The information contained in Chapter One: Roadway Design Standards, dated May 2022, has been updated to reflect the January 2023 Errata. The errata addresses errors, changes in procedure, changes in NDOT department titles, changes in other Roadway Design Manual chapters and other reference material citations occurring since the latest publication of this chapter.

Chapter One presents guidance for the design of New, Reconstructed and 3R projects: additional design guidance for 3R projects is provided in Chapter Seventeen.

Chapter One
Roadway Design Standards

1. STATUTORY AUTHORITY

1.A Federal Authority

1.A.1 Projects on the National Highway System

Section 109(c) of Title 23, United States Code (U.S.C.) (https://www.gpo.gov/fdsys/pkg/USCODE-2011-title23/html/USCODE-2011-title23-chap1-sec109.htm) provides that design and construction standards for new construction and reconstruction on the National Highway System (NHS) and for resurfacing, restoring, and rehabilitating multi-lane limited access highways on the National Highway System shall be those approved by the United States Secretary of Transportation in cooperation with the State highway departments. In a similar manner, 23 U.S.C. 109(b) provides standards for the Interstate system.

1.A.2 Projects not on the National Highway System

Title 23 of the Code of Federal Regulations (23 CFR), Section 625.3(a)(2) (https://www.gpo.gov/fdsys/pkg/CFR-2011-title23-vol1/pdf/CFR-2011-title23-vol1-sec625-3.pdf) states that "Federal-aid projects not on the NHS are to be designed, constructed, operated, and maintained in accordance with State laws, regulations, directives, safety standards, design standards, and construction standards."

1.A.1 3R Freeway Projects on the National Highway System

January 3, 2022 amendments to 23 CFR 625 include the following summary:
(Fed-Register-2021-28236.pdf (localassistanceblog.com)

"FHWA amends its regulations governing design standards and standard specifications applicable to new construction, reconstruction, resurfacing (except for maintenance resurfacing), restoration, and rehabilitation projects on the National Highway System (NHS). In issuing this final rule, FHWA will allow State departments of transportation (State DOT) to adopt procedures or design criteria, as approved by FHWA, that enable the State to undertake resurfacing, restoration, and rehabilitation (RRR) projects on freeways, including Interstate highways, without utilizing design exceptions as long as the RRR procedures or criteria are met. In addition, FHWA incorporates by reference the latest versions of design standards and standard specifications previously adopted and incorporated by reference and removes from its regulations the corresponding outdated or superseded versions of these standards and specifications."

1.B State Authority – Board of Public Roads Classifications and Standards

1.B.1 Minimum Design Standards

The Nebraska Revised Statutes have authorized the **Board of Public Roads Classifications and Standards** to develop minimum standards of design, construction, and maintenance for each functional classification set forth in Sections 39-2103 and 39-2104 (http://uniweb.legislature.ne.gov/laws/browse-chapters.php?chapter=39). The **Nebraska Department of Transportation** (**NDOT**) is required to abide by these standards. If it is not practicable to meet the minimum design standards, a relaxation of the Nebraska Minimum Design Standards must be requested (See Section 10 of this chapter).

1.B.2 Flexibility in the Design and Maintenance Standards

March 2019 amendments to the Nebraska Revised Statutes, Section 39-2113 include the following:

(7) In cooperation with the Department of Transportation, counties, and municipalities, the board is authorized to develop, support, approve, and implement programs and project strategies that provide additional flexibility in the design and maintenance standards. Once a program is established, the board shall allow project preapproval for all projects that conform to the agreed-upon program. The programs shall be set out in memorandums of understanding or guidance documents and may include, but are not limited to, the following:

a) Practical design, flexible design, or similar programs or strategies intended to focus funding on the primary problem or need in constructing projects that will not meet all the standards but provide substantial overall benefit at a reasonable cost to the public;

b) Asset preservation or preventative maintenance programs and strategies that focus on extending the life of assets, such as, but not limited to, pavement and bridges that may incorporate benefit cost, cost effectiveness, best value, or lifecycle analysis in determining the project approach and overall benefit to the public; and

c) Context sensitive design programs or similar programs that consider the established needs and values of a county, municipality, community, or other connected group to enable projects that balance safety while making needed improvements in a manner that fits the surroundings and provides overall benefit to the public.

1.B.3 Practical Design

Policy DES 22-03, January 2023, provides flexibility in the application of Nebraska's highway design standards, in accordance with a Memorandum of Understanding between **NDOT** and the **Board of Classifications and Standards**, executed on October 26, 2022 (https://dot.nebraska.gov/business-center/lpa/boards-liaison/nbcs/downloads/). For additional information see Chapter Seventeen: Resurfacing, Restoration and Rehabilitation (3R) Projects, Section 1.G, of this manual.

2. DESIGN STANDARDS

The primary sources of roadway design guidance and standards for **NDOT** are A Policy on Geometric Design of Highways and Streets (*Green Book*) (Ref. 1.1), A Policy on Design Standards Interstate System (*I-State Green Book*) (Ref. 1.2), the Nebraska Minimum Design Standards (*MDS*) (Ref. 1.3), and this manual. The *MDS* is in Chapter Two of the Nebraska Administrative Code, Title 428 (http://www.roads.nebraska.gov/media/5593/nac-428-rules-regs-nbcs.pdf). The Roadway Design Manual is based on research and publications from **NDOT**, the **American Association of State Highway and Transportation Officials** (**AASHTO**), the **Federal Highway Administration** (**FHWA**), the **Access Board**, and others.

3. HIGHWAY CLASSIFICATION

3.A Classification

Highway system classification is the grouping of highways by their purpose and function (See EXHIBITS 1.1 AND 1.2). Access and mobility are important factors in determining the classification of a highway. Access and mobility exist in an inverse relationship, the greater the access to the highway the lower the mobility. In the classification of highways the greater the mobility the higher the classification. The highest classification is the Interstate, which provides nationwide mobility but access only at interchanges. Local roads, on the other hand, may provide many direct access points but also provide a lower level of mobility.

The classification of a highway includes the highway's function in a network, location (rural/ municipal), traffic volume, trip purposes, and length. Highway system classification is used for roadway identification, selecting the applicable design guidance, project prioritization, and funding purposes for planning, design, traffic operations, and administration of the highway program (minor collectors and local roads are not eligible for Federal-aid funds).

3.A.1 National Highway Functional Classification Map (Nebraska)

(http://dot.nebraska.gov/travel/map-library/func-by-county/)
(https://dot.nebraska.gov/travel/map-library/func-by-city/)

This map shows six classes of roadway:

1. Interstate
2. Other Freeways & Expressways
3. Other Principal Arterials
4. Minor Arterial
5. Major Collector
6. Minor Collector (not eligible for Federal-aid funds)

These classes are based on the **AASHTO** functional classes found and defined in the *Green Book* (Ref. 1.1) and the *I-State Green Book* (Ref. 1.2), and in the **FHWA** publication Highway Functional Classification Concepts, Criteria and Procedures (Ref. 1.4, https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/fcauab.pdf).

3.A.2 State Highway Functional Classification Map (Nebraska)

(http://dot.nebraska.gov/travel/map-library/func-by-county/)
(https://dot.nebraska.gov/travel/map-library/func-by-city/)

This map shows the following eight roadway classifications:

1. Interstate
2. Expressway
3. Major Arterial
4. Other Arterial
5. Collector
6. Remote Residential (Rural Only)
7. Minimum Maintenance (Rural Only)
8. Scenic Recreation (Rural Only)

The state functional classification defines the characteristics for rural and municipal area roadways, as established in the Reissue Revised Statutes of Nebraska Laws Applicable to the Nebraska Department of Transportation (Containing Chapter 3, Aeronautics; Chapter 39, Highways and Bridges; Chapter 49, Laws, Article 8, Definitions, Construction, and Citation; Chapter 60, Motor Vehicles, Article 6, Nebraska Rules of the Road; and Chapter 81, Article 7, Department of Transportation) (https://nebraskalegislature.gov/laws/browse-statutes.php) (Ref. 1.5).

<table>
<tr><th colspan="2">RURAL HIGHWAY FUNCTIONAL CLASSIFICATIONS</th></tr>
<tr><th>FEDERAL HIGHWAY ADMINISTRATION (FHWA)
Source: Ref. 1.4</th><th>STATE OF NEBRASKA
Source: Ref. 1.5</th></tr>
<tr><td colspan="2">* NDOT has responsibility for the design, construction, reconstruction, maintenance, and operation of the following rural highway classifications.</td></tr>
<tr><td>Principal Arterial - Interstate: All routes that comprise the Dwight D. Eisenhower National System of Interstate and Defense Highways belong to the Interstate functional classification and are considered Principal Arterials.</td><td>Interstate: The federally designated National System of Interstate and Defense Highways.</td></tr>
<tr><td rowspan="2">Principal Arterial - Other Freeways & Expressways: Roadways in this functional classification category look very similar to Interstates. While there can be regional differences in the use of the terms ‘freeway’ and ‘expressway’, for the purpose of functional classification the roads in this classification have directional travel lanes, are usually separated by some kind of physical barrier, and their access and egress points are limited to on- and off-ramp locations or a very limited number of at-grade intersections. Like Interstates, these roadways are designed and constructed to maximize their mobility function, and abutting land uses are not directly served by them.</td><td>Freeway: An expressway with full control of access and with grade separations at all intersecting road crossings.</td></tr>
<tr><td>Expressway: A group of highways following major traffic desires in Nebraska which rank next in importance to the National system of Interstate and Defense Highways. The expressway system is one which ultimately should be developed to multilane divided highway standards.</td></tr>
<tr><td rowspan="2">Other Principal Arterials: These roadways serve major centers of metropolitan areas, provide a high degree of mobility and can also provide mobility through rural areas. Unlike their access-controlled counterparts, abutting land uses can be served directly. Forms of access for Other Principal Arterial roadways include driveways to specific parcels and at-grade intersections with other roadways.</td><td>Major Arterial: The balance of routes which serve major statewide interests for highway transportation. This system is characterized by high-speed, relatively long-distance travel patterns.</td></tr>
<tr><td>Scenic-Recreation: Highways or roads located within or which provide access to or through state parks, recreation or wilderness areas, other areas of geographical, historical, geological, recreational, biological, or archeological significance, or areas of scenic beauty.</td></tr>
<tr><td colspan="2">* The various counties shall have responsibility for the design, construction, reconstruction, maintenance, and operation of the following rural highway classifications.</td></tr>
<tr><td>Minor Arterial: Minor Arterials provide service for trips of moderate length, serve geographic areas that are smaller than their higher Arterial counterparts and offer connectivity to the higher Arterial system. In rural settings, Minor Arterial should be identified and spaced at intervals consistent with population density, so that all developed areas are within a reasonable distance of a higher level Arterial. Additionally, Minor Arterials in rural areas are typically designed to provide relatively high overall travel speeds, with minimum interference to through movement.</td><td>Other Arterial: Highways of less importance as through-travel routes which would serve places of smaller population and smaller recreation areas not served by the higher systems.</td></tr>
</table>

