. THEY SHALL BE PLACED SO AS NOT TO INTERFERE WITH THE VISIBILITY OF ANY OTHER TRAFFIC CONTROL SIGNS. ON ROADWAYS, THEY SHOULD BE ERECTED AT THE POINT OF CLOSURE. THE SIGNS MAY BE ERECTED ANYWHERE ON RAMPS AS LONG AS THEY ARE VISIBLE TO THE MOTORISTS USING THE RAMP. ON ENTRANCE RAMPS, THE SIGN SHALL BE ERECTED WELL IN ADVANCE OF THE MERGE AREA TO AVOID DISTRACTING MOTORISTS.

7. DUST CONTROL

THE CONTRACTOR SHALL FURNISH AND APPLY WATER AND CALCIUM CHLORIDE FOR DUST CONTROL.

8. ITEM 659, SEEDING AND MULCHING

SEEDING AND MULCHING SHALL BE APPLIED TO ALL AREAS DISTURBED BY THE CONTRACTOR UNLESS STABILIZED BY OTHERS.

9. DESIGN SPEED

UNLESS NOTED OTHERWISE, THE DESIGN SPEED IS 30 MPH.

NOTES

D--211

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LEGENDS AND SYMBOLS

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

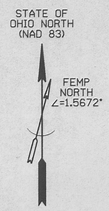
DRAWING TITLE
CIVIL GENERAL NOTES

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	N/A 000153

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00181	G0002	C



NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. THE HAUL ROAD WILL BE EXTENDED TO TIE INTO THE EXISTING NORTH ENTRANCE ROAD. THIS DRAWING WILL BE INCLUDED IN THE 90% SUBMITTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX
92X-5900-X-00179	LENGENDS & SYMBOLS
92X-5900-G-00185	PLAN & PROFILE - SHEET 1 OF 6
92X-5900-G-00186	PLAN & PROFILE - SHEET 2 OF 6
92X-5900-G-00187	PLAN & PROFILE - SHEET 3 OF 6
92X-5900-G-00188	PLAN & PROFILE - SHEET 4 OF 6
92X-5900-G-00189	PLAN & PROFILE - SHEET 5 OF 6
92X-5900-G-00190	PLAN & PROFILE - SHEET 6 OF 6

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
CIVIL SITE PLAN

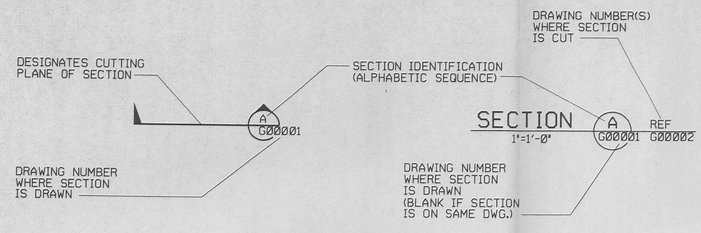
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

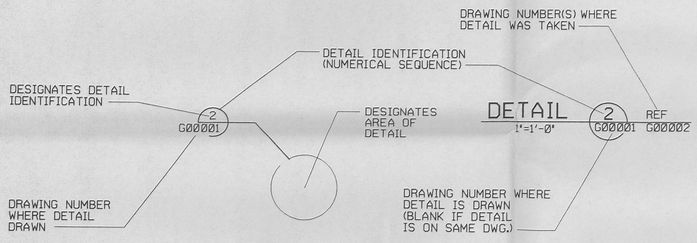
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

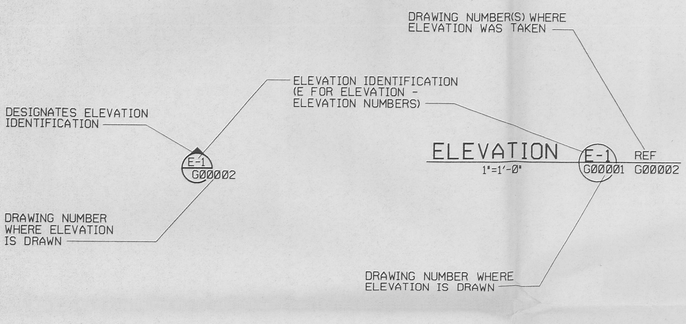
SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	
A-E DATE	N/A DATE	009192

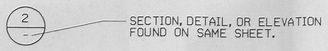
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00180	G0001	C

GENERAL LEGEND









NOTE:

ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING.

FOR EXAMPLE; 95X-5900-G-00002 = DRAWING NUMBER
G00002 = ABBREVIATED DRAWING NUMBER

DIMENSIONING:

DIMENSIONS AND/OR ELEVATIONS MARKED THUS (+/-) SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR.

USE DIMENSIONS AS SHOWN, DO NOT SCALE.

NTS (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

UTILITY SYMBOLS

EXISTING		PROPOSED
------ ST ------	STORM SEWER	ST
------ SN ------	SANITARY SEWER	SN
------ FG ------	FUEL GAS	FG
------ DW ------	DRINKING WATER	DW
------ FQ1 ------	FIRE PROTECTION	FQ1
------ LS ------	LIVE STEAM	LS
------ WS ------	WATER SUPPLY	WS
------ WR ------	COOLING WATER RETURN	WR
------ TW ------	PROCESS WATER	TW
------ CE ------	CONTAMINATE WATER	CE
------ FT ------	FILTRATE OR EFFLUENT	FT
------ DF ------	DEIONIZED FEED	DF
------ PW ------	DEIONIZED WATER	PW
------ BR ------	BRINE	BR
------ RW ------	RAW WATER	RW
------ A ------	ALARM	A
------ CN ------	STEAM CONDENSATE	CN
------ VE ------	VENT LINES	VE
------ SD ------	SUB-SURFACE DRAINAGE	SD
------ SL ------	SUMP LIQUOR	SL
------ E ------	ELECTRICAL	E
------ OE --○---	OVERHEAD ELECTRICAL	OE
------ T ------	TELEPHONE	T
------ G ------	ELECTRIC GROUND	G
------ PA ------	PLANT AIR	PA
------ SA ------	INSTRUMENT AIR SUPPLY	SA
.....	ABANDONED	

BALLOON LEGEND

- PIV — POST INDICATOR VALVE
- SMH — SANITARY MANHOLE
- EMH — ELECTRICAL MANHOLE
- TMH — TELEPHONE MANHOLE
- CB — STORM SEWER CATCH BASIN
- HFH — HIGH PRESSURE FIRE HYDRANT
- LFH — LOW PRESSURE FIRE HYDRANT

GRADING SYMBOLS

EXISTING		PROPOSED
X 584.9	SPOT ELEVATION	X 584.4
------ 584 ------	CONTOUR - MINOR	584
------ 585 ------	CONTOUR - MAJOR	585
(TOE)	SLOPE INDICATOR	(TOE)

ARCHITECTURAL LEGEND

EXISTING		PROPOSED
	DOOR NUMBER	103
	ROOM NUMBER	101

SYMBOLS LEGEND

EXISTING		PROPOSED
	POST INDICATOR VALVE (PIV)	
	FIRE HYDRANT (FH)	
	MANHOLE (MH)	Ⓢ OR Ⓓ
	CATCH BASIN (CB)	D
	LIGHT POLE	
	PIPE SUPPORT	
	ELECTRICAL MANHOLE	E
	TELEPHONE MANHOLE	T
	STREET WASHERS	
	VALVE BOX	
1313	MONITORING WELL	
	SURFACE DRAINAGE FLOW	
	POWER POLE	
	GRAVEL ROADWAY/DRIVEWAY	
	ASPHALT ROADWAY/DRIVEWAY	
	CONCRETE PAD/ ROADWAY/DRIVEWAY	
	BUILDING/TRAILER	
	RAILROAD TRACK	
	OU BOUNDARY	
	FENCE	
	TREE LINE	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	CENTERLINE DRAINAGE DITCH	
	RIVER/CREEK	
	TO BE REMOVED	
	SILT FENCE	
	ELECTRICAL TRANSFORMER	T
	TRANSMISSION TOWER	
	HEADWALL	— OR
BM	BENCH MARK	
XX XX	CONSTRUCTION/WIND BARRIER FENCE	XX XX
	SIGN	
	BOLLARD/GUARD POST	
PB	ELECTRICAL PULL BOX	
	SURVEY CONTROL POINT	
	ROAD CENTERLINE OR BASELINE	
	BEND	OR
	TEE	
	THRUST BLOCK	
	REDUCER	
W OR U	UNKNOWN	
	STRAW BALE SILT BARRIER	
	FENCE GATE	
	CULVERT	

NOTES

E-211

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
LEGENDS AND SYMBOLS

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	000191

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-X-00179	X0003	C

INDEX OF DRAWINGS

INDEX CODE NO.	DRAWING NO.	SHEET NO.	REVISION NO.	DRAWING TITLE	REMARKS
	92X-5900-X-00177	X0001	C	PROJECT TITLE SHEET	
	92X-5900-X-00178	X0002	C	DRAWING INDEX	
	92X-5900-X-00179	X0003	C	LEGENDS & SYMBOLS	
	92X-5900-G-00180	G0001	C	CIVIL - SITE PLAN	
	92X-5900-G-00181	G0002	C	CIVIL - GENERAL NOTES	
	92X-5900-G-00182	G0003	C	CIVIL - GENERAL SUMMARY - SHEET 1 OF 2	
	92X-5900-G-00183	G0004		CIVIL - GENERAL SUMMARY - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00184	G0005	C	CIVIL - TYPICAL SECTIONS	
	92X-5900-G-00185	G0006	C	CIVIL - PLAN & PROFILE - SHEET 1 OF 6	
	92X-5900-G-00186	G0007	C	CIVIL - PLAN & PROFILE - SHEET 2 OF 6	
	92X-5900-G-00187	G0008	C	CIVIL - PLAN & PROFILE - SHEET 3 OF 6	
	92X-5900-G-00188	G0009	C	CIVIL - PLAN & PROFILE - SHEET 4 OF 6	
	92X-5900-G-00189	G0010	C	CIVIL - PLAN & PROFILE - SHEET 5 OF 6	
	92X-5900-G-00190	G0011		CIVIL - PLAN & PROFILE - SHEET 6 OF 6	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00191	G0012	C	CIVIL - CROSS SECTION - SHEET 1 OF 6	
	92X-5900-G-00192	G0013	C	CIVIL - CROSS SECTION - SHEET 2 OF 6	
	92X-5900-G-00193	G0014	C	CIVIL - CROSS SECTION - SHEET 3 OF 6	
	92X-5900-G-00194	G0015	C	CIVIL - CROSS SECTION - SHEET 4 OF 6	
	92X-5900-G-00195	G0016	C	CIVIL - CROSS SECTION - SHEET 5 OF 6	
	92X-5900-G-00196	G0017	C	CIVIL - CROSS SECTION - SHEET 6 OF 6	
	92X-5900-G-00197	G0018		CIVIL - INTERSECTION DETAILS	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00198	G0019		CIVIL - GRADING & SEDIMENT CONTROL - SHEET 1 OF 3	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00199	G0020		CIVIL - GRADING & SEDIMENT CONTROL - SHEET 2 OF 3	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00200	G0021		CIVIL - GRADING & SEDIMENT CONTROL - SHEET 3 OF 3	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00201	G0022		CIVIL - SUPERELEVATION TABLES	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00202	G0023		CIVIL - GENERAL DETAILS - SHEET 1 OF 4	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00203	G0024		CIVIL - GENERAL DETAILS - SHEET 2 OF 4	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00204	G0025		CIVIL - GENERAL DETAILS - SHEET 3 OF 4	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00205	G0026		CIVIL - GENERAL DETAILS - SHEET 4 OF 4	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00206	G0027		CIVIL - PAVEMENT MARKING & SIGNING - SHEET 1 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00207	G0028		CIVIL - PAVEMENT MARKING & SIGNING - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00208	G0029		CIVIL - DETAILS - SHEET 1 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00209	G0030		CIVIL - DETAILS - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-E-00245	E0001		ELECTRICAL - SITE PLAN - SOUTHFIELD AREA	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-E-00246	E0002	C	ELECTRICAL - SITE PLAN - FORMER PRODUCTION AREA	
	92X-5900-E-00247	E0003	C	ELECTRICAL - PLAN AND DETAILS - PEDESTRIAN CROSSING	
	92X-5900-E-00248	E0004	C	ELECTRICAL - PLAN AND DETAILS - RAILROAD CROSSING	
	92X-5900-E-00249	E0005		ELECTRICAL - DETAILS - MISC. ELECTRICAL DETAILS	TO BE INCLUDED AT 90% SUBMITTAL

NOTES

1. THERE ARE REFERENCES TO DRAWING NUMBERS IN THIS PLAN SET WHICH ARE NOT IN THIS PLAN SET SUBMISSION BUT SHALL BE INCLUDED IN THE 90% SUBMITTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00179	LEGENDS & SYMBOLS

