

Chapter Six DESIGN RECOMMENDATIONS REPORT

6-1.0 GENERAL

The Design Recommendations Report is a summary of the project geotechnical and pavement survey information, as well as the information used to develop the project design. It includes all of the design and construction recommendations developed for the project, including any alternatives. A Design Recommendations Report will be prepared for each project by the District Soils and/or Materials Engineer and submitted to the District Engineer and Office of Materials Research & Engineering for review and comment. The review by the Office of Materials Research & Engineering will be in accordance with the recommendations of the Soils Letter Resolution Relationship Task Force Report as implemented by Technical Memorandum 91-43-ME-20. This Memorandum can be found in Appendix C.

Foundation surveys, analysis and recommendations required for proposed bridges, culverts, buildings, retaining structures, embankment fills, swamp crossings, etc. will be prepared by the Foundations Unit (Office of Materials Research & Engineering) and submitted to the requesting Division/District Engineer for incorporation into the project design.

6-2.0 GUIDELINES

An outline of a Design Recommendations Report is included on the following pages. This outline is intended to provide a checklist for the District Soils Engineer to prepare the Design Recommendations Report. It includes recommended major headings (underlined), as well as recommended subtopics for each major heading.

The objective of preparing a Design Recommendations Report is to summarize *all* of the pertinent information that is used in the development of a design, so the outline covers many topics that may not need to be addressed on each and every individual project. In providing this outline, it is hoped to develop a degree of uniformity in the presentation of the Design Recommendations Reports, while retaining enough latitude in the contents to reflect the individuality of each reporting individual and each project.

6-3.0 REPORT OUTLINE

Following is the recommended outline for the Design Recommendations Report.

STATE OF MINNESOTA

DEPARTMENT: _____

Office Memorandum

DATE: _____

TO: _____
District Engineer

FROM: _____
Materials/Soils Engineer

PHONE: _____

SUBJECT: Design Recommendation Letter

S.P. _____ (T.H. _____)

F.A.I. _____ (if applicable)

Geographical limits/location (termini)

Station limits (major equations only)

Length of project, in miles

Type of construction project, e.g., overlay, resurface, reconstruction, etc.

PROGRAMMED LETTING DATE

DESIGNER

I. GENERAL PROJECT INFORMATION**A. Project Scope**

Proposed Construction, Reconstruction, Resurfacing and Rehabilitation

1. Project Termini
 - Termini (or limits) of various construction operations (milling, resurfacing, etc.)
2. Proposed Alignment Changes
3. Proposed Geometric Design Features (No. of lanes, widths, turn lanes, bypass lanes)
4. Proposed Structures (bridges, culverts, etc.)
 - a. Type
 - b. Number
 - c. Locations
 - d. Describe proposed rehabilitation
Remove & reconstruct, widening, realigning, etc.
5. Proposed Interchanges - Type and Location
6. Describe Proposed Work

B. Project Background Information

Existing/Inplace Facility

- a. Geometric Features (no. of lanes, widths, mainline and shoulders)
- b. Existing Pavement Structure (Bituminous, Concrete, Base)
 - (1) Bituminous Pavement
 - (a) Thickness and types of various courses
(including thicknesses of aggregate bases)
 - (b) Pavement width (mainline)
 - (2) Concrete Pavement
 - (a) Thickness (concrete and bases)
 - (b) Width (mainline)
 - (c) Reinforced (JRCP), Non-reinforced (JPCP), Continuous Reinforced (CRCP)
 - (d) Joint spacing
 - (e) Dowelled/non-dowelled
 - (f) Joint seal material
 - (3) Shoulder
Material/Width/Thickness
 - (4) Subsurface Drainage
 - (5) Construction History
(Include dates, and refer to Typical Sections)
- c. Past Traffic (ESALs)
- d. Previous Reports and Correspondence, by date
2. Site Topography
 - a. Type and Amount of Relief
 - b. Land use
 - c. Water Courses, Ponding Areas and Wetland Locations (Natural and man-made)

C. Geologic Information/Survey

1. Surface Geology and Features of Interest
 - a. Pleistocene (Glacial) Soil Features
 - (1) Glacial landforms/terrain
 - (2) General soil types
 - (3) Extent/Uniformity