* Nebraska Revised Statutes, Chapter 39-2105

Exhibit 1.1 Rural Highway Functional Classifications

RURAL HIGHWAY FUNCTIONAL CLASSIFICATIONS	
FEDERAL HIGHWAY ADMINISTRATION (FHWA) Source: Ref. 1.4	**STATE OF NEBRASKA Source: Ref. 1.5**
* The various counties shall have responsibility for the design, construction, reconstruction, maintenance, and operation of the following rural highway classifications.	
Major and Minor Collectors: Collectors serve a critical role in the roadway network by gathering traffic from Local Roads and funneling them to the Arterial network. In the rural environment, Collectors generally serve primarily intra-county travel (rather than statewide) and constitute those routes on which (independent of traffic volume) predominant travel distances are shorter than on Arterial routes. Consequently, more moderate speeds may be posted. Generally, Major Collector routes are longer in length; have lower connecting driveway densities; have higher speed limits; are spaced at greater intervals; have higher annual average traffic volumes; and may have more travel lanes than their Minor Collector counterparts. In rural areas, AADT and spacing may be the most significant designation factors; since Major Collectors offer more mobility and Minor Collectors offer more access.	**Collector:** A group of highways which pick up traffic from many local or land-service roads and carry it to community centers or to the arterial systems. They are the main school bus routes, mail routes, and farm-to-farm market routes.
Local Roads: Local Roads are not intended for use in long distance travel, except at the origin or destination end of the trip, due to their provision of direct access to abutting land. As public roads, they should be accessible for public use throughout the year. Local roads are often classified by default. In other words, once all Arterial and Collector roadways have been identified, all remaining roadways are classified as Local Roads.	**Local:** All remaining rural roads, except minimum maintenance roads and remote residential roads.
	Minimum Maintenance: (a) Roads used occasionally by a limited number of people as alternative access roads for areas served primarily by local, collector, or arterial roads or (b) roads which are the principal access roads to agricultural lands for farm machinery and which are not used by passenger or commercial vehicles.
	Remote Residential: Roads or segments of roads in remote areas of counties with (a) a population density of no more than five people per square mile or (b) an area of at least one thousand square miles, and which roads or segment of roads serve as primary access to no more than seven residences. For purposes of this subdivision, residence means a structure which serves as a primary residence for more than six months of a calendar year. Population shall be determined using data from the most recent federal decennial census.

* Nebraska Revised Statutes, Chapter 39-2105

Exhibit 1.1 Rural Highway Functional Classifications (Continued)

MUNICIPAL HIGHWAY FUNCTIONAL CLASSIFICATIONS	
FEDERAL HIGHWAY ADMINISTRATION (FHWA) Source: Ref. 1.4	**STATE OF NEBRASKA Source: Ref. 1.5**
* **NDOT** has responsibility for the design, construction, reconstruction, maintenance, and operation of the following municipal highway classifications.	
Principal Arterial - Interstate: All routes that comprise the Dwight D. Eisenhower National System of Interstate and Defense Highways belong to the Interstate functional classification and are considered Principal Arterials.	**Interstate:** The federally designated National System of Interstate and Defense Highways.
Principal Arterial - Other Freeways & Expressways: Roadways in this functional classification category look very similar to Interstates. While there can be regional differences in the use of the terms 'freeway' and 'expressway', for the purpose of functional classification the roads in this classification have directional travel lanes, are usually separated by some kind of physical barrier, and their access and egress points are limited to on- and off-ramp locations or a very limited number of at-grade intersections. Like Interstates, these roadways are designed and constructed to maximize their mobility function, and abutting land uses are not directly served by them.	**Freeway:** An expressway with full control of access and with grade separations at all intersecting road crossings. **Expressway:** (a) Extensions of rural expressways and (b) some additional routes which serve very high volumes of local traffic within urban areas.
Other Principal Arterials: These roadways serve major centers of metropolitan areas, provide a high degree of mobility and can also provide mobility through rural areas. Unlike their access-controlled counterparts, abutting land uses can be served directly. Forms of access for Other Principal Arterial roadways include driveways to specific parcels and at-grade intersections with other roadways.	**Major Arterial:** Extensions of the rural major arterials which provide continuous service through municipalities for long-distance rural travel. They are the arterial streets used to transport products into and out of municipalities

* Nebraska Revised Statutes, Chapter 39-2105

Exhibit 1.2 Municipal Highway Functional Classifications

MUNICIPAL HIGHWAY FUNCTIONAL CLASSIFICATIONS	
FEDERAL HIGHWAY ADMINISTRATION (FHWA) Source: Ref. 1.4	**STATE OF NEBRASKA Source: Ref. 1.5**
* The various counties and local governments shall have responsibility for the design, construction, reconstruction, maintenance, and operation of the following municipal highway classifications.	
Minor Arterial: Minor Arterials provide service for trips of moderate length, serve geographic areas that are smaller than their higher Arterial counterparts and offer connectivity to the higher Arterial system. In an urban context, they interconnect and augment the higher Arterial system, provide intra-community continuity and may carry local bus routes.	**Other Arterial:** (a) Municipal extensions of rural other arterials and (b) arterial movements peculiar to a municipality's own complex, that is streets which interconnect major areas of activity within a municipality, such as shopping centers, the central business district, manufacturing center, and industrial parks.
Major and Minor Collectors: Collectors serve a critical role in the roadway network by gathering traffic from Local Roads and funneling them to the Arterial network. Collectors serve both land access and traffic circulation in residential and commercial/ industrial areas. Operating characteristics of Major Collectors differ from Minor Collectors in length (usually greater than three-quarters of a mile), higher speeds and more signalized intersections.	**Collector:** A group of streets which collect traffic from residential streets and move it to smaller commercial centers or to higher arterial systems.
Local Roads: Urban Local Roads provide direct access to adjacent land, provide access to higher roadways systems and carry no through traffic movements. As public roads, they should be accessible for public use throughout the year. Local roads are often classified by default. In other words, once all Arterial and Collector roadways have been identified, all remaining roadways are classified as Local Roads.	**Local:** The balance of streets in each municipality, principally residential access service streets and local business streets. They are characterized by very short trip lengths, almost exclusively limited to vehicles desiring to go to or from an adjacent property.

* Nebraska Revised Statutes, Chapter 39-2105

Exhibit 1.2 Municipal Highway Functional Classifications (Continued)

4. HIGHWAY SYSTEMS

Highways may be networked into a system based on their intended function. The same highway may be part of multiple systems, for example the Interstate is part of the National Highway System, the Strategic Highway Network, and the National Highway Freight Network.

4.A Interstate System
(https://www.fhwa.dot.gov/programadmin/interstate.cfm)

The Dwight D. Eisenhower National System of Interstate and Defense Highways (Interstate System) is a national defense system of highways consisting of routes built to uniform geometric and construction standards. This system connects the principal metropolitan areas, cities, and industrial centers of the United States and, to the greatest extent possible, connects the border routes of continental importance with Canada and Mexico. A map showing the Interstate routes in Nebraska is available at (http://www.roads.nebraska.gov/media/2731/interstate-defense-highway-system.pdf).

4.B National Highway System (NHS)
(https://www.fhwa.dot.gov/planning/national_highway_system/)

The AASHTO Transportation Glossary (2009) defines the NHS as “A system of highway routes and connections to transportation facilities consisting of the Interstate System, other urban and rural arterial routes, and other connector highways to major intermodal transportation facilities.” The NHS serves interstate and interregional travel and includes the Strategic Highway Network, meeting national defense requirements. A map showing the NHS routes in Nebraska is available at (http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/nebraska/).

4.C Strategic Highway Network (STRAHNET)

As defined by the U.S. Department of Defense, “STRAHNET is a system of public highways that are a key part of the deployment of the United States Armed Forces. It provides defense access, continuity, and emergency capabilities for movements of personnel and equipment in both peace time and war.” The National Highway System Designation Act of 1995 provided for the inclusion of STRAHNET and STRAHNET connectors into the NHS. Additional information and maps of the STRAHNET routes and connectors in Nebraska may be found at (https://www.sddc.army.mil/sites/tea/functions/specialassistant/strahnet/forms/allitems.aspx).

4.D National Highway Freight Network
(https://ops.fhwa.dot.gov/freight/infrastructure/nfn/index.htm)

In 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) required the **United States Department of Transportation** (**USDOT**) to establish a National Freight Network to assist the states in directing resources towards improving the movement of freight on the nation's highways. This network consisted of:

- A primary freight network (PFN), designated by the Secretary of the **USDOT**
- Any portions of the Interstate System not designated as part of the PFN
- Critical rural freight corridors

In 2015, the Fixing America's Surface Transportation Act (FAST) established the National Highway Freight Program to improve the efficient movement of freight on the National Highway Freight Network. Section 1116 of the FAST Act provided for a new National Highway Freight Network (NHFN), replacing the National Freight Network established under MAP-21.

The NHFN includes the following subsystem of roadways:

a. Primary Highway Freight System (PHFS) - This is a network of highways identified as the most critical highway portions of the U.S. freight transportation system. The initial designation of the PHFS is highway-only Primary Freight Network (PFN) created under MAP-21.
b. Interstate Routes not on the PHFS - These highways consist of the remaining portion of Interstate roads not designated as part of the PHFS. These routes provide important continuity and access to freight transportation facilities.
c. Critical Rural Freight Corridors (CRFC) - These are public roads not in an urbanized area which provide access and connection to the PHFS and the Interstate with other important ports, public transportation facilities, or other intermodal freight facilities.
d. Critical Urban Freight Corridors (CUFC) - These are public roads in urbanized areas which provide access and connection to the PHFS and the Interstate with other ports, public transportation facilities, or other intermodal transportation facilities.