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
HAUL ROAD CONSTRUCTION

DRAWING TITLE
DRAWING INDEX

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	000130

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-X-00178	X0002	C

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

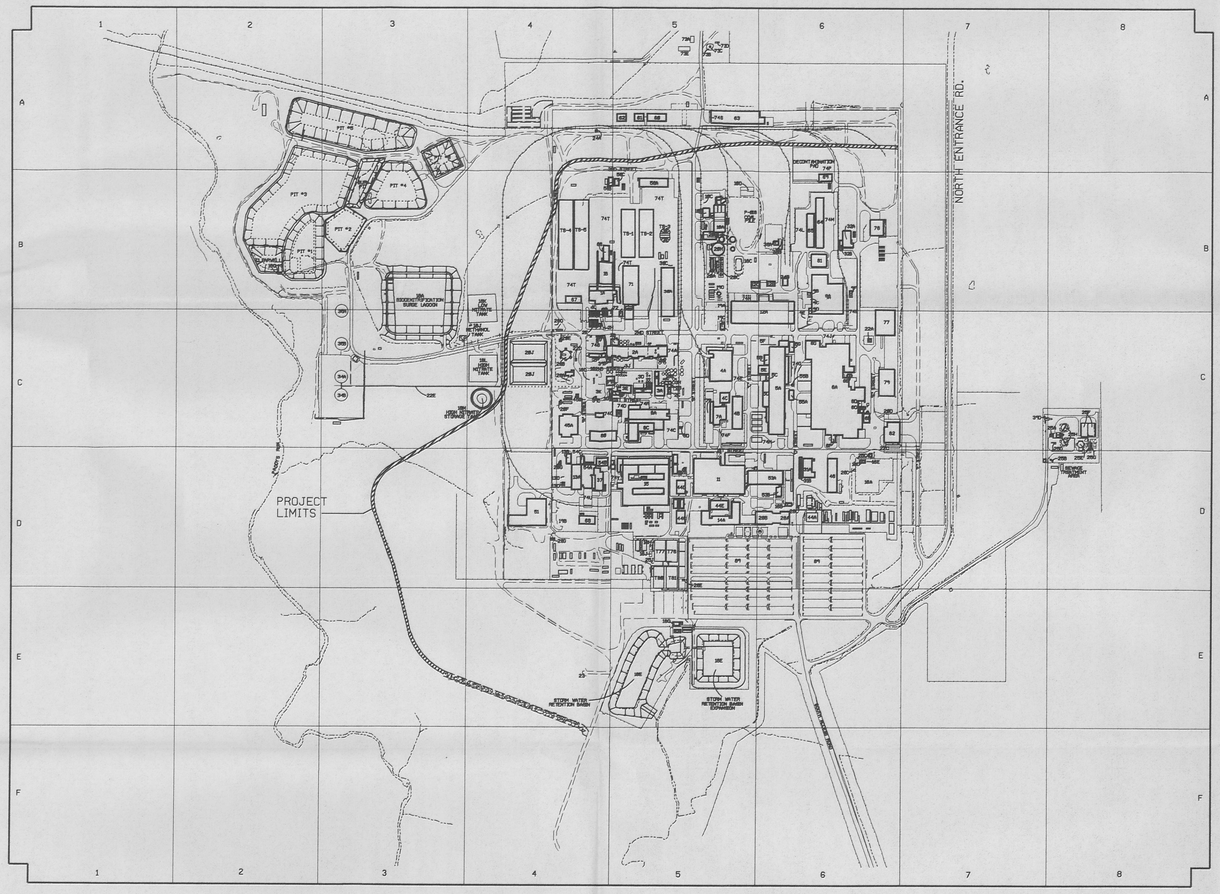
HAUL ROAD

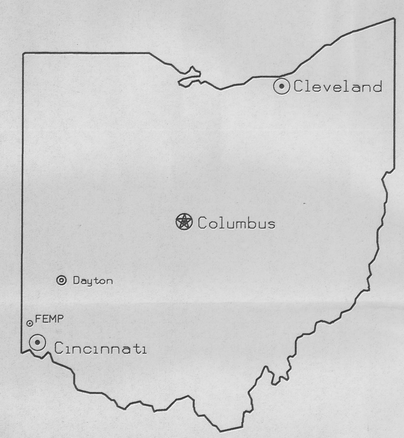
CONSTRUCTION

OPERABLE UNIT 2 - PROJECT ORDER 158

STATE OF OHIO NORTH (NAD 83)

FEMP NORTH ∠=1.5672°





PARSONS

The Ralph M. Parsons Company * Parsons Main, Inc. * Engineering-Science, Inc.

ARCHITECTS - ENGINEERS
CINCINNATI, OHIO

NOTES

REF DWG NO.	DRAWING TITLE
92X-5900-X-00178	DRAWING INDEX

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

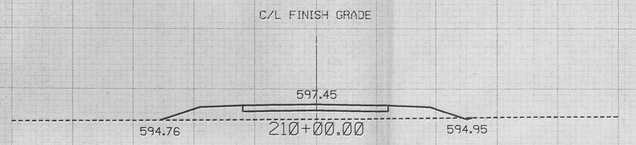
THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

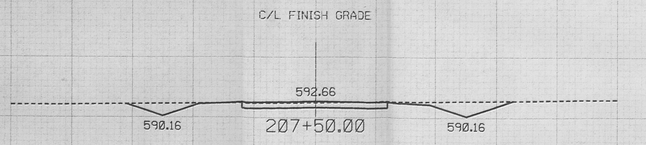
PROJECT NAME
HAUL ROAD CONSTRUCTION

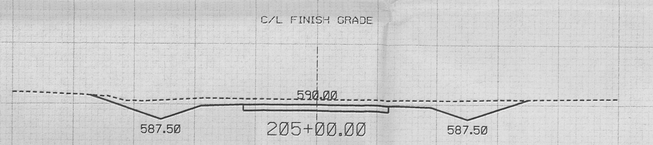
DRAWING TITLE
PROJECT TITLE SHEET

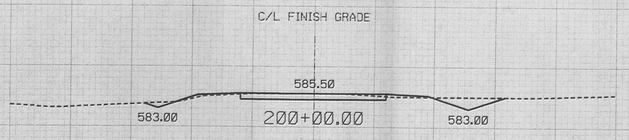
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE: NONE	CLASS
SUBMITTED FOR APPROVAL A-E DATE		FERNCO CRU APPROVAL N/A DATE		000159	

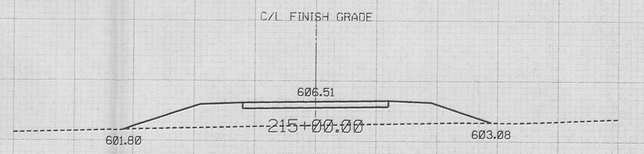
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.2.3.6 00-90701	92X-5900-X-00177	X0001	C

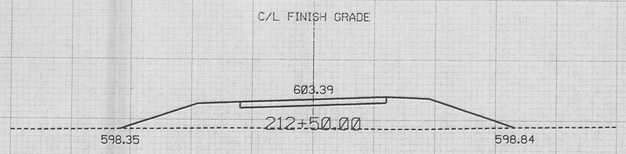












50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" VERTICAL

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" HORIZONTAL

NOTE: FINAL LOCATION AND ELEVATIONS OF DITCH WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00219.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00225 AND 92X-5900-G-00226.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00219	TYPICAL SECTIONS
92X-5900-G-00225	PLAN & PROFILE - SHEET 6 OF 7
92X-5900-G-00226	PLAN & PROFILE - SHEET 7 OF 7

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
B	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 4 OF 4

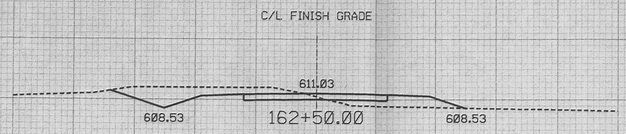
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

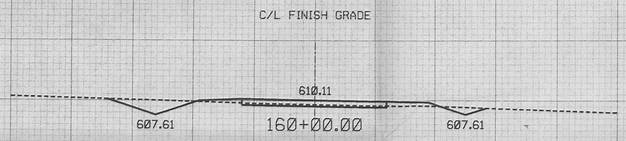
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

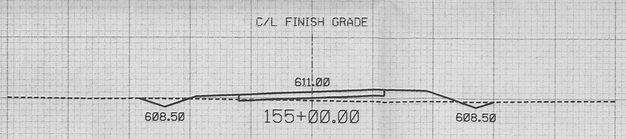
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009258

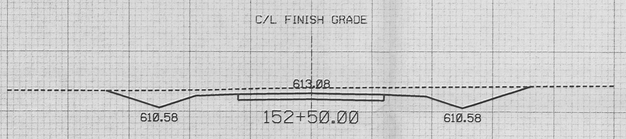
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-9070I	92X-5900-G-00230	G0016	B

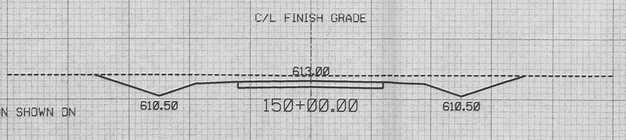
0" 1" 2"











PREVIOUS CROSS SECTION SHOWN ON DWG G00228

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" VERTICAL

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" HORIZONTAL

NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00219.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00223 AND 92X-5900-G-00224.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00219	TYPICAL SECTIONS
92X-5900-G-00223	PLAN & PROFILE - SHEET 4 OF 7
92X-5900-G-00224	PLAN & PROFILE - SHEET 5 OF 7
92X-5900-G-00228	CROSS SECTIONS - SHEET 2 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

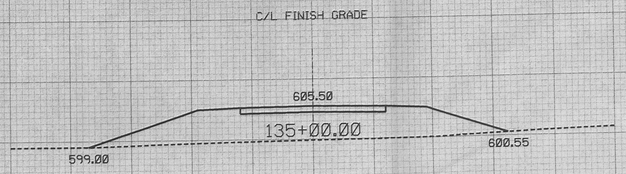
DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 3 OF 4

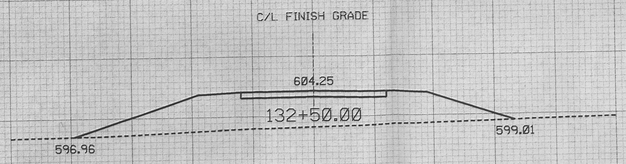
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

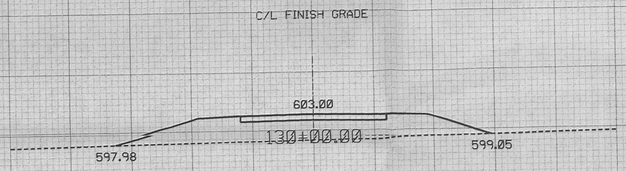
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

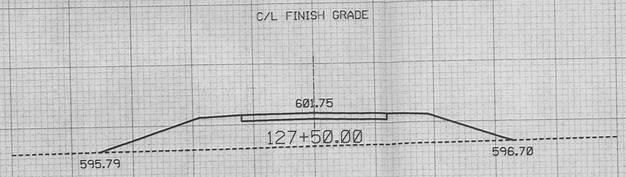
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	008257

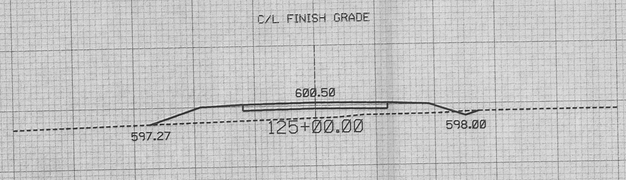
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00229	G0015	C





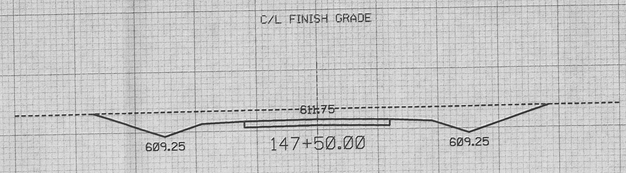


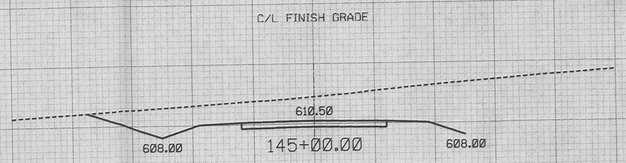


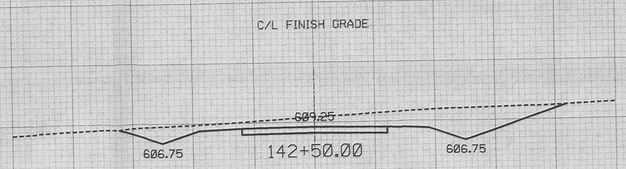


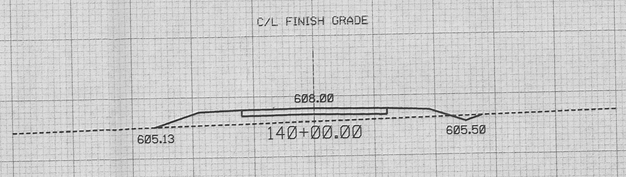
PREVIOUS CROSS SECTION SHOWN ON DWG G00227

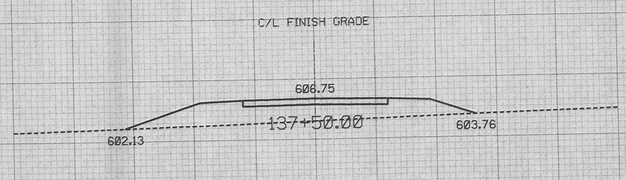
NEXT CROSS SECTION SHOWN ON DWG G00229











NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" VERTICAL

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" HORIZONTAL

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00219.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00221, 92X-5900-G-00222 AND 92X-5900-G-00223.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00219	TYPICAL SECTIONS
92X-5900-G-00221	PLAN & PROFILE - SHEET 2 OF 7
92X-5900-G-00222	PLAN & PROFILE - SHEET 3 OF 7
92X-5900-G-00223	PLAN & PROFILE - SHEET 4 OF 7
92X-5900-G-00227	CROSS SECTIONS - SHEET 1 OF 4
92X-5900-G-00229	CROSS SECTIONS - SHEET 3 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 2 OF 4

