Western Dakota Energy Association Roundtable

Road Design Basics

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Local Roads

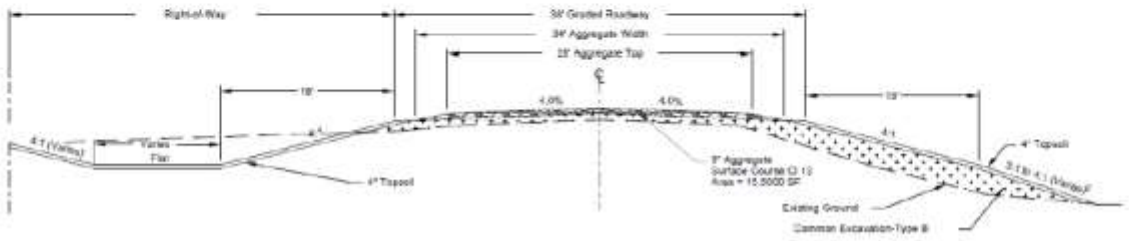
- Section Line Road
- Elevated Section Line Road
- Gravel Township Road
- Gravel County Road
- Paved County Road

Design Standards

Design Standards on County Major Collectors and Local Roads for New or Reconstruction of Existing Infrastructure

	County Major Collectors (CMC) "On-System"	Local Roads (County) "Off-System"	Local Roads (Township) "Off-System"	Local Roads (Other) "Off-System"
Bridge Width (Clear Roadway) – Min is 28 ft	36 ft	36 ft	28 ft	28 ft
Storm Design Frequency (Bridges)*	25 – 100 year	25 – 100 year	15 – 100 year	15 – 100 year
Design Loading (Bridges) – Min is HL-93	HL-93 or US Air Force Minimum Requirements for Transportation Erector Routes			
Culvert Design Frequency*	25 year	25 year	10 year	10 year
Graded Roadbed Width (sub-grade) – Paved surface	38 ft.	38 ft.	30 ft.	30 ft.
- Minimum travel way width (both lanes + shoulders)**	28 ft.	28 ft.	24 ft.	24 ft.
- Minimum pavement section (base and HBP) **	12 " and 4"	8 " and 4"	6" and 3.5 "	6" and 3.5 "
Graded Roadbed Width (sub-grade) – Gravel surface	34 ft.	34 ft.	30 ft.	30 ft.
- Minimum travel way width (both lanes + shoulders)	28 ft.	28 ft.	24 ft.	24 ft.
- Minimum gravel thickness ***	6"	6"	6"	6"
Design Speed	55 – 65 mph	35 – 55 mph	25 – 55 mph	25 – 55 mph
Right of Way Width	150 ft. total	66 – 150 ft. total	66 – 80 ft. total	66 – 80 ft. total
Inslope Ratio	4:1 Minimum	4:1 Minimum	4:1 Minimum	4:1 Minimum
Separation (Road top to Ditch Bottom)**	4.5 ft. Minimum	4.5 ft. Minimum	2.0 - 4.5 ft.	2.0 - 4.5 ft.

***Bridges** - For all County Roads, the minimum design frequency is 25-years and 15 years for all local and township roads. For all County Major Collector Routes both the 50 and 100 year design frequency should be evaluated to in order to avoid overtopping of the roadway. Design frequency of 100 years must be considered when possibility of impacting cities and residents.
***Culverts** – The same design frequencies are required for culverts as they are for bridges; except for township roads, the design frequency is 10-years. These requirements are required according to North Dakota Century Code. Minimum culvert diameter under centerline of county roads is 24" and minimum under approaches and township roads is 18" unless special conditions exist.
** **Pavement and Base thicknesses** are based on AASHTO pavement design guidelines and will vary depending upon ADT & ADTT. CSB shall be a minimum of 12" plus 4" of aggregate base.
** **Roadway widths** are based on ADT & ADTT. Higher traffic roadways may require 12 ft. driving lanes, 6 ft. shoulders, and possible center and right turn lanes. Minimum is 12 ft. driving lanes and 2 ft shoulders for new construction.
*** **Gravel Roadbeds** – gravel shall be laid, water and compacted in accordance with Section 302 of the NDDOT Standard Specification
**** **Separation** – Separations should be 4.5 from ditch bottom to edge of roadway and edge of road should be a minimum of 2.5 ft. above existing terrain were possible.



My Road Needs Fixing

We will send a blade out.

Maybe we should reconstruct

The bridge also needs fixing

Road Design

- Goals and Objectives
- Gather Data
- Project Development
- Preliminary Engineering (Design)

Goal and Objectives

- What Goals do you want to meet with the proposed road improvement project:
- 8 ton - 105,500 road design
- No spring load restrictions
- Wider shoulders, turn lanes, clear zone and inslopes
- Improved stopping sight and passing distances
- Improved drainage and drainage structures
- Reduced impact to traffic

Gather Data

- Public Input
- Harvest data from old plans and ROW documents
- Collect survey data: Topo, Culvert Data, Section Corners, Utilities
- Culvert and Bridge Data
- Geotechnical Data
- Environmental
- Imagery or LiDAR