A map showing the NHFN in Nebraska is available at (https://ops.fhwa.dot.gov/freight/infrastructure/ismt/state_maps/states/nebraska.htm).

For additional information see the **FHWA** Memorandum "National Highway Freight Program (NHFP), FAST Act Section 1116 Implementation Guidance" (https://ops.fhwa.dot.gov/freight/pol_plng_finance/policy/fastact/s1116nhfpguidance/).

4.E Nebraska Expressway System
(http://www.roads.nebraska.gov/media/5809/expressway-system-nebraska.pdf)

State law authorized the development of the Nebraska Expressway System (Expressway System) in 1988 (Nebraska Revised Statutes, Chapter 39-1365). The Expressway System generally consists of multi-lane divided highways. Access to the expressway other than at public roads will be limited; interchanges may be built where an expressway intersects with high volume highways. The intent of the expressway system is to:

1. Connect urban centers of 15,000 population or greater to the Interstate System,
2. Add those routes which have an average daily traffic of 500 or more heavy commercial vehicles, and
3. Add additional segments as required for continuity.

The Expressway System is also shown on the State and National Functional Classification Maps (https://dot.nebraska.gov/travel/map-library/func-by-county/) (https://dot.nebraska.gov/travel/map-library/func-by-city/).

4.F Nebraska Priority Commercial System

The 1988 Department Needs Study initiated the creation of the Nebraska Priority Commercial System, providing a continuous network of routes designed to carry higher traffic volumes, especially larger volumes of commercial vehicles. The Nebraska Priority Commercial System consists of the non-Interstate National Highway System and the Nebraska Expressway System. This system directly serves the first class cities (5,001 – 100,000 population), and directly or indirectly serves the majority of the second class cities (800 - 5,000 population). For additional information, see Chapter Six: The Typical Roadway Cross-Section, Section 2.A.1, of this manual.

4.G Nebraska 28 Foot Top System

Highways in the Sandhills area, highways with ≥ 1,000 future ADT, and highways that link US-6, US-30, or US-34 to the Interstate should have a 28 foot pavement width, striped at 24 feet, and shoulders appropriate for design year traffic (See the *MDS*, Ref. 1.3 and Chapter Six: The Typical Roadway Cross-Section, Section 2.A.2, and EXHIBITS 6.4 AND 6.5, of this manual). The intent of the additional surfacing width is to lessen the probability of vehicles leaving the roadway and to reduce erosion problems.

4.H Other Nebraska State Highways
(http://www.roads.nebraska.gov/media/2733/current-state-highway-system.pdf)

In addition to the previously mentioned highways, **NDOT** is responsible for the administration of the state highway system for the efficient movement of people and goods throughout the State of Nebraska.

5. CAPITAL IMPROVEMENT VS SYSTEM PRESERVATION

Capital improvements (New and Reconstructed projects, See Section 6.A) consist of major modification road projects that extend beyond the work permitted under 3R. These projects generally entail a correction of vertical or horizontal alignment, removal and replacement of the surfacing and base, increase in capacity, and/ or construction on a new alignment.

System Preservation projects consist of focused improvements toward a specific asset that the project is intended to preserve. These projects consist of 3R projects (See Section 6.B) and Maintenance projects.

1. **NDOT** 3R projects preserve highway assets (i.e. pavement or bridges) by addressing deficiencies in the pavement structure and may address safety and operational issues, primarily within the existing roadway footprint.

2. Maintenance projects (See Section 6.C) maintain the existing roadway to its original condition, maintain a minimum condition of bridges, and maintain, and in some instances upgrade, roadside appurtenances such a guardrail. Some maintenance system preservation work is not contracted and subsequently is performed by state maintenance forces.

6. APPLICATION OF DESIGN CRITERIA

6.A <u>New and Reconstructed Criteria</u>

The primary focus of this manual is the design of New and Reconstructed projects. New and Reconstructed projects have an expected service life exceeding 20 years and generally consist of:

- Construction of a new road
- Relocating an existing route on new alignment
- Removal of the pavement structure and construction of a new base or the modification of the existing base, which will be designed to reconstruction standards
    - Modification of the base is defined as improving or strengthening the existing base through chemical (fly ash, lime, etc.) or mechanical (geofabric, geogrid, etc.) means and will require designing to reconstruction standards
- Building a new bridge or reconstructing an existing bridge
- Adding through lanes to the existing alignment

New and Reconstructed projects should be considered when:

- The crash history indicates the need for improvements that can significantly reduce the crash rate
- Meeting 3R standards will require that significant existing geometric deficiencies be corrected
- Significant grading is to be done which requires major right-of-way to be acquired and/ or major utility relocations

The minimum design standards for New and Reconstructed projects on the NHS may be found in the *Green Book* (Ref. 1.1), the *I-State Green Book* (Ref. 1.2), and in Appendix H, "AASHTO Minimum Design Guidance" of this manual. Design standards for projects not on the NHS have been issued by the **Board of Public Roads Classifications and Standards** and may be found in the *MDS* (Ref. 1.3). Note: rural and suburban areas exhibiting urban characteristics may be designed to municipal design standards.

Practical design considerations may allow application of 3R standards to a segment (or segments) of the current New and Reconstructed project (e.g. reconstructing the pavement structure at the existing width without modification of the existing base).

6.B Resurfacing, Restoration and Rehabilitation (3R) Criteria

3R projects are generally undertaken to preserve the highway assets, improve the reliability of the transportation system, maintain the mobility of the highway user, mitigate highway safety issues identified through crash history and operational issues identified through analysis. Generally, it is not the purpose of 3R projects to increase highway capacity. A 3R resurfacing strategy typically has an expected service life of up to 20 years.

Application of 3R design standards to a pavement resurfacing project is, for the most part, determined by the pavement recommendation.

1. Pavement recommendations that address deficiencies in the pavement structure and increase the structural capacity and extend the life of the facility by up to 20 years will usually be designed to 3R standards. Pavement recommendations that require pavement replacement and restoration of the base can be designed to 3R standards. Restoration of the base is defined as restoring the original condition of the base (subgrade preparation). A portion of the existing base may be removed to accommodate the required pavement thickness based on the pavement recommendation.

2. Pavement recommendations that require removal of the entire pavement structure and the construction of a new base or the modification of the existing base will be designed to New and Reconstructed standards. Modification of the base is defined as improving (addition of a drainage layer) or strengthening the existing base through chemical (fly ash, lime, etc.) or mechanical (geofabric, geogrid, etc.) means. However, practical design considerations may allow application of 3R standards to a segment (or segments) of the current New and Reconstructed project (e.g. reconstructing the pavement structure at the existing width without modification of the existing base).

3R design utilizes a cost/ benefit paradigm, including such strategies such as Practical Design, 2+2 Projects, and Super 2 Roadways. For **NDOT** 3R guidance, see Chapter Seventeen: Resurfacing, Restoration and Rehabilitation (3R) Projects of this manual and the *MDS* (Ref. 1.3). Note: rural and suburban areas exhibiting urban characteristics may be designed to 3R municipal design standards.

6.B.1 Bridge Rehabilitation (3R) Work

3R Bridge rehabilitation includes, but is not limited to:

- Partial or complete replacement of the existing deck, including adding new bridge approaches on pile
- Replacement and/ or strengthening (rehabilitation) of the superstructure
- Repairs to the substructure
- Incidental widening associated with these activities

Bridge rehabilitation work is eligible for federal-aid funding. For additional information see the **FHWA** publication Bridge Preservation Guide (Ref. 1.9).
(https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf)

6.C Maintenance Projects

6.C.1 Routine Maintenance

Routine maintenance is work performed on a regular basis to maintain and preserve the condition of the highway at a satisfactory level of service. Examples of routine maintenance include but are not limited to:

- Mowing the roadside
- Snow removal
- Clearing of ditches and drainage structures
- Maintenance of pavement markings
- Crack filling
- Pothole patching
- Isolated overlays

NDOT employees generally perform routine maintenance, which is not ordinarily eligible for federal-aid funding.

6.C.1.a Routine Bridge Maintenance Activities

Routine bridge maintenance activities are performed on a regular basis in response to operational needs and do not generally extend the useful life of the structure. Examples of routine bridge maintenance activities include:

- Trash Removal
- Snow Removal
- Application of Deicers
- Asphalt Patching
- Repairing Accident Damage (Bridge, Appurtenances)
- Repairing Storm Damage

NDOT employees generally perform routine bridge maintenance, which is not ordinarily eligible for federal-aid funding. For additional information see the **FHWA** publication Bridge Preservation Guide (Ref. 1.9).

6.C.2 Preventive Maintenance

Preventive Maintenance projects are programmed for the restoration of the existing mainline roadway surfacing back to its' original condition without significantly increasing the structural capacity. Preventive Maintenance is typically applied to pavements in good condition which have significant service life remaining. The **Board of Public Roads Classifications and Standards** has issued maintenance standards applicable for each functional classification of roadway (Chapter 2, Section 003, of the *MDS*, Ref. 1.3). Building curb ramps and upgrading roadway appurtenances (such as guardrail) are allowed on Preventive Maintenance projects. Mailbox turnouts will not generally be surfaced on a Preventative Maintenance project. A Preventive Maintenance project has an expected service life of up to 12 years.

Application of maintenance standards to a project is generally determined by the pavement recommendation. A grade raise of 2 inches or less of surfacing, or its equivalent (See below), is permissible. More than a 2 inch grade raise will indicate the initial programming of a 3R project, pending further investigation.

M&R has determined that 1 inch of in place recycle is structurally equivalent to ¼ inch of Hot Mix Asphalt, e.g. a pavement determination of 2 inches of in place recycle followed by a 1½ inch overlay is equivalent to a 2 inch grade raise. In place recycling strategies include Cement Stabilized Bituminous, Fly Ash Stabilized Bituminous, Hydrated Lime Slurry Stabilization, Cold in place recycle with foam, and Hot in place recycle.

6.C.2.a Bridge Preventive Maintenance Activities

Bridge preventive maintenance extends the useful life of a bridge by the application of cost-effective treatments to bridges in good or fair condition. Bridge preventive maintenance may be cyclical or condition-based in nature.