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	
A-E DATE	DATE	600156

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.2.3.6 00-00701	92X-5900-G-00228	G0014	C

0" 1" 2"

C/L FINISH GRADE

590.33

587.83 110+00.00 587.83

C/L FINISH GRADE

587.75

585.25 107+50.00 585.25

C/L FINISH GRADE

585.17

582.67 105+00.00 582.67

C/L FINISH GRADE

582.58

580.08 102+50.00 580.08

C/L FINISH GRADE

580.00

577.50 100+00.00 577.50

50 40 30 20 10 ℄ 10 20 30 40 50

1" = 10'- 0" VERTICAL 1" = 10'- 0" HORIZONTAL

NEXT CROSS SECTION SHOWN ON DWG G00228

C/L FINISH GRADE

599.25

596.75 122+50.00 596.75

C/L FINISH GRADE

598.00

593.00 120+00.00 593.62

C/L FINISH GRADE

596.75

594.25 117+50.00 594.25

C/L FINISH GRADE

595.23

592.73 115+00.00 592.73

C/L FINISH GRADE

592.92

590.42 112+50.00 590.42

50 40 30 20 10 ℄ 10 20 30 40 50

NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

NOTES

1. FOR TYPICAL SECTIONS, SEE DRAWING 92X-5900-G-00219.
2. CROSS SECTIONS SHOWN ARE FOR STATIONS SHOWN ON DRAWINGS 92X-5900-G-00220 AND 92X-5900-G-00221.
3. THE TIE-IN FOR THE PROPOSED SECTION TO THE EXISTING GROUND WILL BE PERFORMED FOR THE 90% REVIEW.
4. DRAINAGE AND EARTHWORK WILL BE DESIGNED FOR THE 90% SUBMITTAL WHEN THE SURVEY IS COMPLETE AND THE ALIGNMENT IS FINALIZED.
5. PROPOSED DITCH SLOPES ARE 1 VERTICAL TO 3 HORIZONTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00219	TYPICAL SECTIONS
92X-5900-G-00220	PLAN & PROFILE - SHEET 1 OF 7
92X-5900-G-00221	PLAN & PROFILE - SHEET 2 OF 7
92X-5900-G-00228	CROSS SECTIONS - SHEET 2 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
CROSS SECTIONS
SHEET 1 OF 4

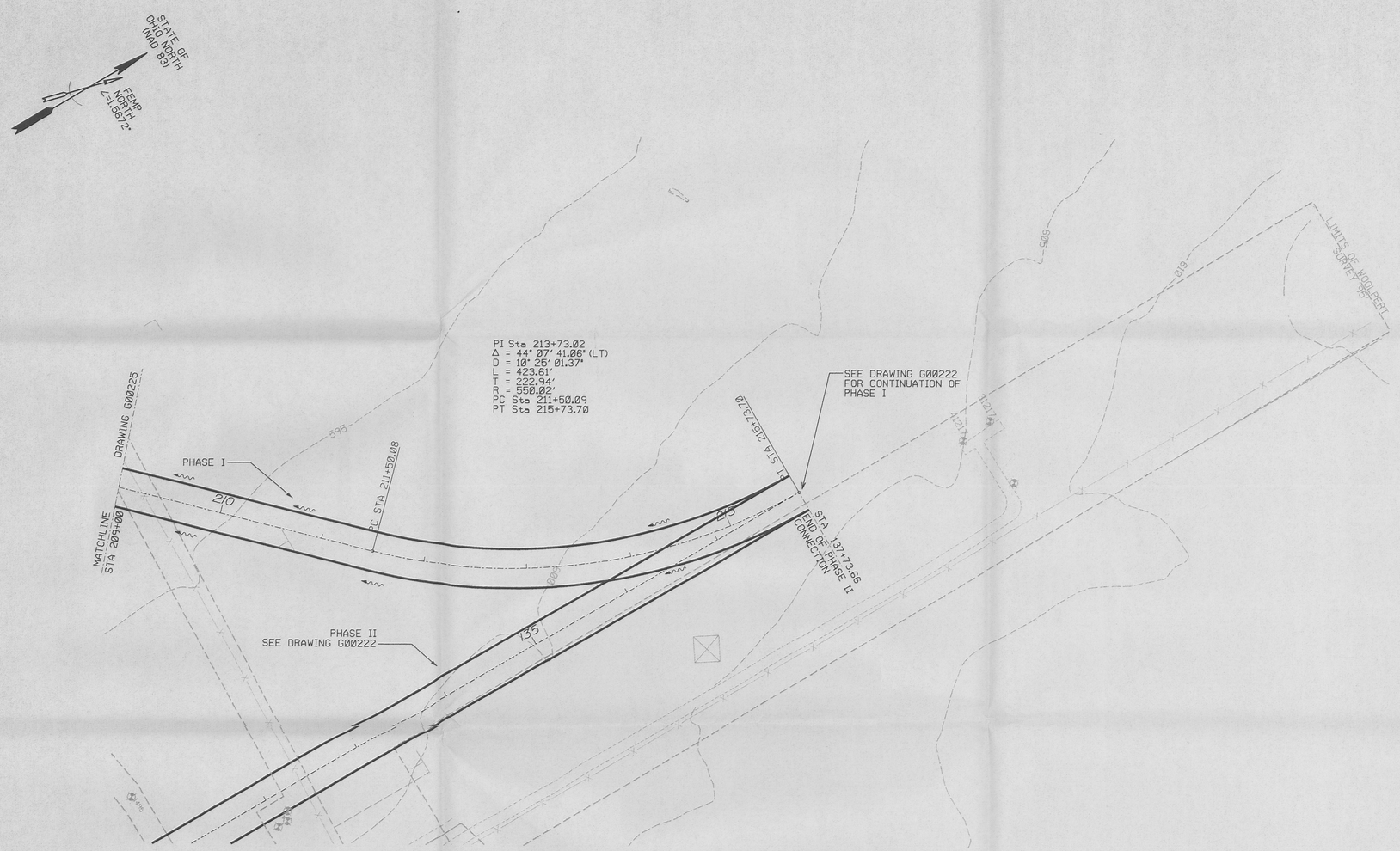
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		1" = 10'	

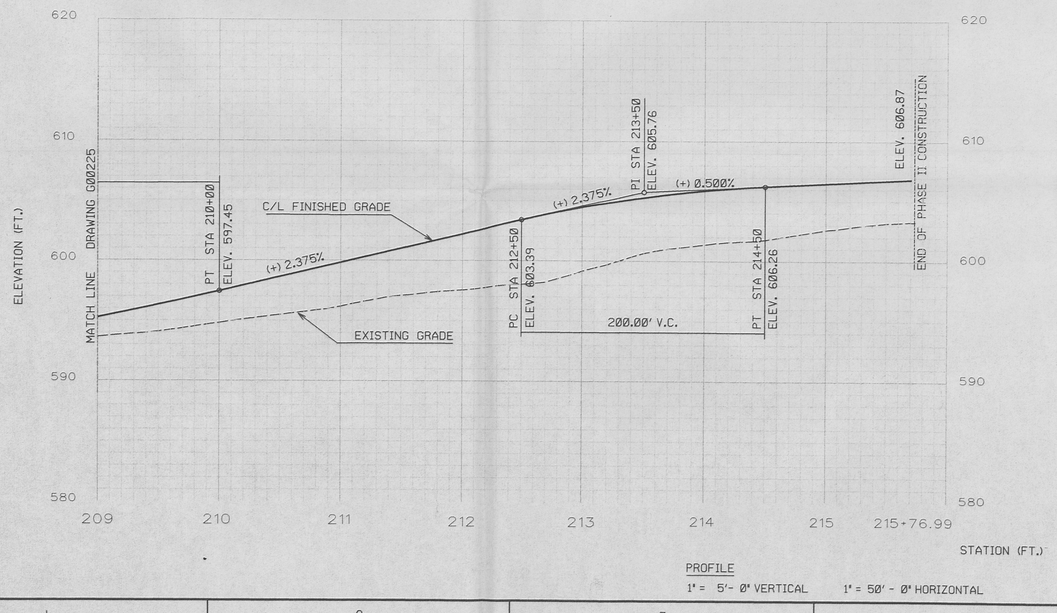
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009155

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	TEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00227	G0013	C

211



PLAN
1"=50'



PROFILE
1" = 5'- 0" VERTICAL 1" = 50'- 0" HORIZONTAL

NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

NOTES

E- 211

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
3. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
4. STORM DRAINAGE SHOWN IS CONCEPTUAL.
5. SEE DRAWINGS 92X-5900-G-00228 AND 92X-5900-G-00230 FOR CROSS SECTIONS.
6. DETAILS OF THE PHASE I / PHASE II TIE-IN WILL BE SHOWN FOR THE 90% REVIEW.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00222	PLAN & PROFILE - SHEET 3 OF 7
92X-5900-G-00225	PLAN & PROFILE - SHEET 6 OF 7
92X-5900-G-00228	CROSS SECTIONS - SHEET 2 OF 4
92X-5900-G-00230	CROSS SECTIONS - SHEET 4 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD
CONSTRUCTION

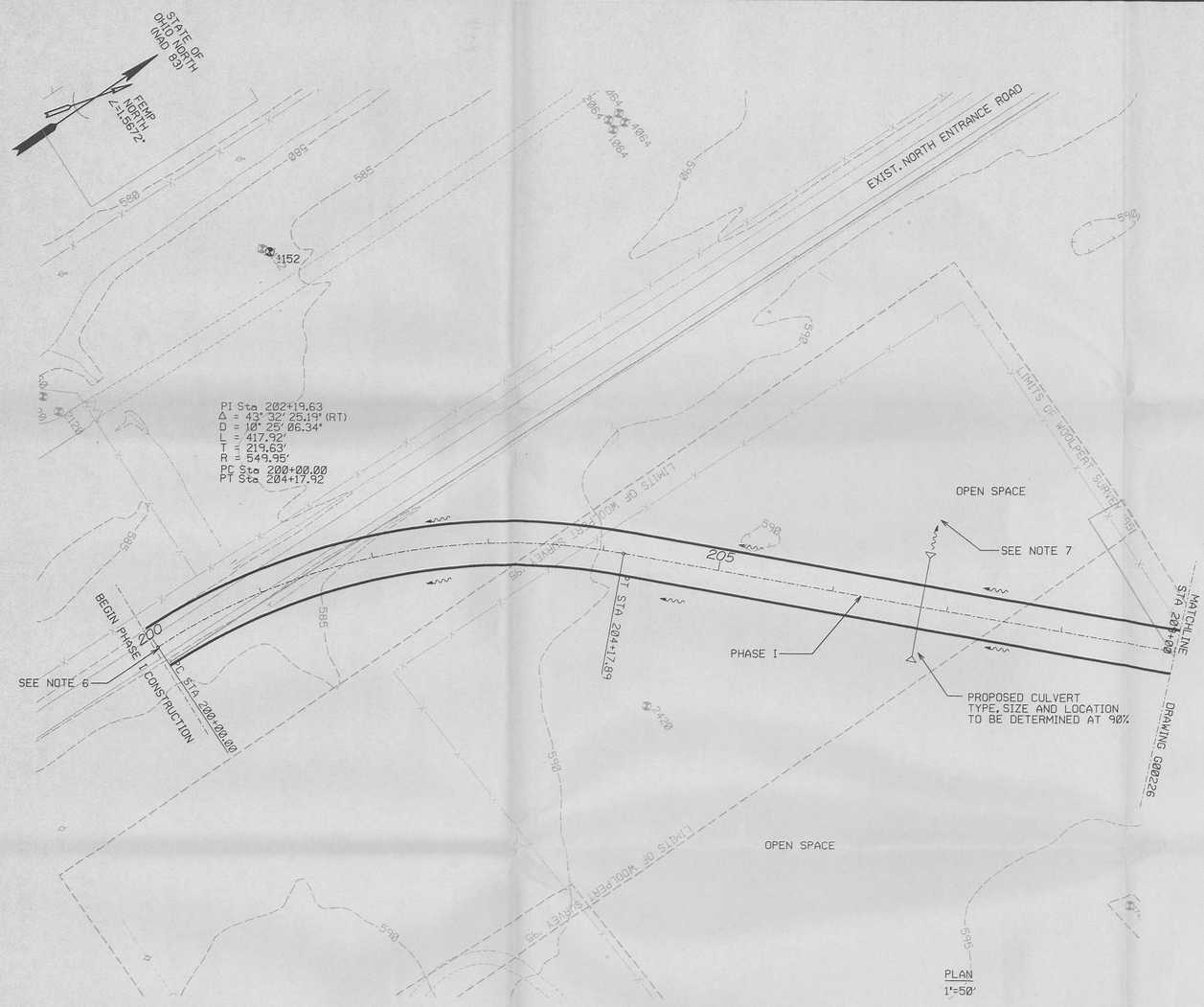
DRAWING TITLE
CIVIL
PLAN & PROFILE
SHEET 7 OF 7

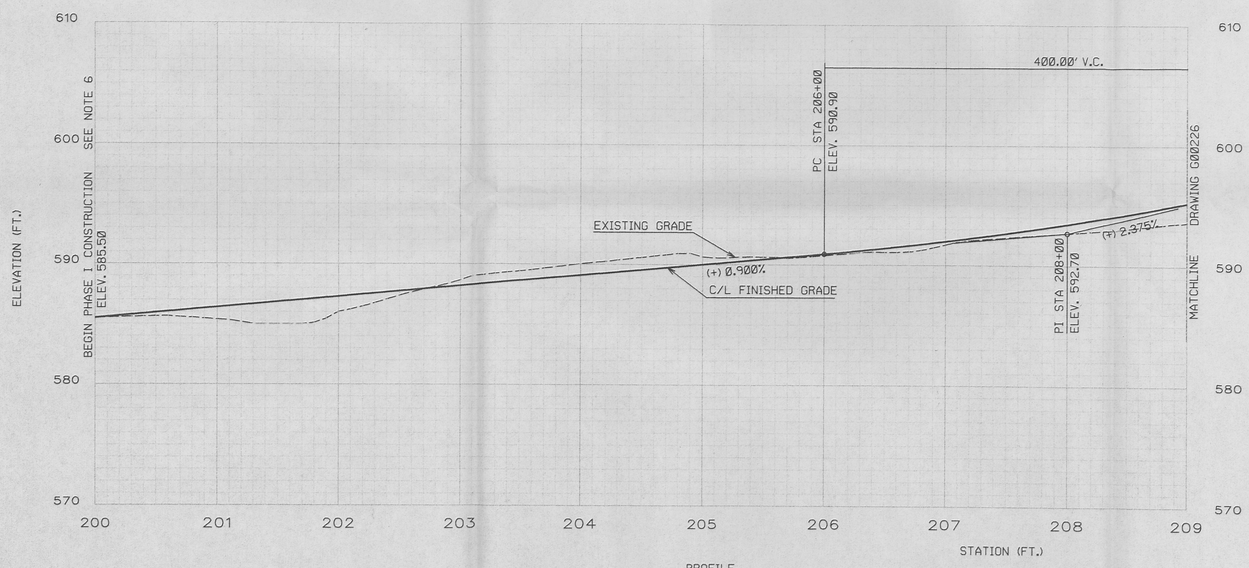
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	009154