Section Corners

Geotechnical

Falling Weight Deflectometer

Soil Borings

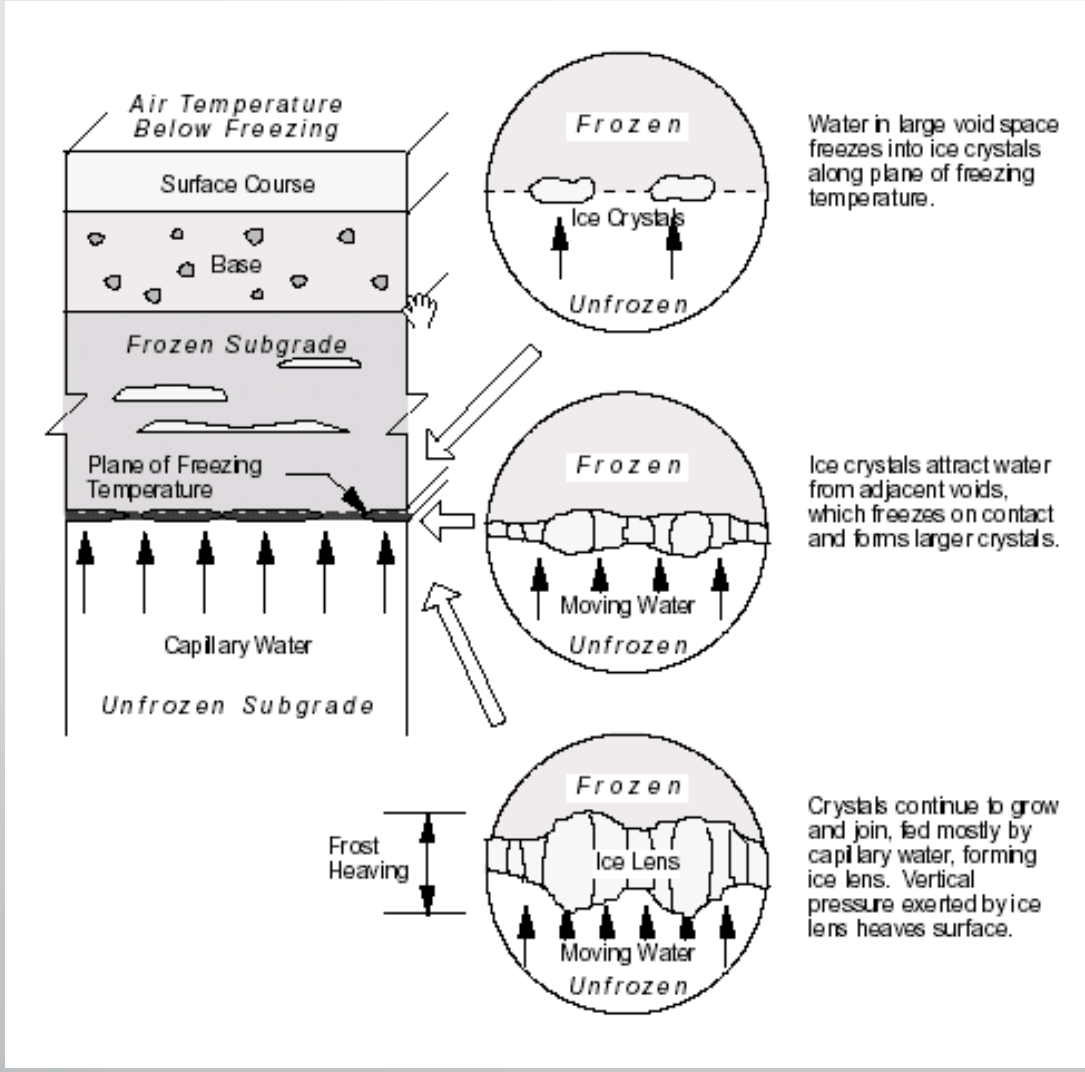
Geotechnical

Roadway coring and collecting samples

Dynamic Cone Penetrometer

Subgrade Soil Types

Frost Cycle Impact on Subgrades



Frost Cycle Impact on Subgrades

Project Development

- Roadway Surface Gravel vs Hard Surfaced
  - Gravel Cross Slope 4%
  - HBP and Concrete 2.1%
- Roadway Core: Surface, Base, and Subgrade
  - Design Life = 20 Years?
  - Vehicle Type and ADT = ESAL
  - Existing Roadway: Subgrade Soils, Base, and Surface
  - How to achieve the desired Structural Strength

Improving Structural Strength

- Improving Subgrade Strength
  - Sub cut poor material and replace
  - Reduce excess moisture from subgrade
  - Stabilize 12-16 inches of Subgrade
  - Increase aggregate base thickness
  - Add Geotextiles to separate or to add strength
  - Stronger or Thicker Surface Materials.
    - Gravel - Thicker Sections, Binder, Additives
    - HBP – Flexible, Reduce Rutting, Reduce Cracking
    - Concrete – Strong, Minimum Rutting

Project Development

- Speed Limit
- Drainage
  - Culvert Type: CMP, RCP, Poly
  - Culvert Capacity: ND Stream Crossing Standards (10-year township and 25-year CMC) prevent overtopping on 50 or 100
  - Bridge and Box culvert Width
- Access Points and Approach width and radius
  - Access Point Spacing
  - Width and Radius of approach
  - Approach Inslopes – CMC Roads (8:1 within the clear zone)

Project Development

- Traffic Control
  - Signing: Size, Retroreflectivity, post material, anchors
  - Rumble Stripes and Strips
  - Striping: 4-inch, 6-inch, water based, epoxy
- Maintenance
  - Fog Seal after paving
  - Chip Seal / Seal Coat to protect from oxidation

County Road 8

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Preliminary Engineering (Design)