Cyclical bridge maintenance consists of recurring activities, scheduled to preserve the bridge elements and to delay their deterioration. Examples of cyclical bridge maintenance activities include:

- Bridge Cleaning (Deck, Superstructure, Substructure)
- Cleaning and Flushing the Drains
- Cleaning Joints
- Deck/ Parapet/ Rail Sealing and Crack Sealing
- Concrete Sealing

Condition-based bridge maintenance work is performed to improve the condition of known defects of bridge components. Examples of work allowed on a condition-based Preventive Maintenance Bridge project include:

Deck:

- Overlays (Polymer, Asphalt with waterproof membrane, Rigid overlays)
- Approach Slabs (Repairs, Replacement of existing approach slabs)
- Slab Turndowns (Eliminate end-of-floor joint and encase girder ends)
- Joints (Repair, Replace, Eliminate)
- Joint Seals (Replace)
- Drains (Repair, Replace)
- Electrochemical Extraction (ECE)/ Cathodic Protection (CP)
- General Repairs (Deck repairs, Bridge Rail and Buttress update and repairs)

Superstructure:

- Structural Steel Repair/ Retrofit (Fracture critical details, Fatigue prone details)
- Painting (Zone coat girder ends, Complete re-painting of steel superstructure)
- Bearing Restoration (Cleaning, Lubrication, Resetting, Repair, Replacement, Passive zinc anodes)
- Concrete (Seal, Patch, Repair)
- Protective Coat (Concrete/ Steel Elements)
- Fatigue Crack Mitigation (Pin–and-hanger replacement, Retrofit fracture critical members)
- Movable Bridge Machinery (Cleaning, Lubrication, Repair)
- General Repairs (End of girder repairs, Damaged elements)

Substructure:

- Concrete (Patch, Repair)
- Corrosion Protection & Mitigation (Passive zinc anodes, Electrochemical chloride extraction)
- Protective Coat (Concrete/ Steel Elements)
- Painting (Spot, Zone, Complete re-painting of steel substructure)
- Pile Preservation (Repairs, Jackets w/epoxy grout, Concrete encasement, Painting of steel bearing piles, Cathodic protection)
- General Repairs (Abutment & piers, Damaged elements)

Channel:

- Scour Counter Measures (Installation, Repair)
- Channel Cleaning (Debris removal)

Cyclical and condition-based bridge preventive maintenance work is eligible for federal-aid funding. For additional information see the **FHWA** publication Bridge Preservation Guide (Ref. 1.9).

Guardrail:

On Preventive Maintenance Bridge projects, guardrail attached to the bridge rail will be reviewed for:

- Impacts to the guardrail (has the guardrail been hit) and condition of the guardrail
- NCHRP or MASH compliance
- A minimum height of 28 inches above the surfacing for the Bridge Approach Section (BAS)
- A minimum height of 26½ inches above the surfacing for the W-Beam guardrail, in accordance with the Roadside Design Guide (Ref. 1.7)

If necessary, the guardrail will be raised to meet the above listed minimum heights and used in place. If the guardrail is unable to meet the above listed minimum heights or does not meet NCHRP 350 standards, the installation will be reviewed for possible replacement and upgrade to MASH standards. If the guardrail is to be used in place, a decision document requiring **NDOT Roadway Design Unit Head** (**Unit Head**) approval will be placed in the document file.

6.D Safety Improvement Projects

(http://roads.nebraska.gov/business-center/lpa/projects/programs/hsip/)

Safety improvement projects are usually located at specific significant crash sites. Significant crash locations are identified and evaluated for cost effectiveness and the **Highway Safety Improvement Plan Implementation Team** addresses critical areas, with federal funds, on a case-by-case basis. The **NDOT District Engineer** (**DE**) may also request a study of individual locations. Safety improvement projects are designed with 10-year traffic forecasts. These projects may include such actions as:

- Changing intersection geometry
- Adding left turn lanes
- Minor radii improvements
- Sight distance improvements

Safety improvement projects are designated as either 3R or the appropriate New and Reconstructed standard. Cost sharing guidelines for safety improvement projects in municipal areas are outlined in NDOT Operating Instruction DOT-OI 60-11, “Municipal Cost Sharing” (Appendix B, “Selected NDOT Operating Instructions”).

7. DESIGN CONTROLS

Once the functional classification of the roadway is known and the type of roadway improvement determined, several basic factors serve as design controls. These controls are determinants for other geometric design standards. See the *Green Book* (Ref. 1.1), the *I-State Green Book* (Ref. 1.2) and the *MDS* (Ref. 1.3) for additional information. Design controls for 3R projects are addressed in Chapter Seventeen: Resurfacing, Restoration and Rehabilitation (3R) Projects, Section 1.B, of this manual.

7.A Design Year Forecast Traffic

The design year forecast traffic data (ADT, DHV, % Heavy Trucks, etc.) is based on the life expectancy of the roadway surfacing. The design year for New and Reconstructed projects and for 3R projects is the year of initial construction plus 20 years. Maintenance projects do not require forecast traffic data.

The designer should contact the **Traffic Analysis Section** of the **Strategic Planning Division** for design year forecast traffic data.

7.B Design Speed

The desirable design speed for a New and Reconstructed project is 5 mph greater than the anticipated posted speed limit for the roadway, except for low-speed municipal projects (≤ 45 mph) where the design speed should be the anticipated posted speed limit. The minimum design speed may be found in the *MDS* (Ref. 1.3). Where the design speed from the *MDS* is greater than the anticipated posted speed limit the design speed from the standards will be used. For example, if the design speed from the *MDS* is 60 mph and the anticipated posted speed limit of the roadway is 50 mph, a design speed of 60 mph will be used.

Reduction of the desirable design speed to the minimum design speed will require **NDOT Roadway Design Assistant Design Engineer** (**ADE**) approval. A design relaxation will be required to design to less than the design speed provided in the *MDS* (Ref. 1.3) (See Section 10.C of this chapter).

7.C Sight Distance

Sight distance includes stopping sight distance, passing sight distance, and intersection sight distance. For further discussion of sight distance see Chapter Four: Intersections, Driveways and Channelization, Section 1.C.2 of this manual and Chapter 3, Section 3.2 and Chapter 9, Section 9.5 of the *Green Book* (Ref. 1.1).

7.D Terrain

Terrain is a design control affecting alignment. Two types of terrain, defined in Chapter 3, Section 3.4.1 of the *Green Book* (Ref. 1.1), are found in Nebraska:

1. **Level:** Highway sight distances, as governed by both horizontal and vertical restrictions, are generally long or can be made to be so without construction difficulty or major expense.

2. **Rolling:** Natural slopes which consistently rise above and fall below the road or street grade, and occasional steep slopes offer some restriction to normal horizontal and vertical roadway alignment.

7.E Roadside Design

Horizontal Clear Zone: For New and Reconstructed projects, the Horizontal Clear Zone is the roadside area, starting at the edge of the travel lane, which is available for errant vehicles leaving the roadway. The Horizontal Clear Zone provides an area free of fixed obstacles and may consist of the shoulder, a recoverable slope, a non-recoverable but traversable slope, and/ or a clear runout area. The required clear zone distance will vary based on the projects' design standard (See the *MDS*, Ref. 1.3). See Chapter Six: The Typical Roadway Cross-Section, Section 9.A.1, of this manual for additional information.

Fixed Obstacle Clearance: For 3R projects, the Fixed Obstacle Clearance, as presented in the *MDS* (Ref. 1.3), provides a roadside environment free of fixed obstacles, reducing the opportunity for off-road impacts. See Chapter Six: The Typical Roadway Cross-Section, Section 9.A.2, of this manual for additional information.

7.F Rural/ Municipal

Separate design standards have been developed for rural and municipal (urban) areas. Rural highways consist of public highways and roads outside the limits of an incorporated municipality; municipal streets are public streets within the limits of an incorporated municipality. Typical cross-sections will differ depending upon rural/ municipal location. Rural design standards reflect the higher design speeds and more flexible right-of-way opportunities possible in rural areas while municipal design standards are based on the lower design speeds, restricted rights-of-way, and higher traffic volumes common in urban areas. Rural locations exhibiting municipal characteristics may be designed to municipal standards.

AASHTO has found it advisable to expand the traditional rural/ municipal definition to five contexts, based not only on location but also on development density, land uses, and building setbacks. The following definitions are from Chapter 1, Section 1.5 of the *Green Book* (Ref. 1.1).

1. **Rural Context:** "The rural context applies to roads in rural areas that are not within a developed community. These include areas with the lowest development density; few houses or structures; widely dispersed or no residential, commercial, and industrial land uses; and usually large building setbacks. The rural context may include undeveloped land, farms, outdoor recreation areas, or low densities of other types of development. Most roads in rural areas fit the rural context and should be designed in a manner similar to past design criteria for rural facilities."

2. **Rural Town Context:** "The rural town context applies to roads in rural areas located within developed communities. Rural towns generally have low development densities with diverse land uses, on-street parking, and sidewalks in some locations, and small building setbacks. Rural towns may include residential neighborhoods, schools, industrial facilities, and commercial main street business districts, each of which present differing design challenges and differing levels of pedestrian and bicycle activity. The rural town context recognizes that rural highways change character where they enter a small town, or other rural community, and that design should meet the needs of not only through travelers, but also the residents of the community. Speed expectations of through travelers change when they enter a rural town."

3. **Suburban Context:** "The suburban context applies to roads and streets, typically within the outlying portions of urban areas, with low to medium development density, mixed land uses (with single-family residences, some multi-family residential structures, and nonresidential development including mixed town centers, commercial corridors, big box commercial stores, light industrial development). Building setbacks are varied with mostly off-street parking. The suburban context generally has lower development densities and drivers have higher speed expectations than the urban and urban core contexts. Pedestrians and bicyclist flows are higher than in the rural context, but may not be as high as found in urban and urban core areas."

4. **Urban Context:** "The urban context has high-density development, mixed land uses, and prominent destinations. On-street parking and sidewalks are generally more common than in the suburban context, and building setbacks are mixed. Urban locations often include multi-story and low- to medium-rise structures for residential, commercial, and educational uses. Many structures accommodate mixed uses: commercial, residential, and parking. The urban context includes light industrial, and sometimes heavy industrial, land use. The urban context also includes prominent destinations with specialized structures for entertainment, including athletic and social events, as will as conference centers. In small- and medium-sized communities, the central business district may be more an urban context than an urban core context. Driver speed expectations are generally lower and pedestrian and bicyclist flows higher than in suburban areas. The density of transit routes is generally greater in the urban context than the suburban context, including in-street rail transit in larger communities and transit teminals in small- and medium-sized communities."