- b. Holocene (recent) Soil Features
 - (1) Recent landforms/terrain
 - (2) General soil types
 - (3) Extent/Uniformity
- c. Bedrock Features
 - (1) Rock type/formation
 - (2) Extent/outcrops
 - (3) Weathering/Condition
- 2. General Subsurface Soil/Rock Conditions (Depth to Rock, refusals other than bedrock - boulders, etc.)
- 3. Data Presentation
 - a. Drilling Field Logs/Observations
 - b. Plot Soil and Bedrock Profile, Topsoil Horizons and Water Levels (with descriptive adjectives)
 - c. Ground Water Data
 - (1) Levels (including piezometers) and wet ditches
 - (2) Springs
 - (3) Nearby wells
 - d. Field and Laboratory Test Data
 - (1) Gradations
 - (2) Proctor's
 - (3) Maximum densities
 - (4) Optimum moistures
 - (5) Atterberg Limits
 - (6) Textural Classifications
 - (7) Percent Passing No. 200 Sieve
 - (8) R-Values
 - (9) etc.
 - e. Interpretation and Analysis of Data
 - (1) Design R-value
 - (2) Modulus
 - (3) Undesirable soils
 - (4) High water table
 - (5) Rock cuts
 - (6) Etc.
- D. Pavement Field and Laboratory Data
 - 1. Deflection Measurements (FWD)
 - 2. Test Data Results (from cores, test pits, soil borings, etc.)
 - a. Core Thickness/Density/Air Void, etc.
 - b. Extraction Test Results
 - c. Gradations
 - d. Etc.
- E. Project Evaluation (Rehabilitation, etc.)
 - 1. Pavement Management Data
 - Pavement Historical Condition (PQI, PSR, SR)
 - 2. Identify Pavement Distresses
 - 3. Deflection Measurement Analysis/Structural Capacity Analysis
 - 4. Surface and Subsurface Drainage Analysis
 - 5. Laboratory Test Data Analysis
 - 6. Identify Factors Causing Distresses
 - 7. Identify Feasible Alternatives that will:
 - a. Address causes of deterioration
 - b. Be effective in repairing existing distress(es).
 - c. Prevent the premature reoccurrence of the distress(es).

- F. Project Analysis
 - 1. Perform Necessary Engineering and Economic Analysis.
 - 2. Select Best Rehabilitation Alternatives.
 - 3. Provide Necessary Recommendations Under II. Design Recommendations.

- G. Traffic Data Collection and Analysis
(Present and 20-year design lane ADT and ESALs)

- H. Turf Establishment Soils
 - 1. Inplace Topsoil Type (Textural Classification)
 - 2. Inplace Topsoil Depth/Extent

II. DESIGN RECOMMENDATIONS**A. Removal, Salvage and Disposition**

1. Existing Structures - Culvert, Etc.
2. Pavements (Bituminous and Concrete)
3. Aggregate Base
4. Topsoil

B. Foundation Surveys, Analysis and Recommendations

1. Recommendations
 - a. Bridge Design & Construction
 - b. Embankment Design and Construction
 - c. Etc.

C. Excavation and Embankment Construction

1. Grading Soil Evaluation
 - a. Define Suitable/Unsuitable Grading Materials
 - b. Define Top of Grading Grade
 - c. Borrow
 - d. Shrinkage Factors (soil and rock)
2. Subgrade Corrections/Compaction Subcuts
 - a. Subcuts, (length, depth, tapers, drainage, backfill material, typical section)
 - (a) Mainline
 - (b) Widened section
 - (c) Turn and bypass lanes
 - b. Special Treatments
 - (1) Rock Excavation (backslopes, tapers, depth, etc)
 - (a) Blasting, ripping
 - (b) Special uses (riprap on aggregate, etc.)
 - (c) Vibration impacts on wells, structures, people
 - (2) Swamp Treatments
 - (a) Excavation (depth and width)
 - (b) Environmental (disposal, haul, backfill, borrow, etc)
 - (c) Floated embankment (Geosynthetics)
 - (d) Embankment widening
 - (3) Frost heaves
 - (4) Drainage/dewatering (Temporary or permanent)
 - (a) Surface
 - (b) Subsurface
3. Embankment and Backfill Material Placement
 - (a) Transitions
 - (b) Slope Preparation - Embankment Widening
 - (c) Backfill Materials (granular, selected grading, etc.)
 - (d) Geotextiles
 - (e) Compaction Requirements
 - (f) Control Rate/Surcharge
 - (g) Test Rolling
4. Culvert Treatments