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00226	G0012	C





PROFILE
1" = 5'- 0" VERTICAL 1" = 50' - 0" HORIZONTAL

NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
3. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
4. STORM DRAINAGE SHOWN IS CONCEPTUAL.
5. SEE DRAWING 92X-5900-G-00229 FOR CROSS SECTIONS.
6. THE TIE-IN TO THE EXISTING NORTH ENTRANCE ROAD WILL BE SHOWN FOR THE 90% REVIEW.
7. AN OUT FALL CHANNEL FOR THE CULVERT SHALL BE CONSTRUCTED BY OTHERS PRIOR TO PHASE I CONSTRUCTION.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00226	PLAN & PROFILE - SHEET 7 OF 7
92X-5900-G-00229	CROSS SECTIONS - SHEET 3 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

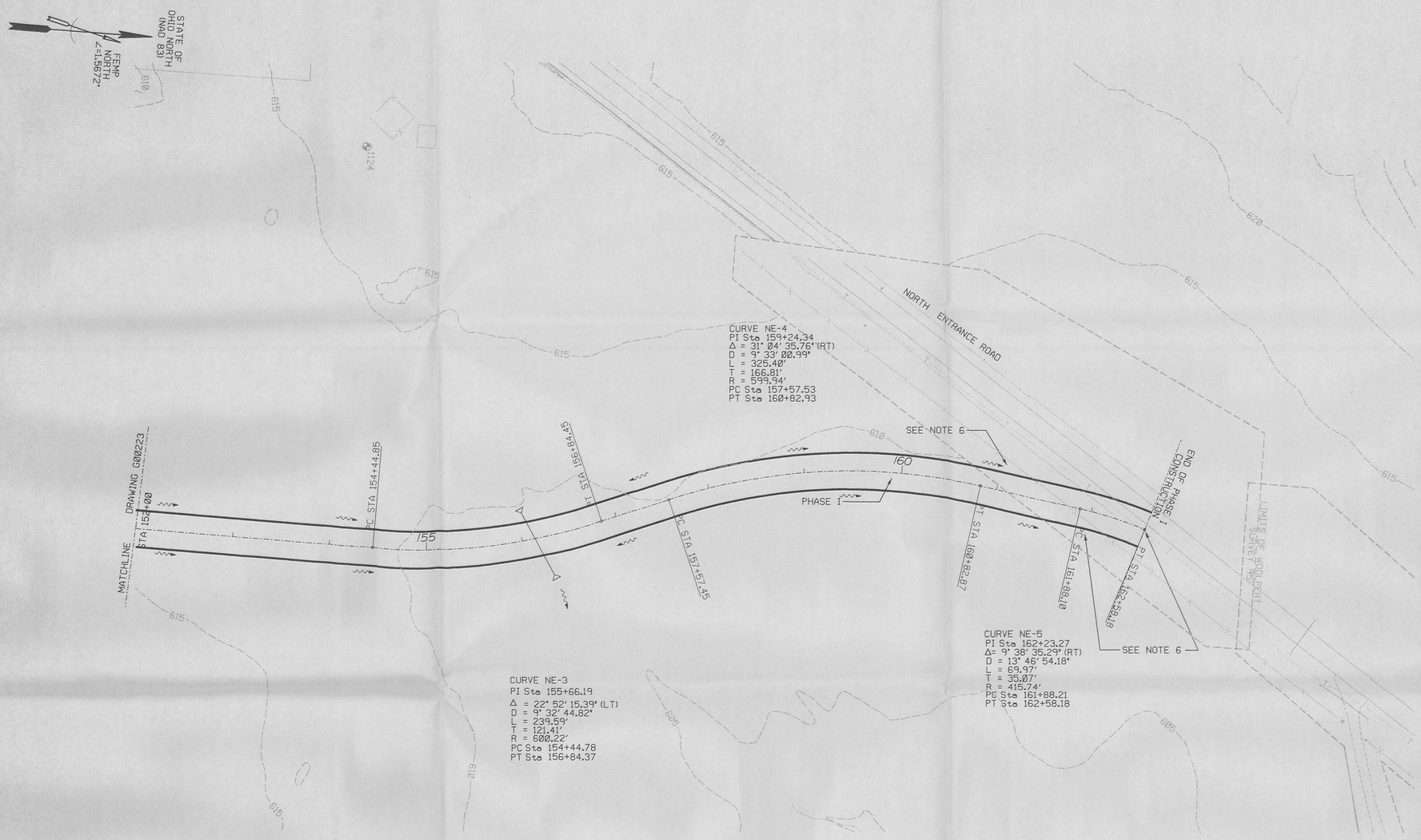
DRAWING TITLE
CIVIL
PLAN & PROFILE
SHEET 6 OF 7

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

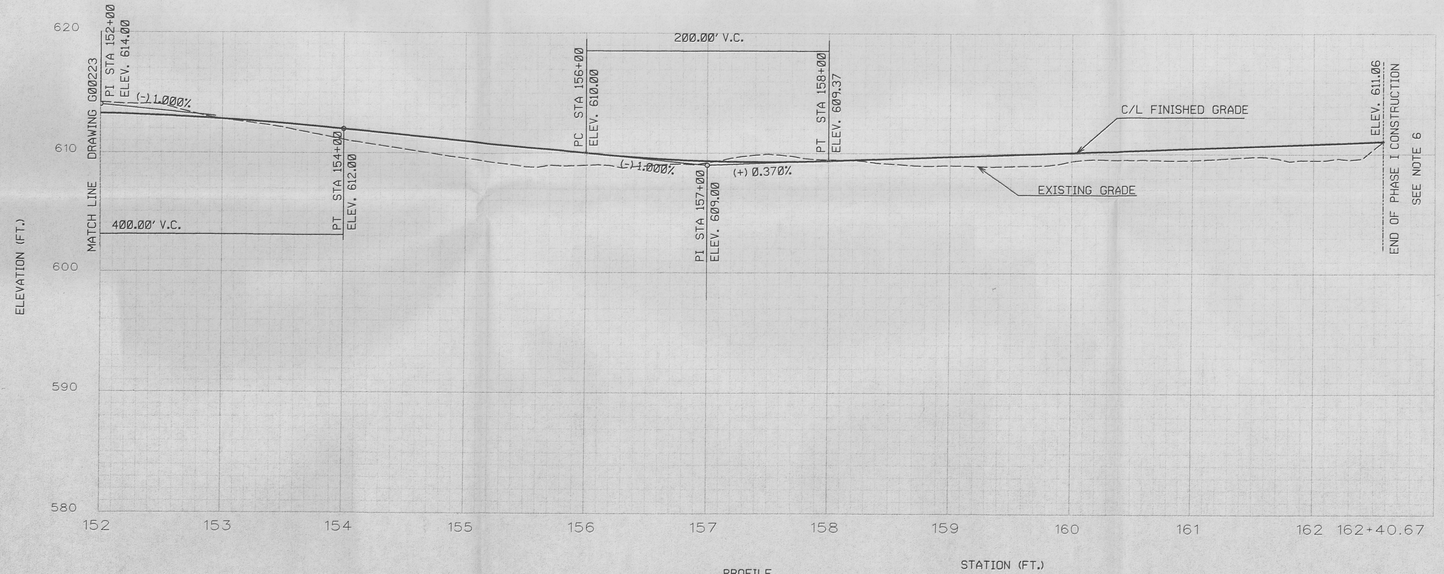
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL	
A-E DATE	DATE	000153

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00225	G0011	C



PLAN
1"=50'



PROFILE
1" = 5'- 0" VERTICAL 1" = 50' - 0" HORIZONTAL

NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
3. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
4. STORM DRAINAGE SHOWN IS CONCEPTUAL.
5. SEE DRAWING 92X-5900-G-00229 FOR CROSS SECTIONS.
6. THE TIE-IN TO THE EXISTING NORTH ENTRANCE ROAD WILL BE SHOWN FOR THE 90% REVIEW.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00223	PLAN & PROFILE - SHEET 4 OF 7
92X-5900-G-00225	PLAN & PROFILE - SHEET 6 OF 7
92X-5900-G-00229	CROSS SECTIONS - SHEET 3 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

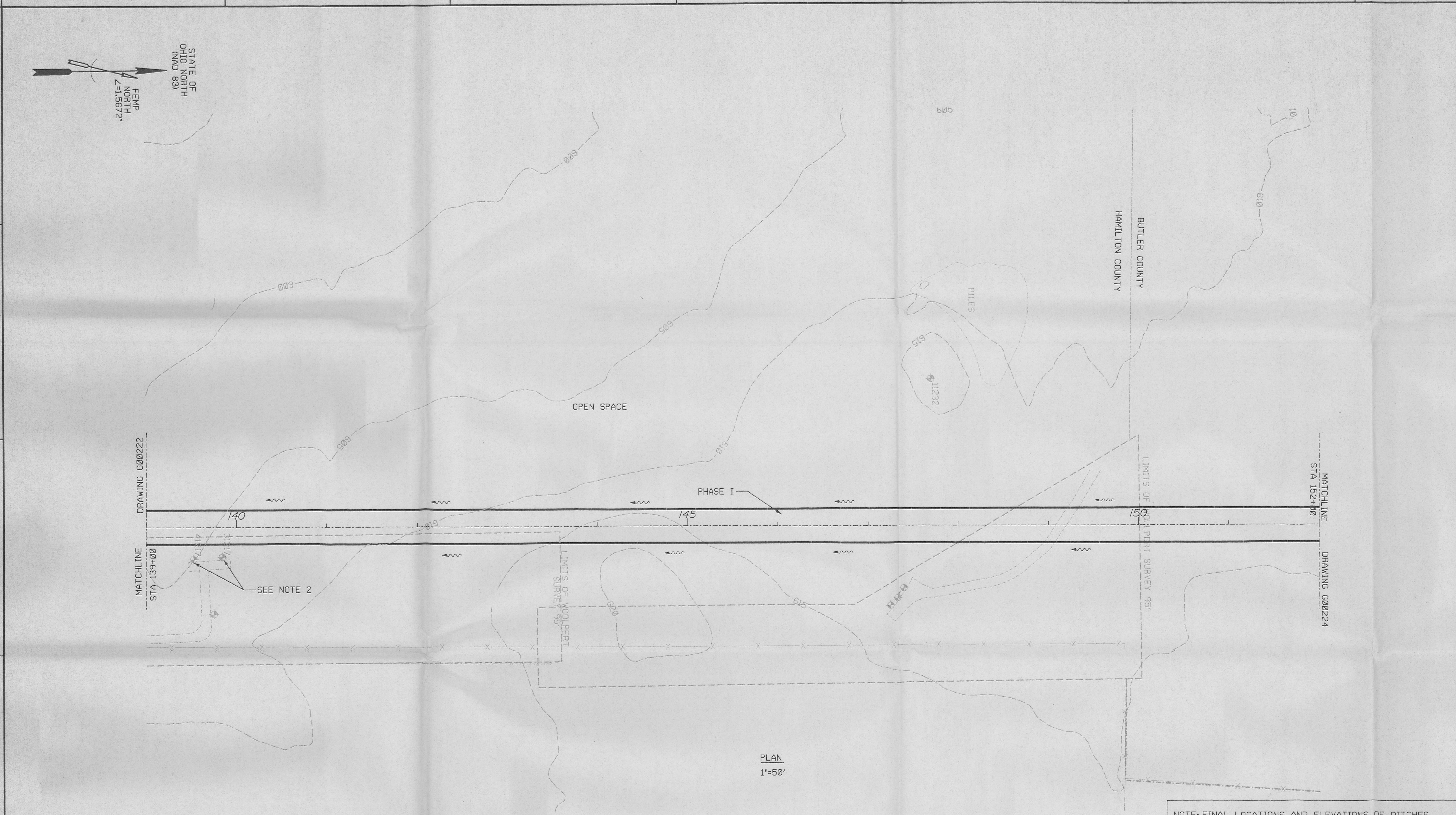
DRAWING TITLE
CIVIL
PLAN & PROFILE
SHEET 5 OF 7

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

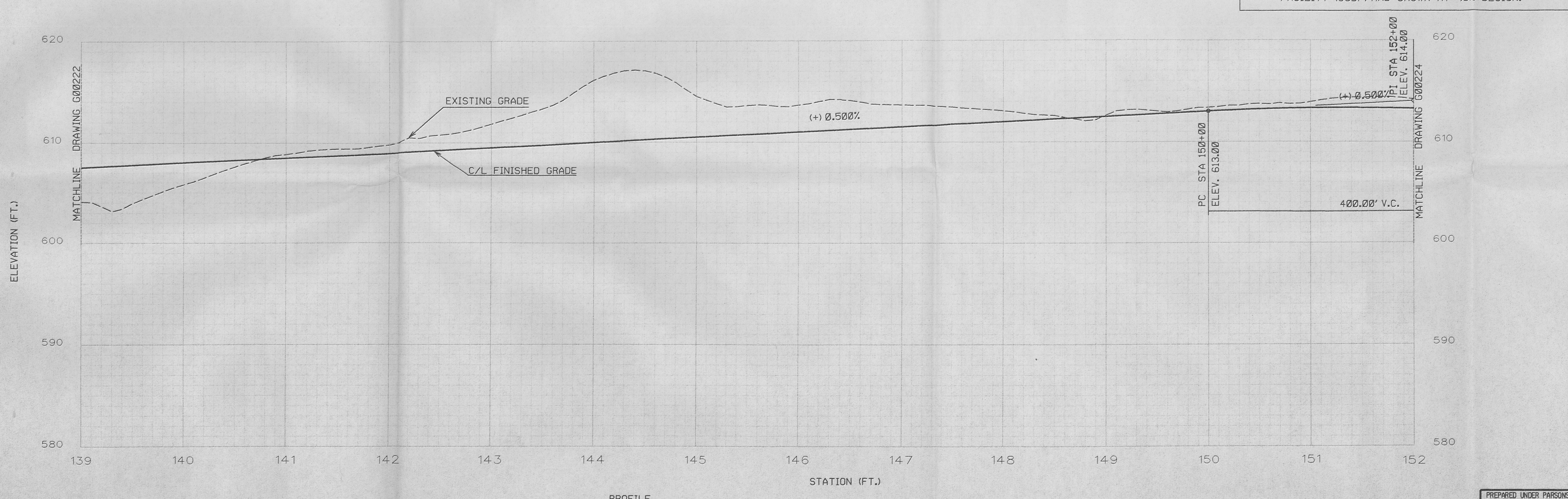
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL — A-E DATE
FERMCO CRU APPROVAL — N/A — DATE
000152

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00224	G0010	C



NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.



PROFILE

1" = 5'- 0" VERTICAL 1" = 50'- 0" HORIZONTAL

NOTES E- 211

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. EXISTING MONITORING WELLS SHALL BE PROTECTED. ROUTE DITCH EAST OF WELLS.
3. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
4. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
5. STORM DRAINAGE SHOWN IS CONCEPTUAL.
6. SEE DRAWINGS 92X-5900-G-00228 AND 92X-5900-G-00229 FOR CROSS SECTIONS.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00222	PLAN & PROFILE - SHEET 3 OF 7
92X-5900-G-00224	PLAN & PROFILE - SHEET 5 OF 7
92X-5900-G-00228	CROSS SECTIONS - SHEET 2 OF 4
92X-5900-G-00229	CROSS SECTIONS - SHEET 3 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW			N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW			N/A
A	ISSUED FOR 30% DESIGN REVIEW			N/A
		INITIALS AND DATE		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

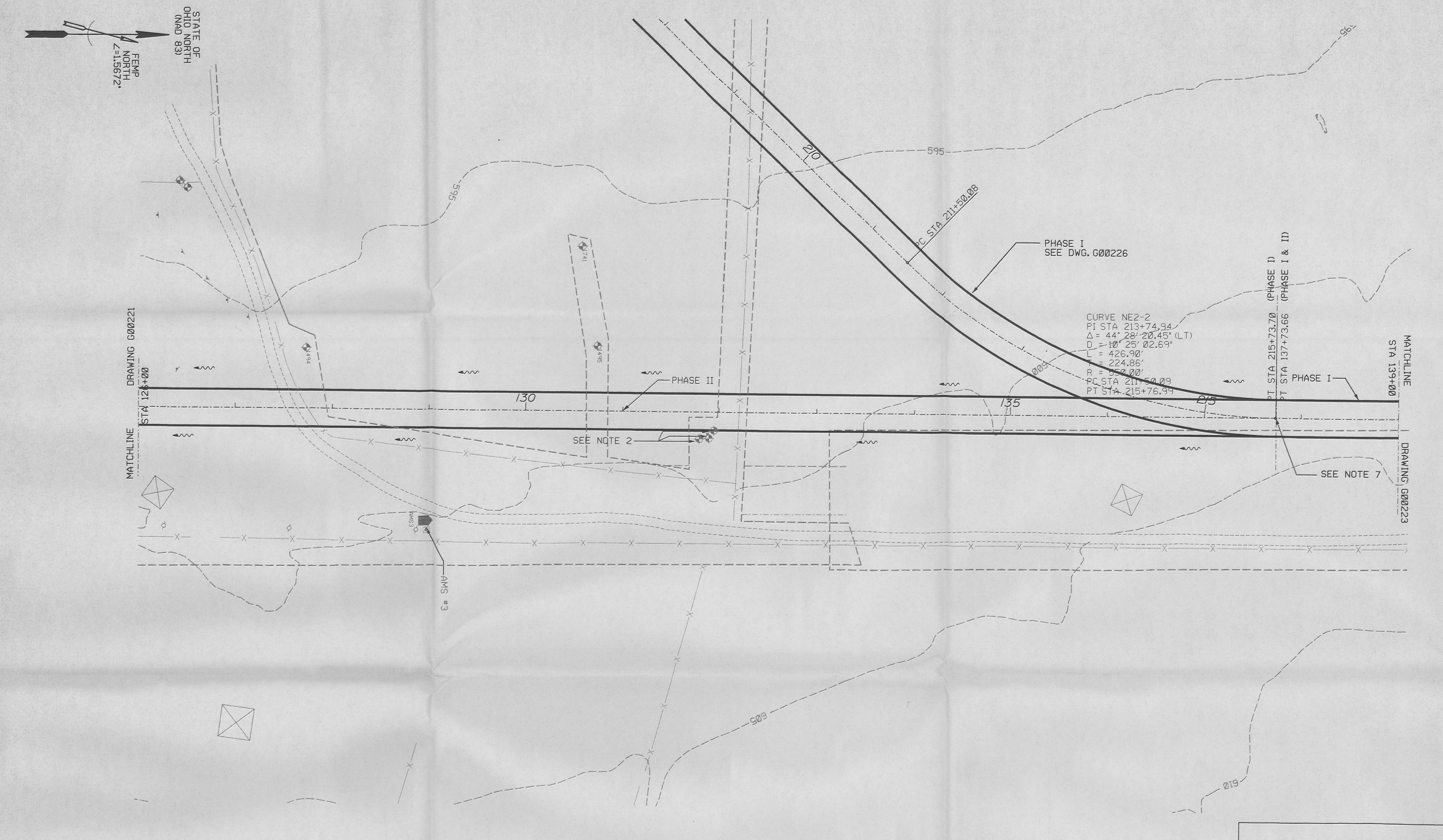
DRAWING TITLE
CIVIL
PLAN & PROFILE
SHEET 4 OF 7

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE: AS SHOWN	CLASS
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL: N/A		000151	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	A-E DOE PROJECT NO.	DATE	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158			WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00223	G0009	C

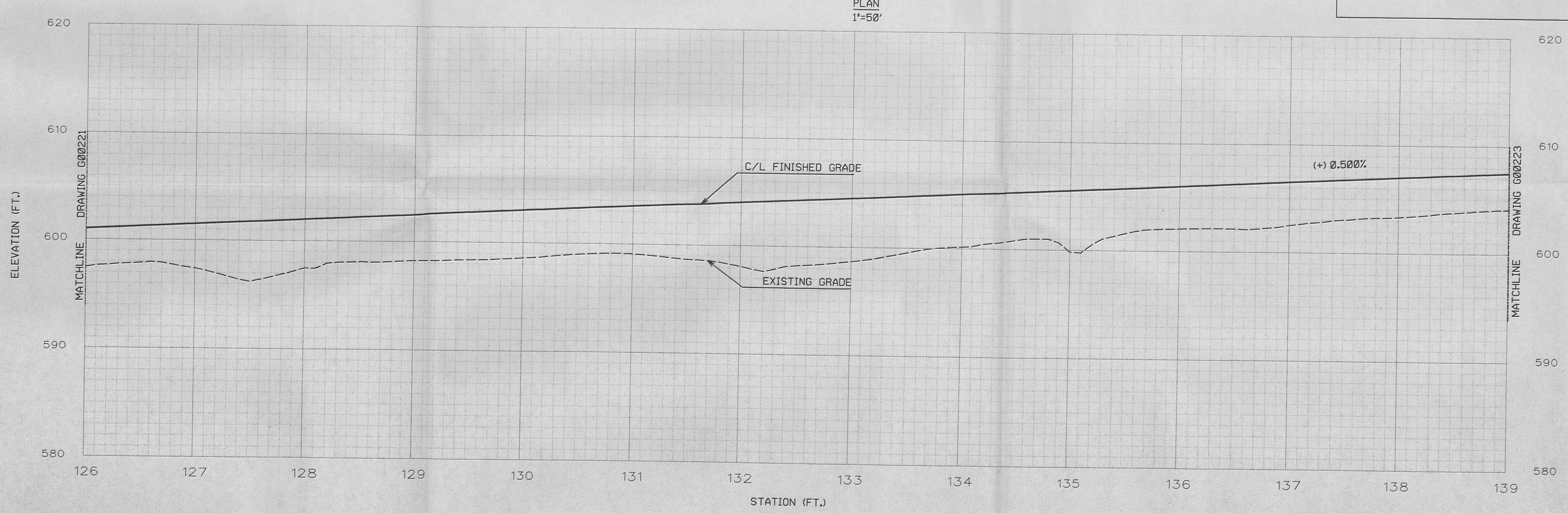
NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. EXISTING MONITORING WELLS SHALL BE ABANDONED BY FERMCO.
3. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
4. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
5. SEE DRAWINGS 92X-5900-G-00227 AND 92X-5900-G-00228 FOR CROSS SECTIONS.
6. STORM DRAINAGE SHOWN IS CONCEPTUAL.
7. DETAIL OF THE PHASE I / PHASE II TIE-IN WILL BE SHOWN FOR THE 90% REVEIW.



NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.

PLAN
1"=50'



PROFILE
1" = 5'- 0" VERTICAL 1" = 50' - 0" HORIZONTAL

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00221	PLAN & PROFILE - SHEET 2 OF 7
92X-5900-G-00223	PLAN & PROFILE - SHEET 4 OF 7
92X-5900-G-00227	CROSS SECTIONS - SHEET 1 OF 4
92X-5900-G-00228	CROSS SECTIONS - SHEET 2 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	
		INITIALS AND DATE		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN AND PROFILE
SHEET 3 OF 7

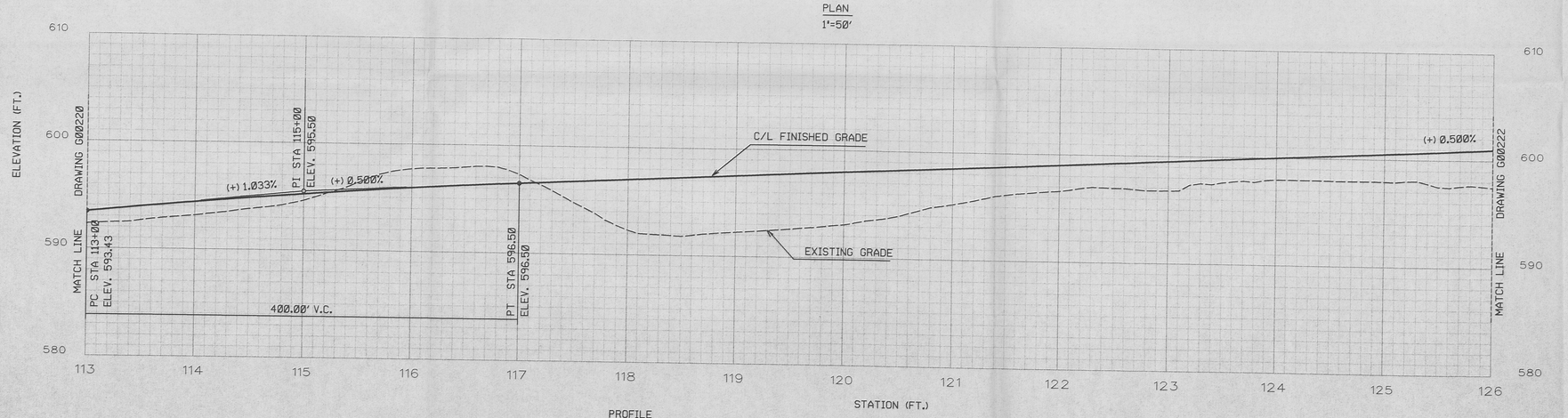
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE AS SHOWN	CLASS
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL N/A			

DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00222	G0008	C

PREPARED UNDER PARSONS PROJECT ORDER NUMBER
OU2/P0158

000150

PLAN
1"=50'



PROFILE
1" = 5'- 0" VERTICAL 1" = 50' - 0" HORIZONTAL

NOTES

E- 211

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. EXISTING SEWAGE TREATMENT PLANT FACILITIES TO BE REMOVED PRIOR TO PHASE II.
3. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
4. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
5. EXISTING MONITORING WELL SHALL BE ABANDONED BY FERMCO.
6. SEE DRAWING 92X-5900-G-00227 FOR CROSS SECTIONS.
7. STORM DRAINAGE SHOWN IS CONCEPTUAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00220	PLAN & PROFILE - SHEET 1 OF 7
92X-5900-G-00222	PLAN & PROFILE - SHEET 3 OF 7
92X-5900-G-00227	CROSS SECTIONS - SHEET 1 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN & PROFILE
SHEET 2 OF 7

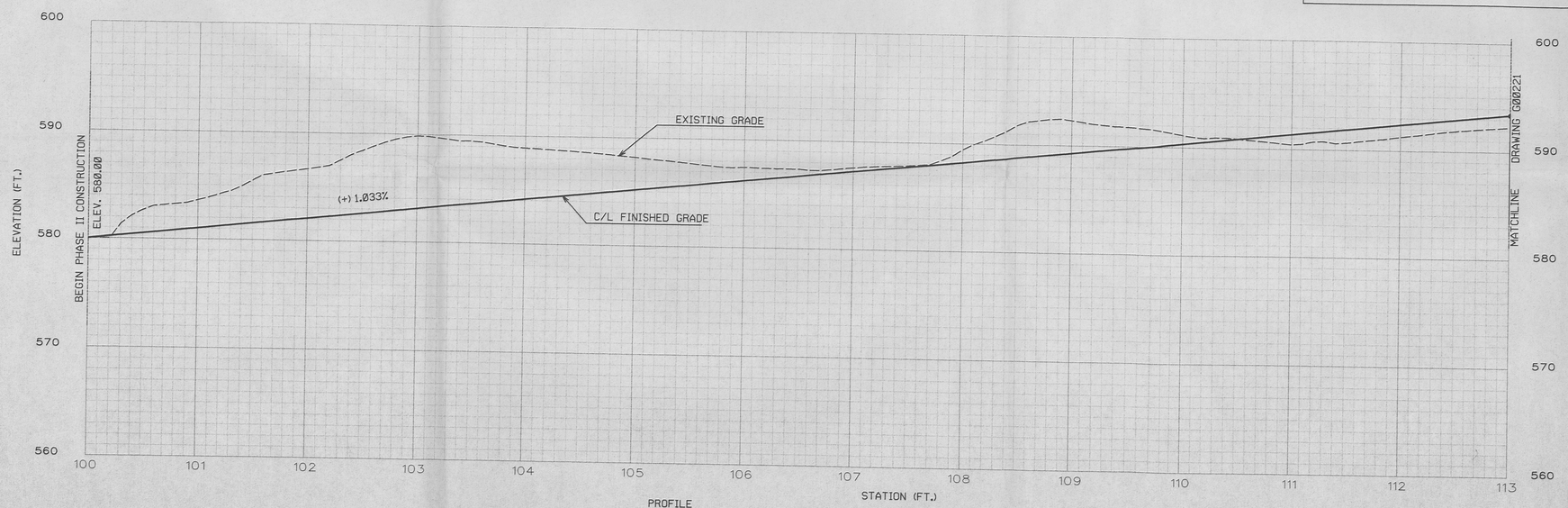
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		AS SHOWN	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	N/A DATE	000170

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-9870I	92X-5900-G-00221	G0007	C

NOTE: FINAL LOCATIONS AND ELEVATIONS OF DITCHES WILL BE COORDINATED WITH THE ON-SITE DISPOSAL FACILITY (OSDF) AND SHOWN AT 90% DESIGN.



PROFILE
1" = 5'- 0" VERTICAL 1" = 50' - 0" HORIZONTAL

NOTES

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.
2. TIE-IN TO THE ROAD WILL BE SHOWN AT THE 90% REVIEW.
3. THE EXISTING GROUND ELEVATION IN THE AREA OF THE NORTH ENTRANCE ROAD WILL BE 6 INCHES LOWER THAN SHOWN. THE TOP 6 INCHES OF CONTAMINATED SOIL WILL BE REMOVED PRIOR TO THE START OF THE ROAD CONSTRUCTION.
4. ACTUAL PROFILE, ALIGNMENT AND DRAINAGE WILL BE COORDINATED WITH THE DESIGN OF THE ON-SITE DISPOSAL FACILITY.
5. STORM DRAINAGE SHOWN IS CONCEPTUAL.
6. SEE DRAWING 92X-5900-G-00227 FOR CROSS SECTIONS.
7. THE EXISTING SEWAGE TREATMENT PLANT ROAD SHALL BE REMOVED TO THE LIMITS SHOWN. (LIMITS TO BE SHOWN AS PART OF THE 90% REVIEW).

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00221	PLAN & PROFILE - SHEET 2 OF 7
92X-5900-G-00227	CROSS SECTIONS - SHEET 1 OF 4

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

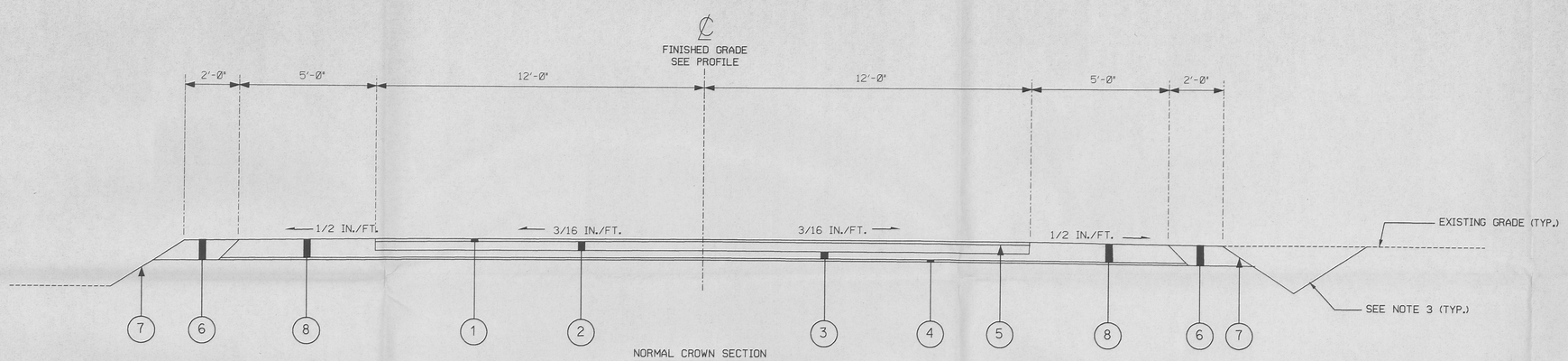
PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
PLAN & PROFILE
SHEET 1 OF 7

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE: AS SHOWN	CLASS
SUBMITTED FOR APPROVAL A-E DATE		FERMCO CRU APPROVAL N/A DATE		000178	

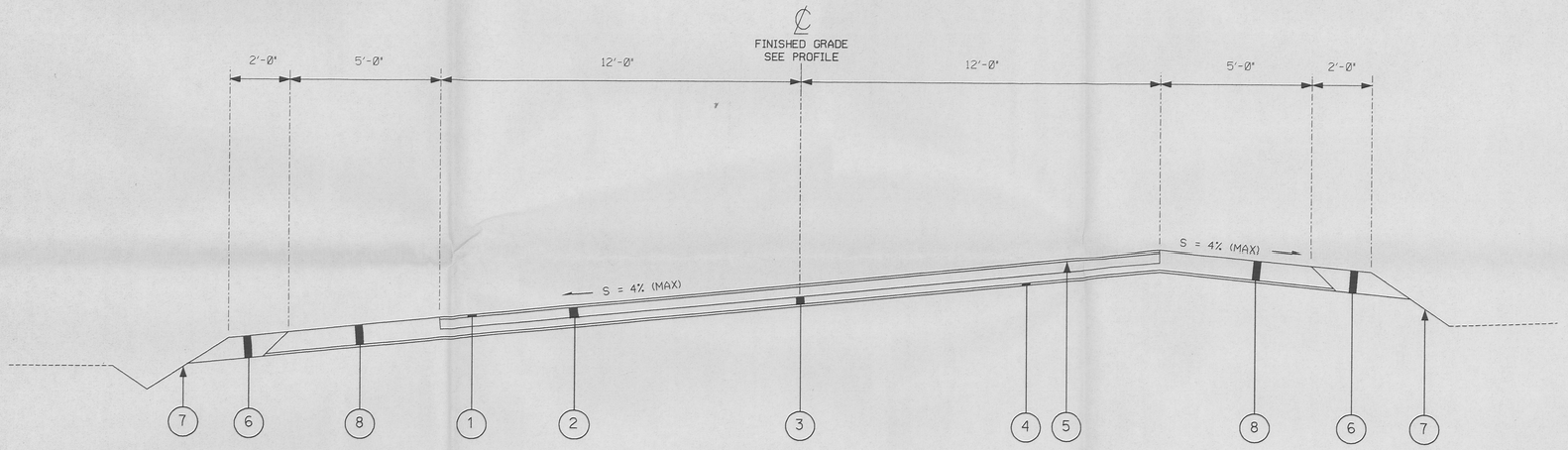
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00220	G0006	C

E- 211



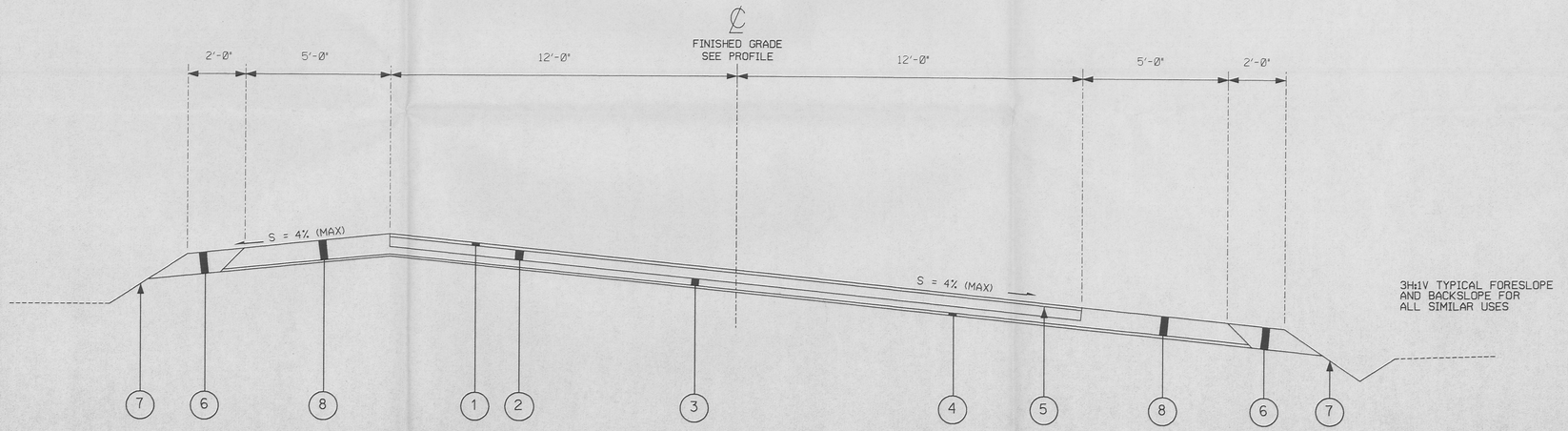
NORMAL CROWN SECTION

STA. 102+90 TO 108+70 STA. 205+50 TO 210+15
STA. 116+05 TO 153+10



SUPERELEVATED SECTION - LEFT

STA. 100+00 TO 102+90 STA. 210+15 TO 215+73.70
STA. 108+70 TO 116+05
STA. 153+10 TO 157+20



SUPERELEVATED SECTION - RIGHT

STA. 157+20 TO 162+58.18
STA. 200+00 TO 205+50

NOTES

1. TRANSITION FROM EXISTING CROSS SECTION TO STA 100+00 AS SHOWN ON DRAWING 92X-5900-G-00220.
2. SEE DRAWING 92X-5900-G-00235 FOR SUPERELEVATION TABLES. STATIONS SHOWN FOR SUPERELEVATED SECTIONS INCLUDE TRANSITIONS. THE SUPERELEVATION TRANSITION IS DEVELOPED BY ROTATING THE PAVEMENT ABOUT THE CENTERLINE.
3. SEE PLAN AND PROFILE AND CROSS SECTION SHEETS FOR DETAILS OF GRADING AND DRAINAGE.

LEGEND

1. 2" ASPHALT CONCRETE (AC-20) SURFACE COURSE (ODOT ITEM 404)
2. 8" ASPHALT CONCRETE (AC-20) BASE COURSE (ODOT ITEM 402)
3. 6" AGGREGATE BASE (ODOT ITEM 304)
4. NON WOVEN GEOTEXTILE
5. BITUMINOUS PRIME COAT
6. EMBANKMENT
7. SEEDING AND MULCHING
8. AGGREGATE SHOULDER (ODOT ITEM 304)

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00227	CROSS SECTIONS - SHEET 1 OF 4
92X-5900-G-00228	CROSS SECTIONS - SHEET 2 OF 4
92X-5900-G-00229	CROSS SECTIONS - SHEET 3 OF 4
92X-5900-G-00230	CROSS SECTIONS - SHEET 4 OF 4
92X-5900-G-00235	SUPERELEVATION TABLES

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS	FERMCO INITIALS	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
CIVIL
TYPICAL SECTION

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE 1' = 2'H 1'=4V	CLASS
SUBMITTED FOR APPROVAL A-E DATE		FERMCO CRU APPROVAL N/A DATE		009177	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00219	G0005	C

211

ITEM	ITEM EXT.	PHASE I TOTAL	PHASE II TOTAL	UNIT	DESCRIPTION
203	12000	----	----	CU YD	EXCAVATION NOT INCLUDING EMBANKMENT
203	20000	----	----	CU YD	EMBANKMENT
203	50000	----	----	CU YD	SUBGRADE COMPACTION
304	20000	3944	3689	CU YD	AGGREGATE BASE
402	20000	2394	2239	CU YD	ASPHALT CONCRETE, AC-20
404	20000	599	560	CU YD	ASPHALT CONCRETE, AC-20
408	10000	5390	5040	GALLON	BITUMINOUS PRIME COAT
659	10000	----	----	SQ YD	SEEDING AND MULCHING
		17956	16792	SQ YD	NON-WOVEN GEOTEXTILE

NOTES

E-211

REF DWG NO.	DRAWING TITLE
92X-5900-G-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS AND SYMBOLS

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERNCO	DATE
			INITIALS AND DATE	
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD
CONSTRUCTION

DRAWING TITLE
CIVIL
GENERAL SUMMARY
SHEET 1 OF 2

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	009178

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.2.3.6 00-90701	92X-5900-G-00217	G0003	C

0" 1" 2"

1. UTILITIES

THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THE PLANS ARE AS OBTAINED FROM FERMCO AS REQUIRED BY SECTION 153.64 O.R.C.

2. CONTINGENCY QUANTITIES

THE CONTRACTOR SHALL NOT ORDER MATERIALS OR PERFORM WORK FOR ITEMS DESIGNATED BY PLAN NOTE TO BE USED "AS DIRECTED BY THE FERMCO CONSTRUCTION MANAGER" UNLESS AUTHORIZED BY THE FERMCO CONSTRUCTION MANAGER. THE ACTUAL WORK LOCATIONS AND QUANTITIES USED FOR SUCH ITEMS SHALL BE INCORPORATED INTO THE FINAL CHANGE ORDER GOVERNING COMPLETION OF THIS PROJECT.

3. ELEVATION DATUM

ALL ELEVATIONS ARE BASED ON U.S.G.S. DATUM.

4. WORK LIMITS

THE WORK LIMITS SHALL BE DETERMINED BY THE FERMCO CONSTRUCTION MANAGER. THE INSTALLATION AND OPERATION OF ALL TEMPORARY TRAFFIC CONTROL AND TEMPORARY TRAFFIC CONTROL DEVICES REQUIRED BY THESE PLANS SHALL BE PROVIDED BY THE CONTRACTOR WHETHER INSIDE OR OUTSIDE THE WORK LIMITS, SUBJECT TO FERMCO CONSTRUCTION MANAGER APPROVAL.

5. MAINTENANCE OF TRAFFIC

NOTICE OF CLOSURE SIGNS, AS DETAILED IN THESE PLANS, SHALL BE ERECTED BY THE CONTRACTOR AT LEAST ONE WEEK IN ADVANCE OF THE SCHEDULED ROAD OR RAMP CLOSURE. THE SIGNS SHALL BE ERECTED ON THE RIGHT HAND SIDE OF THE ROAD/RAMP FACING TRAFFIC. THEY SHALL BE PLACED SO AS NOT TO INTERFERE WITH THE VISIBILITY OF ANY OTHER TRAFFIC CONTROL SIGNS. ON ROADWAYS, THEY SHOULD BE ERECTED AT THE POINT OF CLOSURE. THE SIGNS MAY BE ERECTED ANYWHERE ON RAMPS AS LONG AS THEY ARE VISIBLE TO THE MOTORISTS USING THE RAMP. ON ENTRANCE RAMPS, THE SIGN SHALL BE ERECTED WELL IN ADVANCE OF THE MERGE AREA TO AVOID DISTRACTING MOTORISTS.

6. DUST CONTROL

THE CONTRACTOR SHALL FURNISH AND APPLY WATER AND CALCIUM CHLORIDE FOR DUST CONTROL.

7. ITEM 659, SEEDING AND MULCHING

SEEDING AND MULCHING SHALL BE APPLIED TO ALL AREAS DISTURBED BY THE CONTRACTOR UNLESS STABILIZED OTHERWISE.

8. DESIGN SPEED

UNLESS NOTED OTHERWISE, THE DESIGN SPEED IS 40 MPH.

NOTES

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

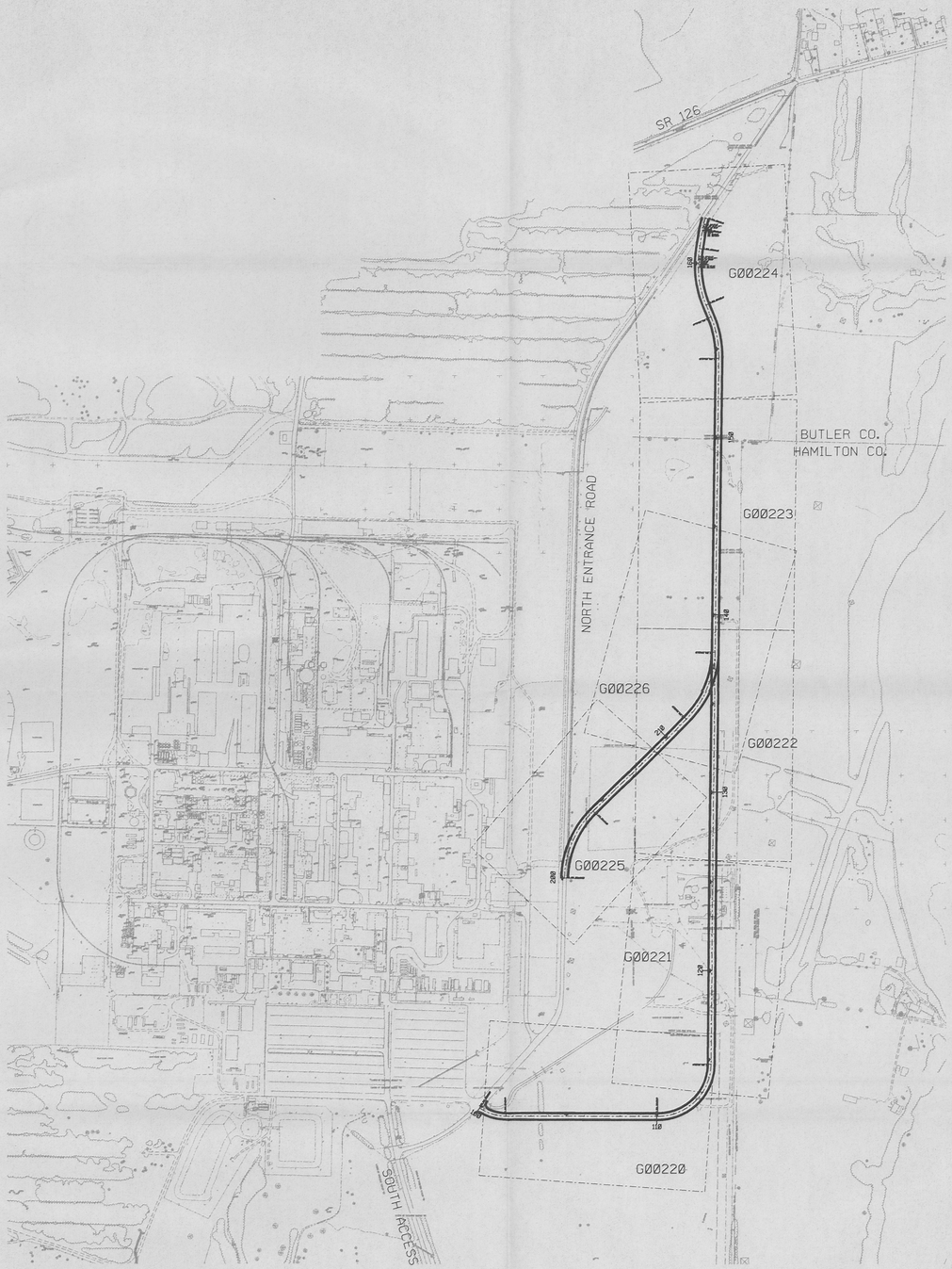
DRAWING TITLE
CIVIL
GENERAL NOTES

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE: NONE	CLASS
SUBMITTED FOR APPROVAL A-E DATE		FERMCO CRU APPROVAL N/A DATE		000175	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-G-00216	G0002	C

STATE OF
OHIO NORTH
(NAD 83)

FEMP
NORTH
∠=1.5672°



NOTES

E-211

1. EXISTING CONDITIONS SHOWN ON THE DRAWINGS WERE PREPARED USING DATA FROM THE DOCUMENTS LISTED BELOW.
   PARSONS TOPOGRAPHY 1992.
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS
   WOOLPERT FIELD SURVEY 11/95.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-X-00214	LEGENDS & SYMBOLS
92X-5900-G-00220	PLAN & PROFILE - SHEET 1 OF 7
92X-5900-G-00221	PLAN & PROFILE - SHEET 2 OF 7
92X-5900-G-00222	PLAN & PROFILE - SHEET 3 OF 7
92X-5900-G-00223	PLAN & PROFILE - SHEET 4 OF 7
92X-5900-G-00224	PLAN & PROFILE - SHEET 5 OF 7
92X-5900-G-00225	PLAN & PROFILE - SHEET 6 OF 7
92X-5900-G-00226	PLAN & PROFILE - SHEET 7 OF 7

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD
CONSTRUCTION

DRAWING TITLE
CIVIL
SITE PLAN

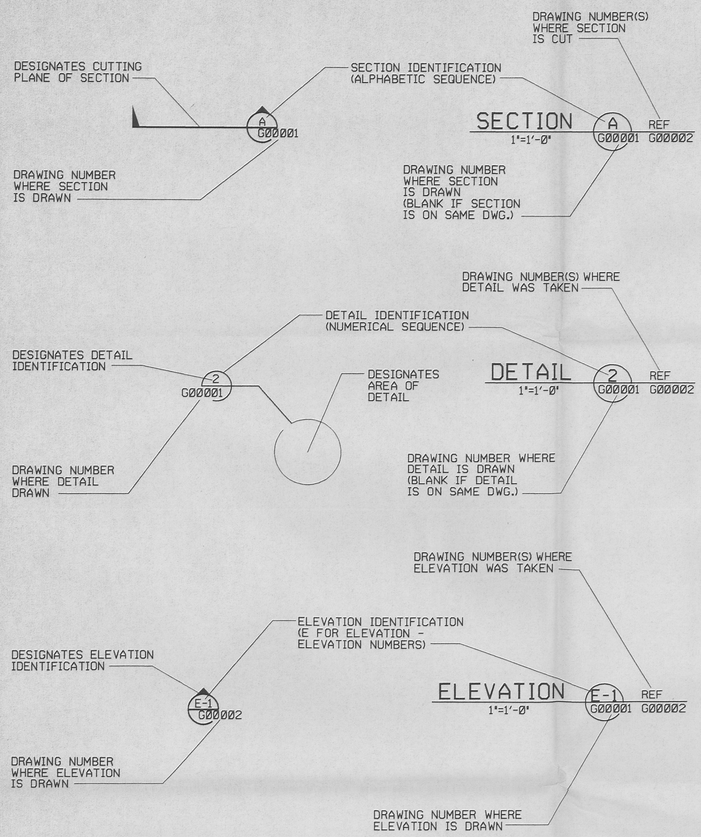
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	
A-E DATE	DATE	000174

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-9070I	92X-5900-G-00215	G0001	C

GENERAL LEGEND



2 — SECTION, DETAIL, OR ELEVATION FOUND ON SAME SHEET.

NOTE:

ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING.

FOR EXAMPLE; 95X-5900-G-00002 = DRAWING NUMBER
G00002 = ABBREVIATED DRAWING NUMBER

DIMENSIONING:

DIMENSIONS AND/OR ELEVATIONS MARKED THUS (+/-) SHALL BE VERIFIED IN THE FIELD BY CONTRACTOR.

USE DIMENSIONS AS SHOWN, DO NOT SCALE.

NTS (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

UTILITY SYMBOLS

EXISTING		PROPOSED
------ ST ------	STORM SEWER	ST
------ SN ------	SANITARY SEWER	SN
------ FG ------	FUEL GAS	FG
------ DW ------	DRINKING WATER	DW
------ FQ1 ------	FIRE PROTECTION	FQ1
------ LS ------	LIVE STEAM	LS
------ WS ------	WATER SUPPLY	WS
------ WR ------	COOLING WATER RETURN	WR
------ TW ------	PROCESS WATER	TW
------ CE ------	CONTAMINATE WATER	CE
------ FT ------	FILTRATE OR EFFLUENT	FT
------ DF ------	DEIONIZED FEED	DF
------ PW ------	DEIONIZED WATER	PW
------ BR ------	BRINE	BR
------ RW ------	RAW WATER	RW
------ A ------	ALARM	A
------ CN ------	STEAM CONDENSATE	CN
------ VE ------	VENT LINES	VE
------ SD ------	SUB-SURFACE DRAINAGE	SD
------ SL ------	SUMP LIQUOR	SL
------ E ------	ELECTRICAL	E
------ OE ------	OVERHEAD ELECTRICAL	OE
------ T ------	TELEPHONE	T
------ G ------	ELECTRIC GROUND	G
------ PA ------	PLANT AIR	PA
------ SA ------	INSTRUMENT AIR SUPPLY	SA
.....	ABANDONED	

BALLOON LEGEND

- PIV — POST INDICATOR VALVE
- SMH — SANITARY MANHOLE
- EMH — ELECTRICAL MANHOLE
- TMH — TELEPHONE MANHOLE
- CB — STORM SEWER CATCH BASIN
- HFH — HIGH PRESSURE FIRE HYDRANT
- LFH — LOW PRESSURE FIRE HYDRANT

GRADING SYMBOLS

EXISTING		PROPOSED
X 584.9	SPOT ELEVATION	X 589.4
------ 584 -------	CONTOUR - MINOR	584
------ 585 -------	CONTOUR - MAJOR	585
(TOE)	SLOPE INDICATOR	(TOE)

ARCHITECTURAL LEGEND

EXISTING		PROPOSED
	DOOR NUMBER	103
	ROOM NUMBER	101

SYMBOLS LEGEND

EXISTING		PROPOSED
	POST INDICATOR VALVE (PIV)	
	FIRE HYDRANT (FH)	
	MANHOLE (MH)	S OR D
	CATCH BASIN (CB)	D
	LIGHT POLE	
	PIPE SUPPORT	
	ELECTRICAL MANHOLE	E
	TELEPHONE MANHOLE	T
	STREET WASHERS	
	VALVE BOX	
1313	MONITORING WELL	
	SURFACE DRAINAGE FLOW	
	POWER POLE	
	GRAVEL ROADWAY/DRIVEWAY	
	ASPHALT ROADWAY/DRIVEWAY	
	CONCRETE PAD/ ROADWAY/DRIVEWAY	
	BUILDING/TRAILER	
	RAILROAD TRACK	
	OU BOUNDARY	
	FENCE	
	TREE LINE	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	CENTERLINE DRAINAGE DITCH	
	RIVER/CREEK	
	TO BE REMOVED	
	SILT FENCE	
	ELECTRICAL TRANSFORMER	T
	TRANSMISSION TOWER	
	HEADWALL	OR
BM	BENCH MARK	
xx xx	CONSTRUCTION/WIND BARRIER FENCE	xx xx
	SIGN	
	BOLLARD/GUARD POST	
PB	ELECTRICAL PULL BOX	
	SURVEY CONTROL POINT	
	ROAD CENTERLINE OR BASELINE	
	BEND	OR
	TEE	
	THRUST BLOCK	
	REDUCER	
W OR U	UNKNOWN	
	STRAW BALE SILT BARRIER	
	FENCE GATE	
	CULVERT	

NOTES

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REF DWG NO.	DRAWING TITLE
92X-5900-X-00213	DRAWING INDEX
92X-5900-G-00215	SITE PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERMCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE
LEGENDS AND SYMBOLS

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95
PLANT/BLDG. NO.		FLOOR		SCALE	CLASS
				NONE	
SUBMITTED FOR APPROVAL A-E DATE		FERMCO CRU APPROVAL N/A DATE		000173	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-9070I	92X-5900-X-00214	X0003	C

INDEX OF DRAWINGS

INDEX CODE NO.	DRAWING NO.	SHEET NO.	REVISION NO.	DRAWING TITLE	REMARKS
	92X-5900-X-00212	X0001	C	PROJECT TITLE SHEET	
	92X-5900-X-00213	X0002	C	DRAWING INDEX	
	92X-5900-X-00214	X0003	C	LEGENDS & SYMBOLS	
	92X-5900-G-00215	G0001	C	CIVIL - SITE PLAN	
	92X-5900-G-00216	G0002	C	CIVIL - GENERAL NOTES	
	92X-5900-G-00217	G0003	C	CIVIL - GENERAL SUMMARY - SHEET 1 OF 2	
	92X-5900-G-00218	G0004		CIVIL - GENERAL SUMMARY - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00219	G0005	C	CIVIL - TYPICAL SECTIONS	
	92X-5900-G-00220	G0006	C	CIVIL - PLAN & PROFILE - SHEET 1 OF 7	
	92X-5900-G-00221	G0007	C	CIVIL - PLAN & PROFILE - SHEET 2 OF 7	
	92X-5900-G-00222	G0008	C	CIVIL - PLAN & PROFILE - SHEET 3 OF 7	
	92X-5900-G-00223	G0009	C	CIVIL - PLAN & PROFILE - SHEET 4 OF 7	
	92X-5900-G-00224	G0010	C	CIVIL - PLAN & PROFILE - SHEET 5 OF 7	
	92X-5900-G-00225	G0011	C	CIVIL - PLAN & PROFILE - SHEET 6 OF 7	
	92X-5900-G-00226	G0012	C	CIVIL - PLAN & PROFILE - SHEET 7 OF 7	
	92X-5900-G-00227	G0013	C	CIVIL - CROSS SECTION - SHEET 1 OF 4	
	92X-5900-G-00228	G0014	C	CIVIL - CROSS SECTION - SHEET 2 OF 4	
	92X-5900-G-00229	G0015	C	CIVIL - CROSS SECTION - SHEET 3 OF 4	
	92X-5900-G-00230	G0016	B	CIVIL - CROSS SECTION - SHEET 4 OF 4	
	92X-5900-G-00231	G0017		CIVIL - INTERSECTION DETAILS - SHEET 1 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00232	G0018		CIVIL - INTERSECTION DETAILS - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00233	G0019		CIVIL - GRADING & SEDIMENT CONTROL - SHEET 1 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00234	G0020		CIVIL - GRADING & SEDIMENT CONTROL - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00235	G0021		CIVIL - SUPERELEVATION TABLES	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00236	G0022		CIVIL - MAINTENANCE OF TRAFFIC - SHEET 1 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00237	G0023		CIVIL - MAINTENANCE OF TRAFFIC - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00238	G0024		CIVIL - SIGNING & PAVEMENT MARKING - SHEET 1 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00239	G0025		CIVIL - SIGNING & PAVEMENT MARKING - SHEET 2 OF 2	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00240	G0026		CIVIL - GENERAL DETAILS - SHEET 1 OF 3	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00241	G0027		CIVIL - GENERAL DETAILS - SHEET 2 OF 3	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-G-00242	G0028		CIVIL - GENERAL DETAILS - SHEET 3 OF 3	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-E-00243	E0001		ELECTRICAL - SITE PLAN - NORTH ENTRANCE ROAD	TO BE INCLUDED AT 90% SUBMITTAL
	92X-5900-E-00244	E0002		ELECTRICAL - INSTALLATION DETAILS - TELEPHONE/FIBER OPTIC CABLES	TO BE INCLUDED AT 90% SUBMITTAL

NOTES

B-211

1. THERE ARE REFERENCES TO DRAWING NUMBERS IN THIS PLAN SET WHICH ARE NOT IN THIS PLAN SET SUBMISSION BUT SHALL BE INCLUDED IN THE 90% SUBMITTAL.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00214	LEGENDS AND SYMBOLS

PRELIMINARY

NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A
A	ISSUED FOR 30% DESIGN REVIEW		N/A

UNITED STATES DEPARTMENT OF ENERGY

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY

PARSONS

THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.

CINCINNATI, OHIO

PROJECT NAME

REROUTED NORTH ENTRANCE ROAD CONSTRUCTION

DRAWING TITLE

DRAWING INDEX

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

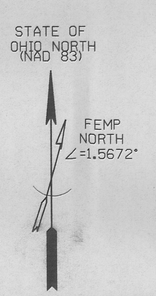
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

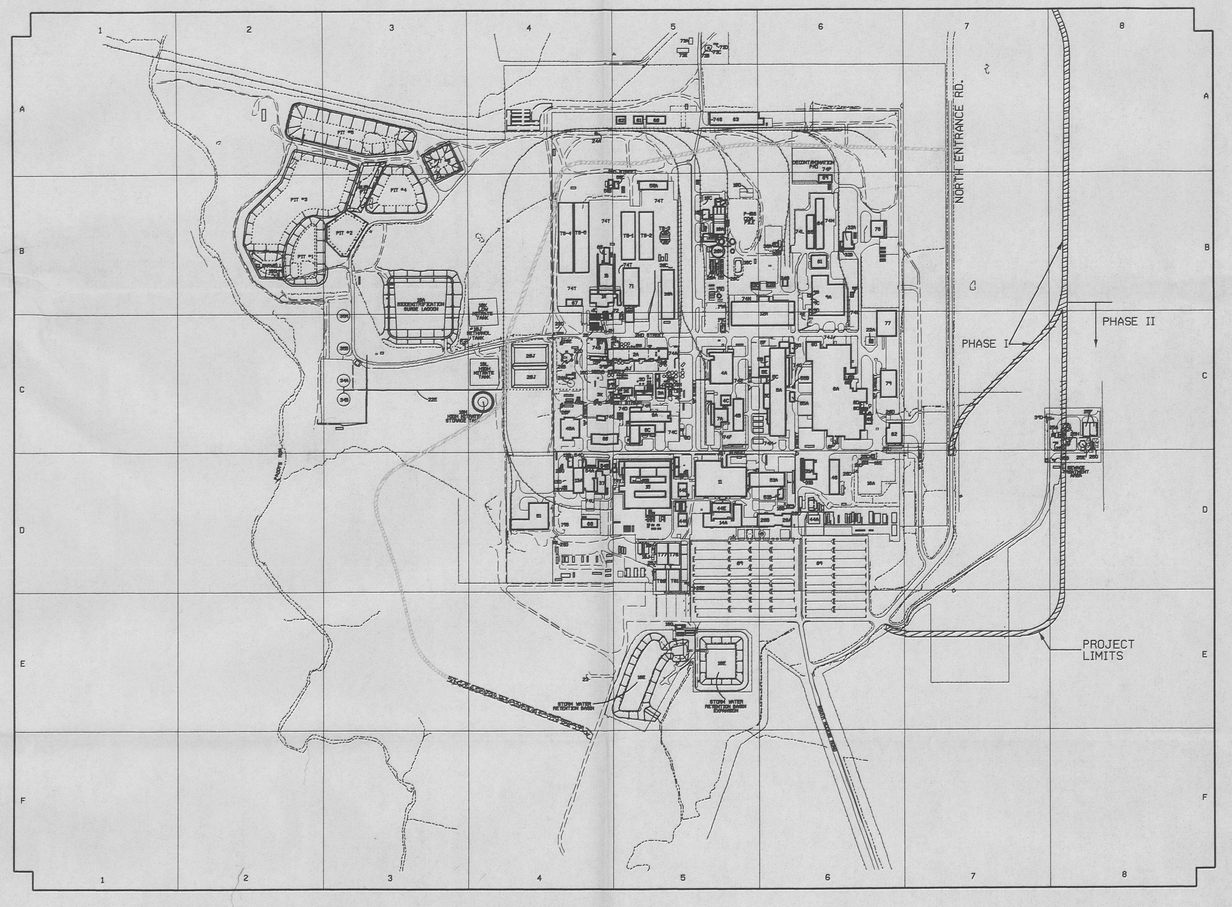
SUBMITTED FOR APPROVAL A-E DATE	FERNCO CRU APPROVAL DATE	
	N/A	008172

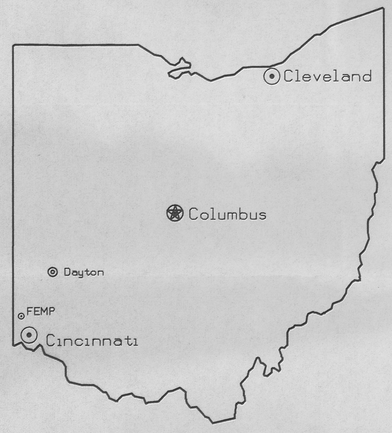
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
0U2/P0158		WBS 1.1.1.1.2.3.6 00-90701	92X-5900-X-00213	X0002	C

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

REROUTED NORTH ENTRANCE ROAD
CONSTRUCTION
OPERABLE UNIT 2 - PROJECT ORDER 158







PARSONS

The Ralph M. Parsons Company * Parsons Main, Inc. * Engineering-Science, Inc.

ARCHITECTS - ENGINEERS
CINCINNATI, OHIO

NOTES

E-211

REF DWG NO.	DRAWING TITLE
92X-5900-G-00213	DRAWING INDEX

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E INITIALS AND DATE	FERNCO INITIALS AND DATE	DATE
C	ISSUED FOR US EPA 30% DESIGN REVIEW		N/A	
B	ISSUED FOR DOE 30% DESIGN REVIEW		N/A	
A	ISSUED FOR 30% DESIGN REVIEW		N/A	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

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CINCINNATI, OHIO

PROJECT NAME
REROUTED NORTH ENTRANCE ROAD
CONSTRUCTION

DRAWING TITLE
PROJECT TITLE SHEET

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
M. BESS	12/18/95			A. CHRISTO	12/18/95

PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
		NONE	

SUBMITTED FOR APPROVAL A-E DATE	FERMCO CRU APPROVAL DATE	000171
	N/A	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
OU2/PO158		WBS 1.1.1.1.2.3.6 00-9070I	92X-5900-X-00212	X0001	C