5. **Urban Core Context:** "The urban core context includes areas of the highest density, with mixed land uses within and among predominantly high-rise structures, and with small building setbacks. The urban core context is found predominantly in the central business districts and adjoining portions of major metropolitan areas. On-street parking is often more limited and time restricted than in the urban context. Substantial parking is in multi-level structures attached to or integrated with other structures. The area is accessible to automobiles, commercial delivery vehicles, and public transit. Sidewalks are present nearly continuously, with pedestrian plazas and multi-level pedestrian bridges connecting commercial and parking structures in some locations. Transit corridors, including bus and rail transit, are typically common and major transit terminals may be present. Some government services are available, while other commercial uses predominate, including financial and legal services. Structures may have multiple uses and setbacks are not as generous as in the surrounding urban area. Residences are often apartments or condominiums. Driver speed expectations are low and pedestrian and bicycle flows are high."

7.G Access Control

Access control improves operational efficiency by limiting the number and location of access points along the highway (access control points are interchanges, intersections, driveways and field entrances). This increases the efficient movement of through traffic and reduces the potential for roadway crashes by minimizing the number of conflict points located along the highway. For further information see Chapter Fifteen: Right-of-Way, Section 3, of this manual.

8. THE CONTROLLING DESIGN CRITERIA

Through research and practical experience, minimum guidance has been established for the geometric design elements of a roadway project. The minimum values for the design criteria are based on such parameters as design speed, roadway location, functional classification of the roadway, traffic volume, and the design vehicle. **FHWA** has adopted the *I-State Green Book* (Ref. 1.2) and the *Green Book* (Ref. 1.1) as their source of roadway design guidance.

FHWA has identified ten elements of roadway geometry for all Interstate, freeway, and high-speed roadway (≥ 50 mph) projects and two design elements for low-speed roadway (≤ 45 mph) projects as being of such importance that when the minimum design standard cannot be attained for a project on the NHS and/ or for a **FHWA** Risk Based Project (RBP for Design), a design exception will be required (See Section 10.A of this chapter). This same rationale was used in the creation of the *MDS* (Ref. 1.3). If a design criterion on any highway project cannot meet the minimum design standard, a relaxation of the *MDS* will be required (See Section 10.B of this chapter). The **FHWA** standards are:

FHWA Controlling Design Elements for Interstate, Freeway, and High-Speed (≥ 50 mph) Roadways		
	Element	**Definition**
1	**Design Speed**	The speed selected to control the geometric features of the project
2	**Lane Width**	The appropriate width to be used for the through travel lanes
3	**Shoulder Width**	The appropriate shoulder width for the roadway
4	**Horizontal Curve Radius**	The horizontal curvature of the roadway
5	**Superelevation Rate**	The appropriate cross slope of the roadway through a horizontal curve
6	**Maximum Grade**	The rate of change in the elevation of a roadway, expressed as a percentage
7	**Stopping Sight Distance**	The distance required by a driver to see an object on the roadway and to bring the vehicle to a safe stop before colliding with that object
8	**Cross Slope**	The cross slope aids in draining the roadway and shoulder
9	**Vertical Clearance**	The clear distance required between the top of the pavement and an overhead object across the entire width of the roadway
10	**Structural Capacity**	The load carrying capacity of a bridge or bridge sized structure

FHWA Controlling Design Elements for Low-Speed (≤ 45 mph) Roadways		
	Element	**Definition**
1	**Design Speed**	The speed selected to control the geometric features of the project
2	**Structural Capacity**	The load carrying capacity of a bridge or bridge sized structure

NDOT has added four controlling design criteria to the *MDS*:

11	**Vertical Alignment**	The vertical curvature of the roadway
12	**Horizontal Clear Zone/ Fixed Obstacle Clearance**	For New and Reconstructed projects, the Horizontal Clear Zone is the roadside area, starting at the edge of the travel lane, which is available for the recovery of errant vehicles. For 3R projects, the Fixed Obstacle Clearance provides an obstacle free zone in the roadside environment.
13	**Lateral Offset to Obstruction**	The distance from the edge of the traveled way to a vertical roadside object. Lateral offset to obstruction should not be confused with the Horizontal Clear Zone/ Fixed Obstacle Clearance (See Section 8.B of this chapter)
14	**Bridge Width**	The width of the lanes and shoulders carried across the bridge, measured from bridge rail to bridge rail or curb to curb

These four additional items are not **FHWA** design criteria; inability to meet the minimum standard will not require a design exception but will require a relaxation of the *MDS* (See Section 10.B of this chapter).

The 14 controlling design criteria in the *MDS* will apply to all roadway classifications (State and Federal) and all design speeds.

8.A NDOT Non-Controlling Design Criteria

Four additional items have been determined by **NDOT** to be important to the design of a roadway while not rising to the level of a controlling criterion. These non-controlling items are:

1. **Barrier Crashworthiness:** Determine if the roadside barriers (e.g. guardrail, bridge rail) are compliant with MASH or NCHRP 350.
2. **Hydraulic Design:** Determine the appropriate **NDOT** Design Storm Frequency for the drainage system components (e.g. culverts, storm sewers, roadway ditches). See the Drainage Design and Erosion Control Manual, EXHIBIT 1.3, “Design Storm Frequencies”.
3. **Pavement Design:** Determine if the projected life expectancy of the pavement is equal to or greater than the project design year.
4. **ADA Accessibility:** Determine if the project meets the guidance found in the Proposed Guidelines for Pedestrian Facilities in the Public Right-of Way and if existing barriers to access will be eliminated. Any requirements which the **NDOT Roadway Design Engineer** determines to be technically infeasible shall be documented in the project file with the **NDOT Roadway Design Engineer’s** signature. For additional information see Chapter Sixteen: Pedestrian and Bicycle Facilities of this manual.

An inability to meet the minimum guidance for these items will require written **Unit Head** approval and justification to the project file except as noted above.

8.B Nominal Shoulder Width for Lateral Offset to Obstruction

8.B.1 Highways With an ADT < 400 VPD

The lateral offset (nominal shoulder width) is given in EXHIBITS 1.3 AND 1.4. Roadside barriers may be placed at the outer edge of the shoulder; however, it is desirable to provide a minimum clearance of four feet from the edge of the traveled way to the barrier. No approval is necessary for the design decision.

8.B.2 Highways With an ADT ≥ 400 VPD

The lateral offset (nominal shoulder width) is given in EXHIBITS 1.3 AND 1.4.

- On a paved or a turf only shoulder, the nominal shoulder width is the shoulder width. For example, on a New and Reconstructed Interstate project with high truck traffic, the shoulder widths are four foot left and 12 foot right, which is also the nominal shoulder width and the lateral offset to obstruction.
- On a shoulder with both a paved and a turf section, the nominal shoulder width is the total shoulder width. For example, on a New and Reconstructed Major Arterial project with an ADT between 2,000 and 3,999 the shoulder width is eight foot total with two foot paved. The nominal shoulder width and the lateral offset to obstruction is eight feet.

NEW AND RECONSTRUCTED RURAL

State Functional Classification	National Functional Classification	Lateral Offset to Obstruction
Interstate	Interstate	The paved shoulder width
Expressway (Access Only at Interchanges)	Other Freeways and Expressways	The paved shoulder width
Expressway	Other Freeways and Expressways	Left = 4 feet/ Right = 8 feet
Major Arterial	Other Principal Arterials or Minor Arterial	ADT ≥ 1,000 VPD: 8 feet ADT 400 – 999 VPD: 6 feet ADT < 400 VPD: 4 feet
Major Arterial	Major Collector, Minor Collector or Local	ADT ≥ 2,000 VPD: 8 feet ADT 400 – 1,999 VPD: 6 feet ADT < 400 VPD: 4 feet
Scenic Recreation – Major Arterial	Other Principal Arterials, Minor Arterial, Major Collector or Minor Collector	Design Speed ≥ 50 mph: 6 feet Design Speed < 50 mph: 4 feet desirable 2 feet minimum

NEW AND RECONSTRUCTED MUNICIPAL

State Functional Classification	National Functional Classification	Lateral Offset to Obstruction
Interstate	Interstate	The paved shoulder width
Expressway (Access Only at Interchanges)	Other Freeways and Expressways	The paved shoulder width
Expressway	Other Freeways and Expressways	Curbed: 1.5 feet from the face of the curb Non-Curbed: Left = 4 feet Right = 8 feet
Major Arterial	Other Principal Arterials or Minor Arterial	Curbed: 1.5 feet from the face of the curb Non-Curbed: ADT ≥ 2,000 VPD: 8 feet ADT 400 – 1,999 VPD: 6 feet ADT < 400 VPD: 4 feet
Major Arterial	Major Collector or Minor Collector	Curbed: 1.5 feet from the face of the curb Non-Curbed: ADT ≥ 2,000 VPD: 8 feet ADT 400 – 1,999 VPD: 6 feet ADT < 400 VPD: 4 feet desirable 2 feet minimum

Exhibit 1.3 Lateral Offset to Obstruction – New and Reconstructed Projects

RESURFACING, RESTORATION AND REHABILITATION (3R)
RURAL

State Functional Classification	National Functional Classification	Lateral Offset to Obstruction
Interstate	Interstate	The paved shoulder width
Expressway	Other Freeways and Expressways	The paved shoulder width
Major Arterial	Other Principal Arterials or Minor Arterial	ADT ≥ 2,000 VPD: 6 feet ADT < 2,000 VPD: 4 feet desirable 2 feet minimum
Major Arterial	Major Collector, Minor Collector or Local	ADT ≥ 2,000 VPD: 6 feet ADT < 2,000 VPD: 4 feet desirable 2 feet minimum
Scenic Recreation – Major Arterial	Other Principal Arterials, Minor Arterial, Major Collector or Minor Collector	4 feet desirable 2 feet minimum

RESURFACING, RESTORATION AND REHABILITATION (3R)
MUNICIPAL

State Functional Classification	National Functional Classification	Lateral Offset to Obstruction
Interstate	Interstate	The paved shoulder width
Expressway	Other Freeways and Expressways	Curbed: 1.5 feet from the face of the curb Non-Curbed: 8 feet
Major Arterial	Other Principal Arterials or Minor Arterial	Curbed: 1.5 feet from the face of the curb Non-Curbed: ADT ≥ 4,000 VPD: 8 feet ADT 2,000 – 3,999 VPD: 5 feet ADT < 2,000 VPD: 4 feet desirable 2 feet minimum
Major Arterial	Major Collector or Minor Collector	Curbed: 1.5 feet from the face of the curb Non-Curbed: ADT ≥ 4,000 VPD: 8 feet ADT 2,000 – 3,999 VPD: 5 feet ADT < 2,000 VPD: 4 feet desirable 2 feet minimum

Exhibit 1.4 Lateral Offset to Obstruction – Resurfacing, Restoration and Rehabilitation (3R) Projects

8.C NDOT Desirable Design Guidance

NDOT has established preferred guidance for the following design criteria. This guidance will be used on all projects, where practicable.