D. Pavement Structure

1. New Construction/Reconstruction
 - a. Pavement Design - Mainline
 - (1) Bituminous Surfacing Designs (full depth and aggregate base)
 - (a) Aggregate base/permeable base types and thicknesses
 - (b) Bituminous layers (courses, thickness and mix types)
 - (c) Drainage (edge drains)
 - (d) Saw and seal
 - (e) etc.
 - (2) Concrete Surfacing Design
 - (a) Base/sub-base/permeable base types and thicknesses
 - (b) Pavement thickness
 - (c) Pavement type (JPCP, JRCP)
 - (d) Joint design
 - i) Transverse joint spacing, dowel size and joint type
 - ii) Longitudinal joint type (tied or untied)
 - iii) Joint sizes and sealant material
 - (e) Drainage (edge drains)
 - b. Shoulder/Turnlane/Bypass Lane Design
(As above for mainline pavement, but using appropriate traffic numbers.)
 - c. Ramps, Loops, Climbing Lane, etc.
(As above for mainline pavement, but using appropriate traffic numbers.)
2. Rehabilitation
 - a. Bituminous and Bituminous over Concrete Pavements
 - (1) Pre-overlay repairs (crackfilling, patching, milling, etc.)
 - (2) Overlay types (functional or structural)
 - (3) Milling
 - (a) Depth
 - (b) Width
 - (4) Overlay
 - (a) Courses and mixture types
 - (b) Thicknesses
 - (5) Drainage (Edge drains)
 - (6) Saw and Seal
 - (7) Etc.
 - b. Concrete
 - (1) Repair type (A, B, & C)
 - (2) Drainage (Edge drains)
 - c. Concrete Overlays
 - (1) Unbonded Overlays
 - (a) Pre-overlay repairs
 - (b) Stress relief layer (thickness & material type)
 - (c) Thickness, joints, etc. refer to new construction
 - (d) Drainage (edge drains, interceptor drains, permeable stress relief layer)
 - (2) Bonded Overlays
 - (3) Concrete over existing bituminous pavement (white topping)
 - d. Widening
 - (1) Courses and thicknesses (permeable base)
 - (2) Mixture types
 - (3) Drainage (edge drains)
 - e. Shoulder thickness Design (base and surfacing)

3. Miscellaneous Bituminous Items
 - a. Mix Design Requirements
 - b. Quality Control Requirements (i.e. 2340 QM and 2331 - for non-QM)
 - c. Density Control
(Based on QC choices)
 - d. Tack coat uses and application rates
 - e. Pre-overlay repairs
 - (1) Patching requirements
 - (2) Patching mixture (type, placement and compaction requirements, etc.)
 4. Aggregate Base Compaction Requirements
- E. Erosion Control and Turf Establishment
1. Topsoil
 2. Lime
 3. Fertilizer
 4. Mulch
 5. Seed Mixtures
- F. Aggregate and Borrow Sources
1. Possible Sources of Aggregate
 - a. Source number
 - b. Legal descriptions
 - c. Owner's name
 - d. Material available (class, use)
 - e. Lease expiration date
 2. Granular and Common Borrow Sources
 - a. Non-exclusive lease designation
 - b. Cost of borrow per cu. yd (1 yd.³ or lump sum)
 - c. Legal Description
 - d. Duration of lease
 - e. Disposition of topsoil and final shaping of pit
- G. Miscellaneous

We concur with the foregoing recommendations, except as noted by insert on the attached sheet.

	DATE	INSERT
Pavement Design Engineer		
*Bituminous Engineer		
*Concrete Engineer		
*Aggregate Engineer		
*Agricultural Engineer		
*Foundations Engineer		
*Geologist		

* NOTE: District Soils/Materials should be included only when relevant to the recommendations contained in the body of the report.)

- cc: Pavement Engineer/Geotechnical Engineer
- Pavement Design Engineer
- Bituminous Engineer
- Concrete Engineer
- Special Provisions Engineer
- Estimating Engineer
- Preliminary Design Engineer
- Central Office Pit Lease Specialist
- District Personnel

Plus other appropriate individuals as determined in the District and/or by the Pavement Design Engineer. If it is necessary to send a copy to a Consultant, another Agency, or a non-Mn/DOT individual, provide a complete address or include other instructions.