- **Design Speed:** The desirable design speed for a New and Reconstructed project is 5 mph greater than the anticipated posted speed limit for the roadway, except for low-speed municipal projects (≤ 45 mph) where the design speed should be the anticipated posted speed limit. (See Section 7.B of this chapter).

- **Design Speed – Left-in-Place Median Crossovers:** A desirable design speed of 65 mph (See Chapter Five: Interstates, Grade Separations, and Interchanges, Section 1.H.4, of this manual).

- **Design Speed – Interstate Phasing:** The design speed for phasing is 10 mph below the posted speed limit. (See Chapter Five: Interstates, Grade Separations, and Interchanges, Section 2.B, of this manual).

- **Design Speed – Temporary Roads:** As a rule-of-thumb, the design speed for the temporary road should be 10 mph less than the existing posted speed. (See Chapter Fourteen: Traffic, Section 6.B, of this manual).

- **Design Vehicle** - The use of a design vehicle smaller than the minimum listed in EXHIBIT 4.9 requires **Unit Head** approval. (See Chapter Four: Intersections, Driveways and Channelization, EXHIBIT 4.9, of this manual).

- **Intersection Turning Radius** - The minimum allowable distance between the edge of the full depth pavement and the outside edge of the tires of the turning design vehicle is 2 feet; the desirable distance is 3 feet. (See Chapter Four: Intersections, Driveways and Channelization, Section 1.C.6, of this manual).

- **Superelevation:** For rural highways and for bridge structures, a desirable maximum superelevation rate of 6% should be used unless design constraints dictate the use of the 8% maximum superelevation rate. The use of the maximum superelevation rate of 8% requires **ADE** approval and a decision letter to the project file. (See Chapter Three: Roadway Alignment, Section 2.C and EXHIBIT 3.2, of this manual).

- **Superelevation – Intersections on Curved Alignment:** The superelevation rate for state highways at intersection with other public roads is desirably 4% or less. (See Chapter Four: Intersections, Driveways and Channelization, Section 1.C.3.b, of this manual).

- **Turf Transition: NDOT** prefers that an additional two feet of turf transition be provided beyond the minimum shoulder width (See EXHIBITS 6.1 THROUGH 6.6). This will maintain the minimum shoulder width after a future overlay surfacing grade raise. If this transition cannot be provided, **ADE** approval and a decision document in the project file is required. (See Chapter Six: The Typical Roadway Cross-Section, Section 2.A, of this manual).

- **Minimum Grades for Drainage – Superelevation Runout:** To facilitate pavement drainage, a minimum profile grade of 1.5% shall be maintained through the area where the adverse crown has been removed. A flatter grade, down to and including a grade of 0.5%, may be used with **Unit Head** approval. (See Chapter Three: Roadway Alignment, Section 2.C.1, of this manual).

- **Minimum Grades for Drainage – Urban Curbed Roadways:** A minimum grade of 0.35% is acceptable. Flatter grades, down to and including 0.20% may be used with **Unit Head** approval. (See Chapter Three: Roadway Alignment, Section 3.A.2, of this manual).

- **Vertical Alignment and Stopping Sight Distance:** The desirable K values should be used for all New and Reconstructed projects. The desirable K values provide intersection stopping sight distance for passenger cars for various conditions. If the desirable K values cannot be met, the vertical curve may be designed to any length down to and including stopping sight distance with **Unit Head** approval and a decision letter to the project file. For intersection conditions other than listed in the exhibits, intersections and driveways (except for field entrances) will be evaluated for intersection sight distance according to the procedures presented in Chapter 9 of the *Green Book*, "Intersection Sight Distance". (See Chapter Three: Roadway Alignment, Sections 3.B.2, 3.C, and 3.D and EXHIBITS 3.9 AND 3.14, of this manual).

- **Loop Ramps:** The **NDOT** desirable loop radius is 250 feet; the minimum loop radius is 100 feet. (See Chapter Five: Interstates, Grade Separations, and Interchanges, Section 3.B, of this manual).

- **Spiral Transition Curves:** Spiral transition curves are preferred on Interstate ramps due to the higher percentage of truck traffic. (See Chapter Five: Interstates, Grade Separations, and Interchanges, Section 3.C, of this manual).

- **Intersection Sight Distance:** Intersections on New and Reconstructed projects should be designed for intersection sight distance for left-turns from a minor roadway based on a passenger car (Section 9.5.3.2.1, "Case B1 – Left-Turn from the Minor Roadway" "Intersection Control" in Chapter 9 of the *Green Book*): **ADE** approval is required if this condition cannot be met. (See Chapter Four: Intersections, Driveways and Channelization, Section 1.C.2, of this manual).

- **Intersection Skew:** When designing New and Reconstructed projects, a skew of 15° or less is preferred. Use of a skew angle greater than 15° requires **Unit Head** approval, with input from **Traffic Engineering**. Method A is used when there are excessive impacts on one side of the roadway, Method B is the preferred intersection realignment; Methods C and D should only be used under very low volume conditions or, if in urban areas, where a minimum distance is provided between the offset intersections. The final design of the realignment requires **Unit Head** approval. (See Chapter Four: Intersections, Driveways and Channelization, Section 1.C.3.a and EXHIBIT 4.8, of this manual).

- **Offset Right-Turn Lanes: NDOT** prefers the use of the tapered offset right-turn lane. **ADE** approval is required to design a parallel offset right-turn lane. (See Chapter Four: Intersections, Driveways and Channelization, Section 1.D.3 and EXHIBIT 4.12, of this manual).

- **Grading:** Variations from the typical grading section will require the approval of the **ADE** and the reasons for the variation will be documented in the project file. (See Chapter Six: The Typical Roadway Cross-Section, Section 9.B and EXHIBITS 6.8, 6.9, 6.10 and 6.16, of this manual).

- **Vertical Clearance:** For new structures it is desirable to include a 0.50 foot allowance for future resurfacing. (See Chapter Ten: Miscellaneous Design Issues, Section 2.E.1, of this manual).

9. NDOT FORM 76

NDOT Form 76, "Roadway Design – Principal Controlling Design Criteria", shall be filled-out for every New, Reconstructed, or 3R project. The completed NDOT Form 76 is circulated with the Plan-In-Hand Report and placed in the project file. The purpose of NDOT Form 76 is to highlight any design criteria used on the project which are less than the **AASHTO** minimum guidance (See Appendix H of this manual) and/ or the guidance in the *MDS* (Ref. 1.3). Such criteria will require a design exception and/ or a relaxation of the *MDS* (See Section 10 of this chapter).

9.A Instructions For Completing NDOT Form 76

9.A.1 Sources

1. **Design Guidance from the *MDS***. The designer should use the *MDS* (Ref. 1.3) to obtain the minimum design values for all projects.

2. **AASHTO Minimum Design Guidance** (See Appendix H of this manual). This guidance has been consolidated from the *I-State Green Book* (Ref. 1.2), the *Green Book* (Ref. 1.1), and the Roadside Design Guide (Ref. 1.7). Some items in Appendix H may be less restrictive than the guidance found in the *MDS*, the designer may use the **AASHTO** design guidance for these items to avoid requesting a design exception and as a justification for using a lower design value when requesting a relaxation of the *MDS*.

3. **NDOT Desirable Design Guidance** (See Section 8.C of this chapter). This listing gives the **NDOT** preferred guidance from the Nebraska Roadway Design Manual and from Roadway Design Division Policy Letters. These design values will be used on all projects, where practicable.

9.A.2 Instructions

NDOT Form 76 (See EXHIBIT 1.5) will be completed using the same format for all projects regardless of the level of approval authority.

Prior to filling out NDOT Form 76, the designer must determine whether the project is on the NHS and/ or if it is a RBP for Design. The designer may view maps showing the NHS routes in Nebraska at http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/nebraska/. The designer should check Clarity© to determine if a project is a RBP for Design.

The designer, using the planning document as a guide and in consultation with the **Unit Head**, will determine the design values to be used on a project for each of the controlling design criteria (See Section 8 of this chapter). Placing a design value which is less than the minimum design value in NDOT Form 76 will require written **Unit Head** approval and justification to the project file. The applicable minimum design value will be entered in NDOT Form 76, in parenthesis, after the chosen design value. This will highlight any departure from the minimum design guidance requiring a design exception and/ or a relaxation of the *MDS* (See Section 10 of this chapter).

Projects on the NHS: The designer may use the **AASHTO** minimum design values (See Appendix H of this manual) but should use the design values from the *MDS* (Ref. 1.3) as the minimum condition. By exceeding or meeting the *MDS* values it will not be necessary to request either a design exception or a relaxation of the *MDS*.

Projects not on the NHS: The designer will use the design guidance from the *MDS* (Ref. 1.3) as the minimum condition. If the minimum design values cannot be attained, the designer will need to request a relaxation of the *MDS* (See Section 10.B of this chapter). RBPs for Design not on the NHS which fail to meet the minimum design values will require a design exception (See Section 10.A.2 of this chapter) in addition to a relaxation of the *MDS*.

Note: When entering the appropriate minimum values into NDOT Form 76, give the source of the guidance (See EXHIBIT 1.5). The designer will enter the following abbreviations on the form:

- "Minimum Design Standards" = (MDS)
- "AASHTO Minimum Design Guidance" = (GB)
- Roadside Design Guide = (RDG)

For Interstate 3R projects, when using the **AASHTO** standards in effect at the time of the most recent New and Reconstructed project on the section of the Interstate, the following abbreviation will be used, including the year the standards were published:

- A Policy on Design Standards – Interstate System = (I-State, 2005).

All projects: If the designer cannot meet the *MDS* value for a design criterion, the **AASHTO** design guidance in Appendix H of this manual should be reviewed to see if that value may be used. The designer may use the **AASHTO** design guidance to avoid requesting a design exception and as a justification for using a lower design value when requesting a relaxation of the *MDS*. When choosing the design values to be used on a project, the designer and **Unit Head** should refer to the NDOT Desirable Design Guidance (See Section 8.C of this chapter), the Roadway Design Manual, and the "Roadway Design Division Policy Letters" for additional guidance. Deviation from these guidelines will require approval from the appropriate **Roadway Design Division** level of authority.

Roadway Design - Principal Controlling Design Criteria (1)

Project No: 77-3 (120)	**Control No.:** 12345	**Name:** Blue Springs North
Designer: FJB	**Unit Head:** KC	

	Roadway #1	**Roadway #2**
Highway or Local Road/Street (2) *Sta. to Sta. (RP to RP)*	U.S. 77 100+00 – 460+62 (13+34 – 20+17)	U.S. 77 625+88 – 982+28 (23+30 – 30+05)
On National Highway System?	Yes	Yes
FHWA RBP for Design? (3)	No	Yes
State Functional Classification	Major Arterial	Expressway
National Functional Classification	Arterial	Principal Arterial: Other Freeways & Expressways
On Priority Commercial System?(4)	Yes	Yes
ADT *(Current/ Design Year) (VPD)*	12,000	32,000
Number of Lanes	2 Lane	4 Lane Divided
Project Type (*New & Reconstructed/ 3R*)	New & Reconstructed	New & Reconstructed
Location (*Rural/ Municipal*)	Rural	Rural
CRITERIA	**DESIGN VALUE USED (MIN. DESIGN VALUE)**	**DESIGN VALUE USED (MIN. DESIGN VALUE)**
Design Speed *(mph)*	65 mph (50 mph, MDS)	70 mph (55 mph, MDS)
Lane Width *(ft.)*	12 ft. (12 ft., MDS)	12 ft. (12 ft., MDS)
Shoulder Width *(Total/Surf.-Rt./Lt.) (ft.)*	8 ft. Paved Both Sides (8 ft. Paved Both Sides, MDS)	8 ft. Paved Right/ 4 ft. Paved Left (8 ft. Paved Right/ 4 ft. Paved Lt., MDS)
Horizontal Alignment		
Superelevation *(Maximum e) (%)*	6% max. (8% max., MDS)	6% max. (8% max., MDS)
Minimum Curve Radius *(ft.)*	1,660 ft. (758 ft., MDS)	2,040 ft. (960 ft., MDS)
Vertical Alignment		
Crest K Value *(Minimum)*	327 (84, MDS)	289 (114, MDS)
Sag K Value *(Minimum)*	211 (96, MDS)	197 (115, MDS)
Maximum Grade *(%)*	3% Level, 4% Rolling (4% Level, 5% Rolling, MDS)	3% Level, 4% Rollin (4% Level, 5% Rolling, MDS)
Stopping Sight Distance *(Min.) (ft.)*	840 ft. (425 ft., MDS)	790 ft. (495 ft., MDS)
Cross Slope *(%)*		
Lane	2% (1.5% to 2%, MDS)	2% (1.5% to 2%, MDS)
Shoulder	4% (2% to 6%, MDS)	4% (2% to 6%, MDS)
Horizontal Clear Zone or Fixed Obstacle Clearance *(ft.)*	30 ft. (30 FT., MDS)	30 ft. (30 ft., MDS)
Lateral Offset to Obstruction *(ft.)*	8 ft. (The Nominal Shoulder Width, MDS)	8 ft. Right/ 4 ft. Left (The Nominal Shoulder Width, MDS)
Vertical Clearance *(ft.)*		
Structures	16.5 ft. (16 ft., MDS)	16.5 ft. (16 ft., MDS)
Sign Trusses and Pedestrian/ Bicycle Overpasses	17.5 ft. (Structure Clearance + 1 ft., MDS)	17.5 ft. (Structure Clearance + 1 ft., MDS)
Clear Bridge Width *(Face of Rail to Face of Rail) (New & Reconstructed/ 3R) (ft.)*	40 ft. (44 ft. MDS/ Full width of approach Roadway including paved shoulders and Pedestrian/ bicycle facilities = 40 ft., GB)	44 ft. (40 ft., MDS)
Structural Capacity *(Bridge Design Loading)*	HL 93 (HL 93, MDS)	HL 93 (HL 93, MDS)

(1) For additional information, see the Roadway Design Manual, Chapter One: Roadway Design Standards, Section 8. (http://dot.nebraska.gov/business-center/design-consultant/rd-manuals/)

(2) "Highway or Local Road/Street" is project-specific, roads may be listed individually or grouped together (e.g. mainline, ramps, county roads, arterials) if they have common design criteria.

(3) Risk Based Project. See the Roadway Design Manual, Chapter One: Roadway Design Standards, Section 10.

(4) For additional information, see the Roadway Design Manual, Chapter Six: The Typical Roadway Cross-Section, Section 2.A.1

MDS = Minimum Design Standards

GB = "AASHTO Minimum Design Guidance"

RDG = Roadside Design Guide

THIS PROJECT WILL REQUIRE A DESIGN EXCEPTION YES ☐ NO ☒

THIS PROJECT WILL REQUIRE A RELAXATION OF THE MINIMUM DESIGN STANDARDS YES ☒ NO ☐

NDOT Form DR-76, November 2022

Exhibit 1.5 Example NDOT Form 76

Non-Controlling Design Criteria (5)		
	Roadway #1	**Roadway #2**
Barrier Crashworthiness *(MASH or NCHRP 350 Compatible?)*	Yes	Yes
Hydraulic Design *(Drainage Manual, pg. 1-12)*		
Culvert *(Design Storm)*	50 yr.	50 yr.
Storm Sewer *(Design Storm)*	50 yr.	50 yr.
Pavement Design (*Pvmt Design Life/Proj Design Year*)	20 yr./ 2042	20 yr./ 2042
ADA Accessibility Will existing barriers to pedestrian accessibility be eliminated as part of this project? Does this project conform to the **NDOT** ADA design guidance as presented in Chapter Sixteen of the *RDM* and in NDOT Operating Instruction 60-10?	Yes ☐ No ☒ Yes ☒ No ☐	Yes ☐ No ☒ Yes ☒ No ☐

(5) For additional information, see the Roadway Design Manual, Chapter One: Roadway Design Standards, Section 8.

Notes:

Roadway #1:

A Relaxation of the Minimum Design Standards will be required for the bridge width at Station 145+20. A 40 ft. bridge width does satisfy the AASHTO Green Book value for a Rural Arterial (Roadway Design Manual, Appendix H, page H-9) so a Design Exception from the FHWA will not be required.

Approved by: _____/_____
Asst. Rdwy. Design Engineer Date

Approved by: _____/_____
Roadway Design Engineer Date

Approved by: _____/_____
District Engineer Date

Reviewed by: _____/_____
FHWA (If Risk Based Project) Date

NDOT Form DR-76, November 2022

Exhibit 1.5 Example NDOT Form 76

10. DEPARTURE FROM STANDARDS

The **AASHTO** minimum design guidance is presented in the *I-State Green Book* (Ref. 1.2), the *Green Book* (Ref. 1.1), and the Roadside Design Guide (Ref. 1.7). This guidance is consolidated in Appendix H of this manual. If the **AASHTO** minimum design guidance cannot be attained for one or more of the controlling design criteria for a project on the NHS, a design exception will be required. A design exception will also be required if the design guidance in the *MDS* (Ref. 1.3) cannot be attained for one or more of the controlling design criteria for a **FHWA** Risk Based Project (RBP for Design) which is not on the NHS. Documentation for the design exception will be included in the project file, as detailed in Section 10.A.2 of this chapter.

If the design standards in the *MDS* (Ref. 1.3) cannot be attained for one or more of the controlling design criteria for any project, a relaxation of the *MDS* will be required, as detailed in Section 10.B of this chapter, unless the project is classified as a Maintenance project. Documentation for the design relaxation will be included in the project file.

10.A Design Exceptions for Projects on the NHS and for Risk Based Projects

10.A.1 Oversight Authority for Departure from Standards

FHWA PROJECT APPROVAL AUTHORITY: FHWA retains full oversight and approval authority for design exceptions to the controlling design criteria for any project on the NHS which has been designated as a RBP for Design.

The designer should check Clarity© to determine if a project is a RBP for Design.

NDOT PROJECT APPROVAL AUTHORITY: Under the terms of the NDOT/FHWA Stewardship & Oversight Agreement (http://roads.nebraska.gov/media/6796/steward-oversight-agr.pdf), **NDOT** assumes oversight and approval authority for design exceptions to the controlling design criteria for any project on the NHS which is not designated as a RBP for Design and for any project designated as a RBP for Design which is not on the NHS.

10.A.2 Design Exception Documentation for RBPs for Design

RBPs for Design which are on the NHS: For RBPs for Design on the NHS that do not meet the **AASHTO** minimum design guidance (See Appendix H of this manual), a design exception document (See EXHIBIT 1.6) will be prepared for **FHWA** approval (See "Guidance on NHS Design Standards and Design Exceptions", https://www.fhwa.dot.gov/design/standards/qa.cfm). If the project does not meet the design standards found in the *MDS* (Ref. 1.3), the designer will also request a relaxation of the *MDS*, as detailed in Section 10.B of this chapter, before obtaining **FHWA** approval.

RBPs for Design which are not on the NHS: For RBPs for Design which are not on the NHS and do not meet the guidance found in the *MDS* (Ref. 1.3), a request for relaxation of the *MDS* will be prepared, as detailed in Section 10.B of this chapter, for both the project file and for approval by the **NDOT Deputy Director - Engineering**. This documentation does not require **FHWA** approval but will be transmitted to the appropriate **FHWA Transportation Engineer**.

Projects on the NHS which are not RBPs for Design: For projects on the NHS that do not meet the **AASHTO** minimum design guidance (See Appendix H of this manual), a design exception document will be prepared for both the project file and for approval by the **NDOT Deputy Director - Engineering**. This documentation will not be submitted to the **FHWA** for approval but will be transmitted to the appropriate **FHWA Transportation Engineer**. The designer will also request a relaxation of the *MDS* as detailed in Section 10.B of this chapter.

Projects meeting the minimum standards: The Plan-in-Hand Report will note those projects that meet the minimum design standards.

10.B Design Relaxations of the *MDS*

A request for a design relaxation letter will follow the **FHWA** memo "Guidance on NHS Design Standards and Design Exceptions" (https://www.fhwa.dot.gov/design/standards/qa.cfm) and will contain the following information:

- Specific design criteria that will not be met
- Existing roadway characteristics
- Alternatives considered
- Comparison of the safety and operational performance of the roadway and other impacts such as right-of-way, community, environmental, cost, and usability by all modes of transportation
- Proposed mitigation measures
- Compatibility with adjacent sections of roadway

"Design Speed" and "Design Loading Structural Capacity" are fundamental criteria in the design of a project and additional documentation is required for relaxations of these criteria. "Design Speed" relaxations should describe the length of the proposed section with a lower design speed compared to the overall length of the project and the measures that will be used in transitioning to adjacent sections with a different design speed. Documentation for relaxations of the "Design Loading Structural Capacity" should include verification of safe load-carrying capacity (load rating) for all State unrestricted legal loads or routine permit loads and, in the case of bridges and tunnels on the Interstate System, all Federal legal loads.

The request for relaxation of the *MDS* will be routed through the **NDOT Division Head** and will then be transmitted to the **NDOT Deputy Director-Engineering** for approval. After approval, the request will be sent to the **Secretary of the Board of Public Roads Classifications and Standards** at least ten working days prior to the board meeting at which it will be presented to the **Board of Public Roads Classifications and Standards** for their approval.

The request for a relaxation of the *MDS* will be presented to the **Board of Public Roads Classifications and Standards** in a power point format. The power point presentation will include location maps, aerial views and pictures of the location(s) of the relaxation, typical sections (existing, proposed, and standard), slides concerning crashes (not including protected information), costs to obtain standards, environmental impacts, etc. The designer or the **Unit Head** will schedule a meeting at least two weeks in advance of the board meeting to present the power point to the **NDOT Roadway Design Engineer**.

10.C Procedure for When Desirable Conditions Cannot be Attained

In those instances where it is not possible to meet the desirable design condition (See Section 8.C of this chapter), a decision document will be created (See EXHIBIT 1.7). The Design Decision Documentation Sheet, NDOT Form 335, may be used for this purpose. This document should be coordinated with the appropriate **NDOT Divisions** (e.g. **DE**, **Project Development**, **Traffic Engineering**) and by the appropriate level of supervision (such as the **Unit Head** or the **ADE**) and placed in the project file. For example: where it is not possible to design a temporary roadway to a design speed 10 mph less than the existing posted speed limit, the designer will detail the reasons why a lower design speed is necessary, obtain approval from the **Unit Head**, and coordinate with **Traffic Engineering**.

NEBRASKA
Good Life. Great Journey.
DEPARTMENT OF TRANSPORTATION

Pete Ricketts, Governor

December 1, 2017

Mr. Joseph Werning
Nebraska Federal Highway Administration
100 Centennial Mall Room 220
Lincoln, NE 68509-3803

Re: Project No. S-680-9(35)
C.N. 22632
Mormon Bridges
Design Exception Request

Dear Mr. Werning

Pursuant to the Code of Federal Regulations (CFR) 625.3(f), exceptions may be approved on a project basis for designs that do not conform to the minimum or limiting criteria set forth in the standards, policies, and standard specifications adopted in 23 CFR 625. FHWA identified 10 Controlling Criteria as having substantial importance to the operational and safety performance of any highway. The Nebraska Department of Transportation (NDOT) is requesting an exception for two of these criteria, shoulder width and vertical clearance. NDOT is requesting the existing one foot inside and outside shoulder width and 15.69 foot vertical clearance for the I-680 eastbound bridge over the Missouri River at reference post (RP) 13.43 to remain in place.

NDOT is developing plans to make 3R improvements to the Mormon Bridges on I-680 over the Missouri River at Reference Post 13.43 between Douglas County, Nebraska and Pottawattamie County, Iowa. The Nebraska Board of Public Roads Classifications and Standards approved the relaxation of standards on October 20, 2017 (see attached request letter and approval letter).

NDOT will engage in mitigation strategies to address the shoulder width and vertical clearance design exception of the eastbound structure. These strategies include providing a "Low Clearance" sign in advance of the structure and a "Bridge Clearance 15'-6"" sign at the first eastbound truss. The bridge width will be mitigated with delineators and object markers on the guardrail approaches to the eastbound bridge.

After evaluation, NDOT staff has concluded it is in the public's interest to make 3R improvements to the existing I-680 eastbound Mormon Bridge. We request FHWA to approve this exception to the Minimum Design Standards for Shoulder Width and Vertical Clearance.

Sincerely,

Mike Owen, P.E.,
Roadway Design Engineer

Attachment: Location Map
Request letter to Nebraska Board of Public Roads Classifications and Standards
Excerpt from 10/20/17 Nebraska Board of Public Roads Classifications and Standards

FHWA Concurrence _____ Date _____

Department of Transportation
1500 Highway 2
PO Box 94759
Lincoln, NE 68509-4759
OFFICE 402-471-4567 FAX 402-479-4325
NDOT.ContactUs@nebraska.gov
dot.nebraska.gov

Exhibit 1.6 Example Design Exception Request Letter

Design Decision Documentation Sheet

Project No.: S-80-9(1215)	Control No.: 22646	Date: 2/2/2018

Project Name/Location: I-480 - 24th Street, Omaha

Designer: Brian Johnson

Item/Subject: WB I-80 Retaining Wall at MM 453.2

Identify Design Guideline/Desirable Condition:

As per the Board of Public Roads Classifications and Standards, New and Reconstructed Municipal Interstate, the shoulder width with truck traffic exceeding 250 DHV are to be 12 feet paved.

A relaxation was granted by the Board of Public Roads on September 16, 2016 for a design which reduces the shoulders of I-80 in 5 locations so as to allow the four lane section to become six lanes. In particular, the westbound outside shoulders under the 24th Street Bridge would be restricted by the existing bridge piers to a width of 8.8 feet for 380 linear feet, then tapers out to 12 feet wide for another 750 linear feet before tapering in to a shoulder width of 6.2 foot at the WB 24th Street on-ramp bridge barrier for 300 linear feet.

To provide the approved shoulder tapering, an existing WB concrete barrier on the outside shoulder will be removed, pavement widened by 4 feet and the concrete barrier reconstructed.

Reason Design Guideline/Desirable Condition Will Not be Met: ***(Cost, ROW, etc.)***

A survey of WB I-80 did not include an existing 200 foot long retaining wall along the outside shoulder prior to the 24th Street on-ramp nor was a wall designed at that location to be suppport the widened pavement. Bridge Division proposed designing a steel sheet pile wall with concrete coping to support the pavement widening with granular material to fill the void with the existing retaining wall. The steel sheet pile wall is estimated at $300,000.

Design Solution Used and Why:

The outside shoulder for westbound I-80 can remain as is and will provide a consistent 8.8 foot shoulder until reaching the 6.2 foot shoulder as the 24th Street on-ramp enters I-80. Although the widening of the concrete barrier provide a 12 foot shoulder for 750 feet is desirble, the tapering of the barrier after the 24th Street Bridge piers (within a tangent section) and at the 24th Street on-ramp (which occurs at the beginning of a curve) would potentially be confusing to a driver's perception.

A comparison of the 12 foot shoulder versus the 8.8 foot shoulder using Interchange Safety Analysis Tool, enhanced, or ISATe, produced a distribution of crashes that there would be effectively no change. The attached ISATe document shows the expected distribution of crashes for three alternatives:

1-Top table is a four lane roadway using the existing geometrics

2- Middle table is a six lane roadway with all shoulder restrictions used in the relaxation, except that the WB outside shoulder was assumed to be a constant 6 foot width in this area for the ease of creating the spreadsheet. Adding the concrete barrier tapers would have been extensive.

3- The bottom graph is a six lane roadway with the extensive sectioning of the roadway to create the 12 foot shoulders with tapers.

Review/Comment by Others: ***(District, Traffic, M&R, Wetlands, etc.)***

Attached Documentation: ***(Photograph, Email, etc.)*** none

Approval: _____ _____ ***OR*** Approval Document Attached
(Name) *(Print Name)*

NDOT Form 335, November 2017

Exhibit 1.7 Example Design Decision Documentation Sheet

11. REFERENCES

1.1 American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets (*Green Book*), Washington, D.C., 2018.

1.2 American Association of State Highway and Transportation Officials, A Policy on Design Standards Interstate System (*I-State Green Book*), Washington, D.C., 2016.

1.3 Board of Public Roads Classifications and Standards, Nebraska Minimum Design Standards (*MDS*), Current Edition. (http://www.roads.nebraska.gov/media/5593/nac-428-rules-regs-nbcs.pdf)

1.4 Federal Highway Administration, Highway Functional Classification Concepts, Criteria and Procedures, U.S. Department of Transportation, FHWA, Washington, D.C., 2013. (https://www.fhwa.dot.gov/planning/processes/statewide/related/highway_functional_classifications/fcauab.pdf)

1.5 Reissue Revised Statutes of Nebraska, Laws Applicable to the Nebraska Department of Transportation (Containing Chapter 3, Aeronautics; Chapter 39, Highways and Bridges; Chapter 49, Laws, Article 8, Definitions, Construction, and Citation; Chapter 60, Motor Vehicles, Article 6, Nebraska Rules of the Road; and Chapter 81, Article 7, Department of Transportation), July 2017 (https://nebraskalegislature.gov/laws/browse-statutes.php)

1.6 Nebraska Department of Transportation, NDOR/FHWA Stewardship & Oversight Agreement, October 2006 (http://roads.nebraska.gov/media/6796/steward-oversight-agr.pdf)

1.7 American Association of State Highway and Transportation Officials, Roadside Design Guide, Washington, D.C., 2011.

1.8 Title 23 of the Code of Federal Regulations (*23 CFR*) (https://www.fhwa.dot.gov/legsregs/directives/cfr23toc.htm)

1.9 Federal Highway Administration, Bridge Preservation Guide, U.S. Department of Transportation, FHWA, Washington, D.C., Spring 2018. (https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf)