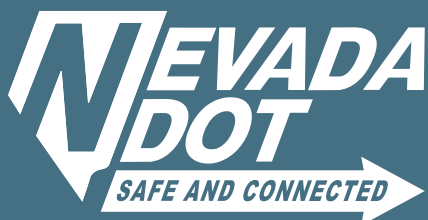


NEVADA DEPARTMENT OF TRANSPORTATION

Road Design Guide

2019
Edition



Brian Sandoval
Governor

Rudy Malfabon P.E.
Director

Scott Hein P.E.
Chief Road Design



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NDOT Director

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Chief Roadway Design Engineer

This guide has been prepared for the Nevada Department of Transportation's engineering personnel, divisions, other agencies, and contracted consultants.

The intent of this guide is to establish uniform design criteria, review important geometric elements for consideration, and to provide additional information to supplement the AASHTO publication "A Policy on Geometric Design of Highways and Streets." The criteria and information in this Road Design Guide is intended to be used in conjunction with the NDOT Publications "Standard Plans for Road and Bridge Construction" and "Standard Specifications for Road and Bridge Construction" during the design of projects. A list of other referenced publications can be found in [Section 3.15](#).

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SECTION 1 DESIGN POLICY

1.0 Policy

The policies and procedures presented in this guide are intended to provide guidance and direction to NDOT staff, consultants and those wishing to complete work within NDOT right-of-way. This guide does not contain all NDOT policies but covers those which have the largest impact during the project design phase.

In addition to the policies and procedures outlined in this section, NDOT follows the requirements outlined in the Stewardship Agreement executed in May of 2015 between NDOT and the Federal Highway Administration (FHWA), hereinafter referred to as the "Stewardship Agreement." The Stewardship Agreement defines the roles and responsibilities of FHWA and NDOT.

Under the Stewardship Agreement, FHWA had delegated responsibility for various approvals to NDOT. However, FHWA may retain the approval for various activities on Projects of Divisional Interest (PoDIs).

PoDIs are projects that FHWA has identified as having an elevated risk, contain elements of higher risk, or present a meaningful opportunity for FHWA involvement to enhance meeting program or project goals. They are selected by the local Division office of FHWA on an annual basis. PoDI project selection is risk-based and oversight activities are established and documented in a PoDI plan. This may include project approvals, or oversight activities related to a specific phase or element of the project.

Major Projects (>\$500M) are always PoDI. This applies to projects on and off the NHS. Other projects may be selected as a PoDI. Each PoDI will have a PoDI plan, developed by FHWA, that identifies the role and level of involvement of FHWA.

1.1 Americans with Disabilities Act (ADA)

It is NDOT's policy to comply with the requirements of the Americans with Disabilities Act (ADA) to the fullest extent possible. The ADA was signed into law in 1990 and is comprised of five titles that cover different aspects of public life. Title II (State and Local Government) applies to the programs, services and activities of NDOT. One of the requirements under Title II of the ADA is that NDOT must ensure that its facilities are accessible. NDOT has adopted the proposed Public Rights-of-Way Accessibility Guidelines (PROWAG) as its design standard for transportation projects within NDOT right-of-way. All new construction of pedestrian facilities shall follow PROWAG.

Existing pedestrian facilities (curb ramps, driveways, sidewalks, etc.) when reconstructed shall follow PROWAG. Projects which are deemed as alterations require that the curb ramps be updated to current proposed PROWAG standards. Curb ramps that meet the 1991 ADA Accessibility Guidelines (ADAGG) may be left in place. If right-of-way constraints limit NDOT's ability to incorporate improvements to the curb ramps, the ramps will be addressed in accordance with the NDOT Americans with Disabilities Act Transition Plan.

Improvements to traffic signals which impact the signal poles and/or pedestrian push buttons will include updating the pedestrian push buttons to meet the current proposed PROWAG standards. If right-of-way constraints limit NDOT's ability to incorporate improvements to the pedestrian push buttons, the pedestrian push buttons will be addressed in accordance with the NDOT Americans with Disabilities Act Transition Plan.

Other improvements to pedestrian facilities should be considered during the development of the scope of work of a project and be included when possible. If not included in the project, the improvements will be addressed in accordance with the NDOT Americans with Disabilities Act Transition Plan.

See "NDOT Americans with Disabilities Act Transition Plan," for more information regarding the transition plan and for the definition of alterations.

1.2 Approaches

To enhance the safety and integrity of its roadways, NDOT's policy on projects outside of the urban areas without curb and gutter is to upgrade the existing approaches to current minimum standards and pave them. Unpermitted approaches will be improved and paved if the approach owner obtains an encroachment permit for the approach.

SECTION 1 DESIGN POLICY

The fee for the encroachment permit for the approach will be waived. The costs of improving and paving approaches will be covered by NDOT.

This policy is not intended to encourage access where access is not commonly needed or used, therefore this does not apply where there is no well-defined approach or to periodically used approaches, such as those at seldom-used stock gates in rural areas.

1.3 Bicycle Facilities

Bicycles and pedestrians are to be expected at any time on all public roadways except for a few specifically designated prohibitions which only occur on controlled-access facilities in selected urban areas. Overall, less than 1% of Nevada's roadways (by centerline miles) have been designated as prohibited to bicycles and pedestrians. Even within the NDOT maintained system, the number is less than 4%.

It must be assumed that bicycles and pedestrians may, and will, use all the remaining 99+% of roadway miles at any time. This includes adequate and appropriate accommodation during all construction and maintenance activities.

To comply with NDOT's Complete Streets policy, the addition or improvement of bicycle facilities should be considered on all projects.

Bicycle and pedestrian facility design, pavement markings, and signage shall conform to the appropriate standards and guidance and coincide with community wayfaring schemes as appropriate.

Prohibitions may only be implemented when comparable, safer alternatives exist within the highway, bikeway and walkway networks and must follow the process outlined in NRS 484B.593. There is no federal or state law mandating prohibition of bicycles or pedestrians on highways (including controlled access facilities/freeways) due to the existence of alternative roadways. Statistically, bicycles and pedestrians are, in many cases, safer on controlled access highways than on alternative roadways. Prohibitions of bicycles and pedestrians are generally considered due to issues related to the crossing of heavy, or complex, multi-lane ramp movements. Bicycle and pedestrian prohibitions should also provide adequate alternative wayfaring signage around the prohibition if users are being removed from a facility.

Bicycle elements of approved local and state planning documents must be considered in the development of any project. The bicycle elements are found within:

- Nevada Statewide Bicycle Plan
- NDOT Rural County Bicycle Plans
- Metropolitan Planning Organization's (MPO's) Bicycle Planning Elements of their Regional Transportation Plans
- Local Community Master Plans

All areas of the state are covered by NDOT bicycle plans at a minimum. These plans can be found at www.bicyclenevada.com.

Provisions for bicycle accommodation on a highway corridor may range from the development of a specifically designated bicycle facility to the inclusion of shared lanes. Facility types may include:

- On-Highway facilities (Bike Lanes, Shared Travel Lanes, use of shoulders, etc.); and
- Off-Highway facilities (Shared-Use Paths, etc.)

Bicycle accommodations may involve the acquisition of additional highway footprint or reallocation of existing highway space (reconfigurations, including vehicular travel lanes) as appropriate.

Bicycle networks should be clearly distinguished, rideable, and provide safe connectivity, both on-highway and off-highway, between facilities. Logical, safe, and rideable transitions between bicycle facility types should be provided at all confluence points. Designs should allow for bicyclists to effectively use the roadway and bicycle networks without dismounting or transitioning to a pedestrian mode.

SECTION 1 DESIGN POLICY

The safe accommodation of bicycles on affected highways during construction must be provided for all temporary traffic control plans. Prohibitions or discouragement of bicycles through construction areas without appropriate, safe, and comparable detouring, as outlined in standard guidelines, or safe accommodation through the construction area, shall not be allowed. Under state law, bicycles are to be afforded the same rights as vehicles.

Designs should take advantage of opportunities to provide separation of modes, without diminishment of mobility or access to destinations, whenever possible.

Consideration of how bicyclists will safely ride and legally navigate the highway will be part of every designed project. If proposed bicycle facilities are not a part of the scope of the designed project, sufficient room for their future construction should be considered and should be included in the right-of-way width requirement.

1.4 Complete Streets

Complete Streets is an approach to designing and operating transportation facilities for all users, including bicyclists, pedestrians, motorists, and transit riders of all ages and abilities. NDOT has adopted a policy to consider Complete Streets design on all transportation improvement projects, with the exception of controlled-access facilities where pedestrians and bicyclists are prohibited from using the roadway. The safety and mobility needs of all users should be addressed on all projects, regardless of funding, to the highest extent possible.

For more details on the NDOT Complete Streets Policy, see [NDOT Complete Streets Policy](#), current edition.

1.5 Change in Control of Access

In conformance with 23 USC 111, NDOT requires approval of a Change in Control of Access (CCOR) when there is a change to the access on the Interstate or state-maintained highways. Under the Stewardship Agreement, the Federal Highways Administration (FHWA) retains the right of approval for the Interstate system and the Department approves changes to state-maintained routes. When submitting CCOR documentation, follow the steps as described in [Section 1.8 Geometric Approvals](#).

1.6 Design Exceptions

It is NDOT's policy to design facilities to meet design standards to the fullest extent possible. NDOT uses the AASHTO's A Policy on Geometric Design of Highways and Streets design criteria. Of those, FHWA has established ten controlling criteria. Design exception documentation is required whenever these ten controlling criteria can't be met. FHWA reviews this documentation on Interstate projects, and the documentation is offered for review on other freeway projects, but may not be required. It is preferred to combine design exception documentation with the geometric approval on projects that require both. When submitting design exception documentation, follow the steps as described in [Section 1.8 Geometric Approvals](#).

The ten controlling criteria are:

1. Design Speed
2. Lane Width
3. Shoulder Width
4. Horizontal Curve Radius
5. Superelevation Rate
6. Stopping Sight Distance (SSD)
7. Maximum Grade
8. Cross Slope
9. Vertical Clearance
10. Design Loading Structural Capacity

All 10 controlling criteria apply to high-speed (i.e., Interstate highways, other freeways, and roadways with design speed 45 mph or greater) roadways on the NHS. The SSD applies to horizontal alignments and vertical alignments except for sag vertical curves. On low-speed roadways (i.e., non-freeways with design speed less than 45 mph) on the NHS, only the following two controlling criteria apply:

SECTION 1 DESIGN POLICY

1. Design Loading Structural Capacity
2. Design Speed

1.7 Design Documentation

Design exceptions, subject to approval by FHWA (or on behalf of FHWA as a Special Temporary Authority (STA) granted to NDOT through a Stewardship and Oversight agreement), are required for projects on the NHS only when the controlling criteria are not met. The FHWA expects documentation of design exceptions to describe all of the following:

- 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. Exceptions to these criteria should be extremely rare and FHWA expects the documentation to provide the following additional information:

- Design Speed exceptions:
 - Length of section with reduced design speed compared to overall length of project.
 - Measures used in transitions to adjacent sections with higher or lower design or operating speeds.
- Design Loading Structural Capacity exceptions:
 - 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, all Federal legal loads.

The FHWA encourages agencies to document all design decisions to demonstrate compliance with accepted engineering principles and the reasons for the decision.

Search the Federal Register for Document Number FHWA-2015-0020 for further information.

Additionally, under the Stewardship Agreement, FHWA had delegated responsibility for approval of design exceptions to NDOT. However, FHWA may retain the approval of design exceptions on Projects of Division Interest (PoDIs).

1.8 Geometric Approvals

NDOT requires geometric approval documentation on all projects that have a new alignment or significant changes to existing vertical and/or horizontal alignments (overlays do not require this documentation). Under the Stewardship Agreement, FHWA has delegated responsibility for approval of geometrics to NDOT. FHWA reviews the geometric approval documentation on Interstate projects, and the documentation is offered for review on other freeway projects, but may not be required.

The steps for completing a Consultant prepared geometric approval or design exception are as follows:

1. The Consultant submits to the Project Manager (PM) a stamped geometric approval package along with a cover letter that states the geometrics meet AASHTO standards as well as any Department standards. The geometric approval package includes the stamped title sheet, typical sections, plan and profile sheets, location control sheets, geometric detail sheets (if applicable), and striping sheets.
2. After the PM has reviewed the package, he/she sends the geometric approval package to the Assistant Chief Roadway Design Engineer (ACRDE), along with a memo, for official approval. The memo states that the NDOT Design team has had a chance to review and make comments, and agrees the geometrics meet AASHTO and Department standards.
3. The ACRDE will review and then prepare the official NDOT geometric approval memo and send it to the Chief Roadway Design Engineer (CRDE) for signature along with the geometric approval package.

SECTION 1 DESIGN POLICY

4. The CRDE will review and sign the geometric approval, then send signed copies to the FHWA (as required) and the Assistant Director of Engineering.
5. Signed copies will be provided to the PM and/or Principal Roadway Design Engineer (PRDE) to be filed in the project records on ProjectWise.

The steps for completing geometric approvals or design exceptions for in-house designs are as follows:

1. The PRDE reviews and comments on the geometric approval package consisting of title sheets, typical sections, plan and profile sheets, location control sheets, geometric detail sheets (if applicable), and striping sheets.
2. After the PRDE has reviewed the geometric approval package, he/she sends it to the ACRDE with a memo stating that the NDOT Design team has had a chance to review and make comments, and agrees the geometrics meet AASHTO and Department standards.
3. The ACRDE will review and then prepare the official NDOT geometric approval memo and send it to the CRDE for signature along with the geometric approval package.
4. The CRDE will review and sign the geometric approval, then send signed copies to the FHWA (as required) and the Assistant Director of Engineering.
5. A signed copy will be provided to the PRDE to be filed in the project records on ProjectWise.

1.9 Pedestrian Facilities

Pedestrian elements of approved local and state planning documents must be considered in the development of any project. Pedestrian planning elements are found within:

- Metropolitan Planning Organization's (MPO's) Pedestrian Planning Elements of their Regional Transportation Plans
- Local Community Master Plans
- NDOT ADA Transition Plan

Provision for pedestrian accommodation on a highway corridor may range from the development of a specific designated pedestrian facility or be as simple as shared use of the highway facility.

Facilities types can include:

- On-Highway facilities (adequate shoulders, refuge islands, etc.)
- Off-Highway facilities (Sidewalks, Shared-Use Paths, etc.)

Pedestrian accommodation may involve the acquisition of additional highway footprint or reallocation of existing highway space (reconfigurations including vehicular travel lanes) as appropriate.

Pedestrian networks should be clearly distinguished, walkable, ADA compliant, and provide safe connectivity, both on-highway and off-highway, between facilities. Logical, safe, accessible transitions between pedestrian networks should be provided at all confluence points.

The safe accommodation of pedestrians on affected highways during construction shall be provided for in all temporary traffic control plans. Prohibitions or discouragement of pedestrians through construction areas without appropriate, safe, comparable detouring, as outlined in standard guidelines, or safe accommodation through the construction area, shall not be allowed.

Designs should take advantage of opportunities to provide separation of modes, without diminishment of mobility or access to destinations, whenever possible.

Consideration of how pedestrians will safely walk and legally navigate the highway will be a part of every designed project. If proposed pedestrian facilities are not a part of the scope of the designed project, sufficient room for their future construction should be considered and should be included in the right-of-way width requirement.

SECTION 1 DESIGN POLICY

1.10 Public Interest Findings

In conformance with federal and state regulations, NDOT requires a public interest finding for the following conditions:

1. Use of publicly owned equipment
2. Contractor purchased equipment for state ownership
3. Use of convict produced materials
4. Use of patented or proprietary products
5. Use of state preferred materials
6. Use of state owned or furnished materials or products

Approval of a public interest finding has been delegated to NDOT under the Stewardship Agreement. The Chief Roadway Design Engineer must approve public interest findings. However, FHWA may retain approval on PoDIs.

See the FHWA Contract Administration Core Curriculum Participant's Manual and Reference Guide at <http://www.fhwa.dot.gov/programadmin/contracts/coretoc.cfm> for more information.

1.11 Public Involvement

NDOT's policy is to involve the public in the development of all capacity projects. Other projects may be considered for public involvement on a case by case basis. This policy is carried out through the National Environmental Policy Act (NEPA) process in coordination with the Environmental Division, the Public Information Division and FHWA. Some improvements outside of capacity projects that may require public involvement include:

1. Changes to access
2. Elimination of on-street parking
3. Addition of street lighting
4. Traffic control

1.12 Resolution of Support

NDOT in compliance with NRS 408.403, shall seek approvals or Resolution of Support from other local public agencies when working within their jurisdictions on freeways. Further, under NRS 408.397, NDOT shall seek approval from the governing board of any city or town that it is proposed to change or divert a highway to exclude that city or town.

1.13 Safety

NDOT shall consider safety improvements, including recommendations from Road Safety Audits (RSA), on all projects and shall discuss those improvements with Safety Engineering.

1.14 Transportation Management Plans

All projects shall require a Traffic Management Plan (TMP). For more information, see the Work Zone Safety and Mobility Implementation Guide at <https://www.nevadadot.com/home/showdocument?id=4756>.

1.15 Landscape and Aesthetics

It is NDOT's policy that the Landscape & Aesthetics Program be considered on all transportation projects. The Program will apply to the entire NDOT-managed highway system. The Landscape & Aesthetics Program emphasizes regionally appropriate material and drought-tolerant plants.

The Landscape & Aesthetic treatment types and levels have been identified on all major highways. The treatment types and levels are shown in the corridor plans and can be found at <https://www.nevadadot.com/projects-programs/landscape-aesthetics>. For those roads not covered by a specific corridor plan, the treatment types and levels are determined using NDOT's Landscape & Aesthetics Master Plan and a nearby corridor plan, when appropriate.

SECTION 1 DESIGN POLICY

Approximately three percent (3%) of the total construction costs on all new construction and capacity improvements is allocated to the landscape and aesthetic treatments.

Some treatments that improve the appearance of the highway are part of the normal construction practice. These treatments are required for safety or environmental mitigation and are considered standard construction costs. They do not count towards the required percentage of landscape and aesthetic costs. Some examples include rock mulch and re-vegetation for erosion control, standard surface treatments including rustication on concrete surfaces, paint on sound walls and retaining walls, standard painting on bridge structures, and painting or integral color for concrete barrier rails. For further direction or clarification of costs, see the Senior Landscape Architect.

On projects impacting existing facilities, existing painted or stained elements such as bridges, walls and barrier rail will be painted or stained with the standard corridor colors within the project limits, even if they are not directly impacted by construction. The cost of painting or staining these elements is considered a base cost and is not part of the Landscape & Aesthetics Program budget.

In some cases, where there is already a standard concrete surface treatment, such as fractured fin or standard rustication, the cost difference between the standard treatment and the enhanced treatment counts towards the landscape and aesthetics costs.

1.16 Stormwater and Low Impact Development

It is NDOT's policy that Low Impact Development (LID) strategies be implemented on all transportation projects, where feasible. LID is an approach to managing stormwater as close to its source as possible using nonstructural permanent measures including minimizing site disturbance, increasing sheet flow, slope flattening, and utilizing vegetation and natural drainage. In addition, LID utilizes various types of basins, filters, and surfaces to treat run-off close to the run-off source.

Additional information on LID and stormwater design can be found in NDOT's [Stormwater Quality Manuals Planning and Design Guide](#).

1.17 Tree Removals

NDOT considers trees as an asset. Therefore, it is NDOT's policy that any significant trees, with trunk diameter 4 inches (4") or greater, scheduled to be removed under a project shall require approval from the Chief Road Design Engineer. The policy also requires that NDOT mitigate the removal of significant trees through a mitigation plan created by the Landscape Architecture Section of the Design Division. See [Section 4.25 Removal Items](#) for more details.

1.18 Value Engineering/Analysis

In conformance with 23 USC 106 and 23 CFR 627, NDOT will conduct value engineering (VE) on all federally-funded projects on the NHS with an estimated total project cost equal to or greater than \$50,000,000 and on all federally-funded bridge projects on the NHS with an estimated total project cost equal to or greater than \$40,000,000. The total project costs must include the costs associated with environmental studies, preliminary engineering, final design, right-of-way acquisition and construction.

NDOT has adopted a policy to complete VE on all projects greater than or equal to \$25,000,000 on the NHS and to consider them for all projects exceeding \$10,000,000. In addition, the policy requires VE prior to the release of a request for proposals on a design-build project for all NHS projects greater than or equal to \$25,000,000.

SECTION 2 DESIGN CRITERIA

2.0 Design Criteria

This section establishes a range of design criteria for high speed and low speed facilities. Use the design criteria that is appropriate for the specific roadway, terrain, AADT, and land use. For information that describes roadway categories and other design standards, roadway characteristics, access control, and general design features, refer to the **Access Management System and Standards 2017 Edition**.

Refer to the **AASHTO "A Policy on Design Standards - Interstate System" 2016 Edition** for other specific design criteria for Interstate Systems. In Nevada, the interstate standard only applies to I-11, I-15, I-215, I-515, I-80 and I-580. Other freeways on the NHS, but not on the interstate, shall be designed to **AASHTO "A Policy on Geometric Design of Highways and Streets" 2018 7th Edition (2018 Green Book)** standards.

The criteria listed below are intended for new construction or capacity type improvements. Low Speed facilities are defined as less than 45 mph and High Speed facilities are defined as 45 mph and greater.

2.1 High Speed Facilities (45 mph or Greater)

GENERAL CRITERIA					
Design Element	Desirable Criteria	Minimum Criteria	Reference		Comments
Design Vehicle	WB-67	*	<i>2018 Green Book</i> , Page 2-58		See design vehicle in Section 3.1 for further guidelines
Design speed Mainline (Rural)	70 mph	*	<i>2018 Green Book</i> , Page 8-2 (Freeway)	<i>2018 Green Book</i> , Page 7-3 (Arterial)	Need to consider terrain, adjacent land use, and functional class. See Section 3.1
Design speed Mainline (Urban)	70 mph (Freeway)	*	<i>2018 Green Book</i> , Page 8-2 (Freeway)		Need to consider terrain, adjacent land use, and functional class. See Section 3.1
Lane width (Mainline)	12'	*	<i>2018 Green Book</i> , Page 8-3		See lane width in Section 3.6 for further guidelines
Lane width (Ramp)	12'	*	<i>2018 Green Book</i> , Page 10-121		For ramp radius less than 500' consider wider travel lane width for off-tracking
Shoulder width (Mainline) (RT)	10' *	*	<i>2018 Green Book</i> , Page 8-3		Widths shown include lateral offset for guardrail/barrier rail
Shoulder width (Mainline) (LT)	4' - 10' (10' for three or more lanes)	*	<i>2018 Green Book</i> , Page 8-3		Number of lanes changes the shoulder widths see Section 3.7
Shoulder width (Ramp) (RT)	8'	*	<i>2018 Green Book</i> , Page 10-121		Widths shown include lateral offset for guardrail/barrier rail see Section 3.7
Shoulder width (Ramp) (LT)	4' (Freeway)				
Bridge shoulder width	4' (Accommodate future build out)	*	<i>2018 Green Book</i> , Page 10-21		See design year (bridge projects) in Section 3.1 for other considerations

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

HIGH SPEED FACILITIES (45 MPH OR GREATER)

HORIZONTAL ALIGNMENT				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Minimum radius (Mainline)	6% Table	*	<i>2018 Green Book</i> Page 3-43 (Table 3-9)	8% may be considered in Southern Nevada
Minimum radius (Ramps)	6% Table	*	<i>2018 Green Book</i> Page 3-43 (Table 3-9)	8% may be considered in Southern Nevada
Minimum radius (Loop Ramps)	25 mph	*	<i>2018 Green Book</i> Page 10-106	8% may be considered in Southern Nevada.
Minimum tangent between curves	Sum of Superelevation Runoff and Runout lengths	*	<i>2018 Green Book</i> Page 3-61 (Section 3.3.8)	

VERTICAL ALIGNMENT				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Crest vertical curve "K" Value	Design Speed	*	<i>2018 Green Book</i> Page 3-169 (Figure 3-37) and 3-170 (Table 3-35)	Grades greater than 3% require additional consideration
Sag vertical curve "K" Value	Design Speed	*	<i>2018 Green Book</i> Page 3-174 (Figure 3-44) and 3-176 (Table 3-37)	Check against headlight sight distance in Section 3.8
Interstates - NHS	1000' on Interstate Systems	Minimum length of Vertical Curve = 3X Design Speed for NHS and other State Routes	NDOT Policy	

SUPERELEVATION				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
e_{max} (Method 5)	6%	*		Cross slope of 8% may be considered in Southern Nevada
Minimum Runoff Length	Use Equation 3-23, <i>2018 Green Book</i> , Page 3-63	*	<i>2018 Green Book</i> , Page 3-66 (Table 3-16a)	See "Table 3-15 Adjustment Factor for Number of Lanes Rotated", <i>2018 Green Book</i> , Page 3-64. No runoff or run-out on bridge structures, if possible. If not possible, consider extending runoff or run out through bridge structure. Link to Superelevation Calculation Worksheets.
Minimum Tangent Runout	Use Equation 3-24, <i>2018 Green Book</i> , Page 3-70	*	<i>2018 Green Book</i> , Page 3-66 (Table 3-16a)	
% of runoff on tangent	67%	*	<i>2018 Green Book</i> , Page 3-70	

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

HIGH SPEED FACILITIES (45 MPH OR GREATER)

GRADES				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Maximum Grades for Rural and Urban Freeways	3% to 6% Depending on Terrain	*	<i>2018 Green Book</i> , Page 8-5 (Table 8-1)	
Curb and gutter facilities	0.3% or greater slope	Not less than .02% in very flat terrain	NDOT Policy	NDOT Drainage Manual 2006 Edition, Section 3.3.2.2

SIGHT DISTANCE				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Stopping (Mainline)	Based on Design Speed	*	<i>2018 Green Book</i> , Page 3-4 (Table 3-1)	If grade is greater than 3%, see "Table 3-2. Stopping Sight Distance on Grades," <i>2018 Green Book</i> , Page 3-6
Stopping (Ramps)				
Stopping (Urban Arterials)			<i>2018 Green Book</i> , Page 3-11 (Table 3-4)	Adjustment factor for grades is not available, use engineering judgment for adjusting distances
Passing Sight Distance				
Intersection Sight Distance		*	<i>2018 Green Book</i> , Pages 9-35 thru 9-58	Sight distance is based on various cases.
Horizontal Curve (Middle Ordinate)		*	<i>2018 Green Book</i> , Pages 3-113 thru 3-119	See "Figure 3-13. Diagram Illustrating Components for Determining Horizontal Sight Distance," <i>2018 Green Book</i> , Page 3-115.

SINGLE-LANE RAMP DESIGN

ACCELERATION LANES				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Gap Acceptance Length (Lg)		500' to 300' (based on nose width)	<i>2018 Green Book</i> , Page 10-129	See "Figure 10-72, Note 3," <i>2018 Green Book</i> , Page 10-129
Acceleration length			<i>2018 Green Book</i> , Pages 10-132 and 10-134	See "Table 10-4" or as adjusted by "Table 10-5," <i>2018 Green Book</i> , Page 10-132
Taper-Type Taper (Lane Merge)	70:1	50:1	<i>2018 Green Book</i> , Page 10-129	
Parallel-Type Taper (lane Merge)	500'	300'	<i>2018 Green Book</i> , Page 10-130 thru 10-131	Parallel-type entrance ramps are preferred

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

HIGH SPEED FACILITIES (45 MPH OR GREATER)

DECELERATION LANES				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Deceleration Length		*	<i>2018 Green Book</i> , Page 10-138 (Figure 10-6)	Minimum Deceleration lengths with flat grades or than 3%.
Parallel-Type Taper (Add Lane)		250'	<i>2018 Green Book</i> , Page 10-137 (Figure 10-73)	
Taper-Type Exit Divergence Angle	2° - 5°	*	<i>2018 Green Book</i> , Page 10-133	Divergence angle is usually between 2° and 5°

TWO-LANE RAMP DESIGN

ACCELERATION LANES				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Gap Acceptance Length (Lg)	500'	300'	<i>2018 Green Book</i> , Page 10-145 (Figure 10-76)	Gap acceptance is increased when volume exceeds capacity in Highway Capacity Manual, refer to <i>2018 Green Book</i> , Page 10-144
Acceleration length		*	<i>2018 Green Book</i> , Pages 10-132 and 10-133	See "Tables 10-4 and 10-5," <i>2018 Green Book</i> , Page 10-132
Taper-Type Taper (Lane Merge)	70:1	50:1	<i>2018 Green Book</i> , Pages 10-145	
Parallel-Type Taper (Lane Merge)		300'	<i>2018 Green Book</i> , Pages 10-145	Parallel-type entrance ramps are preferred

DECELERATION LANES				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Deceleration Length		*	<i>2018 Green Book</i> , Page 10-138 (Table 10-6)	Minimum Deceleration lengths with flat grades or less than 2%
Auxiliary lane length		1500'	<i>2018 Green Book</i> , Page 10-146 (Figure 10-77)	
Parallel-Type Taper (Add Lane)		300'	<i>2018 Green Book</i> , Page 10-146 (Figure 10-77)	
Divergence Angle From Mainline To Ramp	2° - 5°	*	<i>2018 Green Book</i> , Page 10-133	Divergence angle is usually between 2° and 5°

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

HIGH SPEED FACILITIES (45 MPH OR GREATER)

VERTICAL CLEARANCE				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
New highway bridges over or under street or highway		16'-6"	NDOT Structures Manual, 2008 Edition, Page 11-61 (Figure 11.9-A)	Vertical clearance on collector & local roads may be 14'-6" if approved by District Eng.
Temporary structures or false work		16'-0"	NDOT Structures Manual, 2008 Edition, Page 11-61 (Figure 11.9-A)	Verify with Bridge Division
Rehabilitated/Existing Bridges to remain in place				
Overhead sign structures. Pedestrian Crossings		18'-0"	NDOT Structures Manual, 2008 Edition, Page 11-61 (Figure 11.9-A)	Verify with Bridge Division
Railroad under highway (from top of track to bottom of structure)		23'-6"	Union Pacific Railroad Guidelines for Railroad Grade Separation Projects, Current Edition	Coordinate false work and construction activities with UPRR. See Section 5.15 Right-of-Way Utilities for additional information regarding clearances around R/R structures
Electrified (50 Kv Line)		26'-0"		All communication with R/W Utilities Section
Electrified (25 Kv Line)		24'-3"		
Non-Electrified		23'-0"		

HORIZONTAL CLEARANCE				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Railroad to pier protection wall		18'-0"	Measured from centerline of track	Requires coordination with UPRR
Railroad to parallel roadway		25'-0"	Measured from centerline of track	Requires coordination with UPRR (UPRR may require future track or frontage)

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

2.2 Low Speed Facilities (44 mph or Less)

LOW SPEED FACILITIES (44 MPH OR LESS)

GENERAL				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Design Vehicle	Single Unit Truck (Three Axle) SU-40	WB-40	<i>2018 Green Book</i> , Page 2-55	See design vehicle in Section 3.1 for further guidelines
Design speed		*	<i>2018 Green Book</i> , Page 5-2 thru 5-3 (Table 5-1)	Consider terrain, adjacent land use, and functional classification
Lane width	12' Lane	*	<i>2018 Green Book</i> , Page 5-7, Table 5-5 (Local Roads and Streets) and Page 6-6, Table 6-5 (Collector Roads and Streets)	See lanes in Section 3.6 Lanes for further guidelines
Turn lane width	14' Lane	10' Lane	<i>2018 Green Book</i> , Page 4-9	
Shoulder width (Mainline) (RT)	8' Arterial 4' Frontage/Service Road	6' Arterial 2' Frontage/Service Road	<i>2018 Green Book</i> , Page 4-12, Section 4.4.2, Shoulder Width	Widths include lateral offset for longitudinal barriers. AADT must be reviewed.
Shoulder width (Mainline) (LT)	8' Arterial 4' Frontage/Service Road	6' Arterial 2' Frontage/Service Road		
Bridge width		Match approach roadway		See design year (bridge projects) in Section 3.1 for other considerations

HORIZONTAL ALIGNMENT				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Minimum radius (Mainline)	Use Table 3-13, <i>2018 Green Book</i> , Page 3-54	*	<i>2018 Green Book</i> , Page 3-54 thru 3-55 (Table 3-13)	Values shown are considered minimum radius. It is desirable to superelevate roadway when possible. See Section 3.5
Minimum tangent length between reverse curves	The sum of superelevation runoff and runout lengths	*	<i>2018 Green Book</i> , Page 3-70	Refer to "Section 3.3.8 Transition Design Controls," <i>2018 Green Book</i> , Page 3-61

VERTICAL ALIGNMENT				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Crest vertical curve "K" Value	"K" Value based on design speed		<i>2018 Green Book</i> , Page 5-5 (Table 5-3 Stopping Sight Distance) Page 5-5 (Table 5-4 Passing Sight Distance)	See "K-Value" under Alignments in Section 3.2 for additional information

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

LOW SPEED FACILITIES (44 MPH OR LESS)

VERTICAL ALIGNMENT (continued)

Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Sag vertical curve "K" Value	"K" Value based on design speed		2018 Green Book, Page 5-5 (Table 5-3 Stopping Sight Distance) Page 5-5 (Table 5-4 Passing Sight Distance)	Check against headlight sight distance in Section 3.8
Minimum length of vertical curve	Based on "K" Value	3X Design speed	2018 Green Book, Pages 3-164 to 3-180 (Section 3.4.6)	

SUPERELEVATION

Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
e_{max} (Method 2)	e_{max} 6%	*	2018 Green Book, Page 3-54 thru 3-55 (Table 3-13)	e_{max} 6% should be considered maximum super elevation in icy climates
Minimum Runoff Length	Varies with no. of lanes and e_{max}	*	2018 Green Book, Page 3-66 thru 3-67 (Table 3-16a)	
Minimum Tangent Runout	Varies with no. of lanes and e_{max}	*	2018 Green Book, Page 3-70 (Equation 3-24)	
% of runoff on tangent	67%	*	2018 Green Book, Pages 3-70 and 3-71	No runoff or run-out on bridge structures if possible. If this is not possible, consider extending runoff or run-out through bridge structure.

MAXIMUM GRADES FOR LOCAL RURAL ROADS

Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Level	7% (Design speed of 45 mph)	*	2018 Green Book, Page 5-4 (Table 5-2)	Consider a truck climbing lane when the reduction in speed of heavy trucks exceeds 10 mph
Rolling	9% (Design speed of 45 mph)	*		
Mountainous	12% (Design speed of 45 mph)	*		
Curb and gutter facilities	0.5% or greater slope	0.3%	NDOT Policy	NDOT Drainage Manual 2006 Edition, Section 3.3.2.2

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 2 DESIGN CRITERIA

LOW SPEED FACILITIES (44 MPH OR LESS)

SIGHT DISTANCE				
Design Element	Desirable Criteria	Minimum Criteria	Reference	Comments
Stopping (Mainline)	Distance based on initial speed	*	<i>2018 Green Book</i> , Page 5-5 (Table 5-3)	Refer to "Table 3-2. Stopping Sight Distance on Grades," <i>2018 Green Book</i> , Page 3-6. With grades >3%, use adjustment factors. "Equ. 3-3," <i>2018 Green Book</i> , Page 3-5.
Intersection Sight Distance		*	<i>2018 Green Book</i> , Page 5-5 (Table 5-3)	Sight distance based on various cases refer to "9.5.3 Intersection Control," <i>2018 Green Book</i> , Page 9-39.

* Consult Principal Roadway Design Engineer with concurrence of Chief Roadway Design Engineer

SECTION 3 DESIGN ELEMENTS

3.0 Design Elements

General: This section is a supplement to AASHTO's *A Policy on Geometric Design of Streets and Highways, 2018 7th Edition (2018 Green Book)*, and is intended to be used for review of geometric elements. Section 3 will clarify, expand, and adopt certain geometric design elements used in Roadway Design. Additionally, this section addresses specific items the Designer uses during the process of designing a project. Many of these items are discussed in detail in the Standard Specifications for Road and Bridge Construction and Standard Plans for Road and Bridge Construction.

3.1 Design Considerations

Design Speed: Design speed is a selected speed used to determine the various geometric design features of the roadway. The selected design speed should be consistent with the speeds that drivers are likely to expect on a given highway facility ("2.3.6 Speed," *2018 Green Book*, Page 2-21).

The Designer selects the design speed based on the type of roadway category, average annual daily traffic (AADT), terrain, and adjacent land use. For roadway category and design speeds see the [Access Management System and Standards](#).

On rural freeways, the design speed shall be 70 mph. For urban freeways, adjust the design speed accordingly ("8.2.1 Design Speed," *2018 Green Book*, Page 8-2).

For all other routes, the design speed shall be set at 10 mph over the posted speed. Modifications require coordination with the Principal Road Design Engineer.

Coordinate the design speed with the Principal Traffic Operation Engineer and Traffic Operation Division on new facilities so the posted speed limit can be signed appropriately. For additional information on selecting a design speed, see [NCHRP Report 504 – Design Speed, Operating Speed, and Posted Speed Practices](#). See [Section 3.10](#) concerning design speeds on ramps.

Posted speed: Posted speed limits are not the highest speeds that might be used by drivers. Posted speed limits are usually set to approximate the 85th percentile speed of traffic as determined by measuring the speeds of a sizable sample of vehicles.

Operating Speed: The speed at which drivers are observed operating their vehicles during free-flow conditions. The 85th percentile of the distribution of observed speed is the most frequently used descriptive statistic for the operating speed associated with a particular location or geometric feature. (*2018 Green Book*, Page 2-22)

Improvements on Existing Facilities: Since speeds often increase when there is a new pavement widening or when geometric improvements are made, engineering judgment should be exercised in determining the reasonableness and applicability of using an existing off-peak 85th percentile speed that is below the maximum functional class speed. It is suggested a speed study be performed.

New Facilities: The anticipated operating speed and traffic volumes are frequently used when selecting the design speed. The anticipated off-peak 85th percentile speed may be based on the speeds of facilities with similar classifications, geometry, and traffic characteristics.

2-Lane Facilities: On 3R 2-lane rural highway projects, marking should be based on a pass/no pass study. See [Section 5.12](#) for requesting passing studies through Roadway Systems.

Design Vehicle: The design vehicle for interstate and NHS routes is WB-67. The design vehicle for other routes will require evaluation by the Designer.

Turn Templates: Select the appropriate design vehicle for the facility and run turning templates using Swept Path Analysis software at all intersections to check for off-tracking around island noses, curb returns, and tight ramp configurations.

SECTION 3 DESIGN ELEMENTS

Permitted Facilities: The physical design vehicle for all facilities intended for use by motor vehicles shall be all such vehicles allowed by law including tractor-trailer combinations operating under annual or trip permits issued by the department; the department's website lists the current dimensions for these tractor-trailer combinations. During the design of temporary traffic control, lanes reduced more than 14' shall be reported to [Over-dimensional Permits](#).

Design Year: The design year starts from the time when a highway project is open to traffic. Highway and bridge design should be based on traffic volumes that are expected to occur within the expected service life of the project. Traffic forecast design years provide necessary information so that the designer can evaluate alternatives to address traffic and congestion issues. The selected design year is intended to cover the time period necessary to evaluate functionality over the expected service life of the project. This information and design year traffic forecast volumes are requested from the Traffic Information Division.

Design year traffic (requested from Traffic Information Division) forecast volumes are necessary to:

- Determine the appropriate scope of improvements and associated geometric design criteria.
- Determine how well the project meets objectives for capacity, delay, and mainline or intersection for Level of Service (LOS). LOS is determined by means of capacity analysis, which requires the design year traffic volumes. ("2.4.5 Levels of Service," *2018 Green Book*, Page 2-36)
- Evaluate project work types on a consistent statewide basis.
- Determine the number of lanes to remain open during construction.
- Allow for informed decision making on project alternatives and trade-offs.

It may not always be practical to construct projects that fully accommodate design year traffic, or even to fully address existing traffic congestion. Engineering judgment and consideration of all relevant factors provides the flexibility in determining to what extent design year traffic can be accommodated. Traffic forecasts alone do not dictate project scope. Forecasts are only one of many factors (safety needs, mobility needs, environmental issues, community needs, etc.) to be addressed.

Capacity projects: New capacity projects are usually designed with a service life to meet the 20-year traffic forecast model.

Bridge projects: New bridge projects are usually designed with a service life to meet the 75-year traffic forecast model. Provide adequate bridge width for intersection approach lane widening, either in the scope of the bridge work or design the bridge to facilitate future widening.

Design designation: Traffic information such as current and future volume, speed, and directional split is shown on the title sheet for new construction and capacity projects. See the Plan Preparation Guide for additional information.

3.2 Design Principles

Alignments: The centerline layout or position on the ground surface is called an Alignment. The horizontal and vertical alignments establish the general character of a highway. The configuration of line and grade affects safe operating speeds, sight distances, and opportunities for passing and highway capacity. Decisions on alignment have a significant impact on construction costs. Horizontal and vertical alignments complement each other and should not be designed independently.

Horizontal Alignment: Includes the straight path, curves or deviation in horizontal direction. The horizontal alignment should be free of curvature around intersections, railroad crossings, and drop lanes. On divided highways, variation in the width of the median and the use of separate profiles and independent horizontal alignment should be considered.

Compound Curves: Caution should be exercised in the use of compound circular curves. Although compound curves give flexibility to fitting the highway to the terrain and other controls, designers should avoid using them whenever possible. When curves with considerably different radii are located too close together, the alignment will not have a pleasing appearance. On compound curves for open highways, the ratio of the larger radius to the smaller radius should not exceed 1.5 to 1. On ramps the ratio of the larger radius to the smaller radius may be increased to a 2 to

SECTION 3 DESIGN ELEMENTS

1 ratio. However, the use of compound curves on ramps, with a larger curve between two smaller curves should be avoided. ("3.3.13 General Controls for Horizontal Alignment," *2018 Green Book*, Page 3-119)

Curve Length: For small deflection angles, curves should be sufficiently long to avoid the appearance of a kink. The minimum length of horizontal curve on main highways should be 15 times the design speed (mph). On high-speed controlled access facilities that use flat curvature for aesthetic reasons, the desirable minimum length for curves should be 30 times the design speed (mph). ("3.3.13 General Controls for Horizontal Alignment," *2018 Green Book*, Page 3-119)

Reversing Curves: Reversing curves should be avoided whenever possible. Severe physical restrictions or other considerations may dictate the use of curves in opposite directions with a short connecting tangent. In such cases, the minimum length of tangent shall be sufficient to provide superelevation transitions for both curves consistent with the design speed.

Vertical Alignment: Includes vertical curves and gradient on the ground. Vertical curves effect gradual changes between tangent and either a crest curve or sag curve.

Downgrades: Avoid steep downgrades on roads frequented by high profile vehicles that need to make free left or right-hand turns. For example, a roadway that has a design speed of 40 mph at a 6% downgrade could cause a high-profile vehicle attempting to make a turn onto a cross street or at the bottom of an off-ramp to tip over. The 6% downgrade acts like a negative (adverse) superelevation to the vehicle making the turning movement. Steep downgrades should be limited near on-ramps, at the bottom of off-ramps, and cross streets to avoid the effects of negative superelevation. Grades greater than 3% require adjustments for stopping sight distance. See "Table 3-2. Stopping Sight Distance on Grades," *2018 Green Book*, Page 3-6 for more information.

K-value: Rate of vertical curvature, K, is the length of curve per percent algebraic difference in intersecting grades. ($K = \text{Length of curve} / \text{Algebraic difference in intersecting grades}$). The value of K is useful in determining minimum lengths of vertical curves for various design speeds. ("3.4.6 Vertical Curves", *2018 Green Book*, Page 3-164)

Crest: Minimum lengths of crest curves based on sight distance criteria generally are satisfactory from a standpoint of safety, comfort, and appearance. An exception may be at decision areas, such as ramp exit gores, where longer sight distances and longer vertical curves should be provided ("3.4.6.2 Crest Vertical Curves," *2018 Green Book*, Page 3-166). See "Tables 3-35 and 3-36," *2018 Green Book*, Pages 3-170 and 3-172 for design controls for Crest Vertical Curves based on stopping and passing sight distances.

Special care must be taken when the roadway surfaces are created from vertical curves and/or superelevations that reduce the available gutter slopes. ("Section 3.3.2.2," *NDOT Drainage Manual*, Page 3.6)

Sag: At least four different criteria for establishing lengths of sag vertical curves are recognized to some extent. They are (1) headlight sight distance, (2) passenger comfort, (3) drainage control, and (4) general appearance. See "Sag Vertical Curves", *2018 Green Book*, Page 3-172 for more information. See "Table 3-37. Design Controls for Sag Vertical Curves", *2018 Green Book*, Page 3-176 for design controls for sag vertical curves. Lighting sag curves allows for the use of the comfort criteria.

Alignment Coordination in Design: During the Design of the horizontal alignment and profile, adjustments in either, or both, can be made jointly to obtain the desired coordination. ("3.5.3 Alignment Coordination in Design," *2018 Green Book*, Page 3-182)

Coordinate the location of the vertical profile with the Structural Division for new bridges or reconstruction projects.

Grade Breaks: Normally a vertical curve is required for all changes in grade. Grade breaks at the beginning or ending of a vertical curve should be avoided. On 3R projects grade breaks may be perpetuated only if the cost of eliminating the grade break is unreasonable. These grade breaks may occur where a history of plantmix overlays meets PCCP.

On 3R projects, a grade break may be introduced to transition the structural roadbed improvement into the adjoining section of road (longitudinal transition) at the following rates:

- 50 feet per inch where the posted speed limit is 45 mph or less

SECTION 3 DESIGN ELEMENTS

- 100 feet per inch where the posted speed limit is greater than 45 mph

No vertical curve is required when the algebraic difference in grade is:

- 0.5% or less for design speeds equal to or less than 45 mph
- 0.2% or less for design speeds greater than 45 mph

Vertical Clearances: When developing vertical alignments, the clearance requirements for bridges must be considered. Considerations include:

- Accommodating the current and future expansion of the roads
- The constructability of the bridge such as providing additional height for false work
- In urban areas achieving sight distance to the signal system heads
- Providing additional height on single point urban interchanges to accommodate clearance of the signal system when the convergence is designed underneath
- Meeting the requirements of the owner for structures over infrastructure such as railroads

See "Figure 11.9-A Minimum Vertical Clearances", *2008 NDOT Structures Manual*, Page 11-61 for vertical clearances at bridge structures.

See [Section 5.15](#) regarding clearances around railroad facilities.

See [Section 5.21](#) regarding clearances around airports.

Drainage: Changes to vertical profiles can have significant impacts to the drainage design, e.g., overtopping areas, fill slopes (affecting culvert lengths, roadside ditches, pipe cover, etc.), longitudinal slopes (affecting onsite drainage design), etc. Consult with the Hydraulics Division when modifying vertical profiles throughout the design process.

3.3 Clear-zone

Definition: The clear-zone is the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles.

General: The Department measures the clear-zone from the outer edge of the through lane. When determining clear-zones in auxiliary lane areas, use the volume of the through lanes and the freeway design speed to obtain the clear-zone distance. The resulting clear-zone distance should be measured from the outer edge of the through lane.

"Table 3-1," *2011 Roadside Design Guide*, Page 3-3 can be used to determine the suggested clear-zone distance for selected traffic volumes and speeds. However, the Table provides a general approximation of the needed clear-zone distance. The designer should keep in mind site-specific conditions, design speeds, rural versus urban locations, and practicality. Extrapolating clear-zone data for higher design speeds not shown in "Table 3-1" will not be considered by the Department.

The designer may choose to modify the clear-zone distance for horizontal curvature by using "Table 3-1" with "Table 3-2," *2011 Roadside Design Guide*, Page 3-4. These modifications are normally considered only when crash histories indicate a need, or a specific site investigation shows a crash potential that could be significantly lessened by increasing the clear-zone width, and when such increases are cost effective.

When obstructions exist behind curbs, a minimum lateral offset of 3' should be provided beyond the face of curb to the obstruction at intersections and driveways ("3.4.1 Curbs", *2011 Roadside Design Guide*, Page 3-13). A minimum lateral offset of 1.5' should be used elsewhere. However, this lateral offset should not be construed as the clear-zone distance.

Ideally, any non-traversable obstructions within the clear-zone should be removed or relocated outside of the clear-zone. When removal or relocation is not feasible, consider shielding the object (guardrail, barrier rail, etc.) or using breakaway bases. If none of these options are possible, the object should be delineated using an object marker.

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3.4 Cross Slope

Normal Crown: The standard cross slope on tangents shall be a 2% crown section for the paved portion of the finished roadbed and the shoulders. For undivided highways on tangent, the high point of the crown shall be the centerline of the finished roadbed and shall slope to the edge of the paved section. For divided highways on tangent, the high point of the crown is typically on the edge of pavement nearest the median and shall slope to the right edge of the paved section. See Profile Grade in Plan Preparation Guide for location of vertical alignment.

Ramps: Ramps should be sloped to drain at a 2% cross slope (unless designed superelevation controls cross slope). See Profile Grade in Plan Preparation Guide for location of vertical alignment.

Bridges: Geometric changes, such as superelevation and width transitions, should not occur within the limits of a bridge structure unless the cost of doing so is justified with the Structural Engineer.

Drainage: If there are facilities that may impede drainage from the normal crown, (e.g., raised islands), coordinate with the Hydraulics Division for any necessary drainage considerations.

3.5 Superelevation

General: NDOT has adopted Method 5 for calculating superelevation on all high speed facilities (45 mph or greater). Method 2 may be used on low speed urban streets (less than 45 mph) only if necessary. Use of other superelevation criteria requires approval of the Assistant Chief Roadway Design Engineer. The design should be based on an e_{max} of 6% (desirable) for all high-speed roads and an e_{max} of 4% for urban conditions. An e_{max} of 8% in southern Nevada is permissible. In snow and ice prone locations, the cross slope should be limited to 6%. Provide adequate tangent lengths between reversing curves to accommodate superelevation transitions for full run-off and run-out between the curves.

For minimum radii for design superelevation rates and design speeds derived using Method 5, see "3.3.5 Design Superelevation Tables," *2018 Green Book*, Page 3-41. For minimum radii and design superelevation rates for low speed urban streets derived using Method 2, see "Table 3-13" in "3.3.6 Design for Low-speed Streets in Urban Areas", *2018 Green Book*, Page 3-54.

Refer to the [Design Training Archives](#) for training and examples.

Run-Out Transition: The tangent run-out section consists of the length of roadway needed to accomplish a change in outside-lane cross slope from the normal cross slope rate to zero (flat), or vice versa. ("Methods of Attaining Superelevation," *2018 Green Book*, Page 3-81)

Run-off Transition: The superelevation run-off section consists of the length of roadway needed to accomplish a change in outside-lane cross slope from zero (flat) to full superelevation, or vice versa ("Transition Design Controls," *2018 Green Book*, Page 3-61). The preferable portion of the run-off length placed on the tangent is 0.67 (i.e., 67%) in advance of the PC and 0.67 (i.e., 67%) after the PT, since this tends to minimize the peak lateral acceleration and the resulting side friction demand for all speeds. The superelevation run-off lengths given in "Table 3-16a," *2018 Green Book*, Page 3-66 are based on 12' lanes.

Number of Lanes Rotated: Auxiliary lanes are not to be considered as additional lanes to be rotated. Additionally, shoulder widths are generally not considered as additional lanes to rotate. The adjustment factor for the number of lanes rotated is shown in "Table 3-15," *2018 Green Book*, Page 3-64. Consult the Principal Road Design Engineer for additional guidance.

Drainage: Check for drainage problems in vertical sag or crest curves that contain superelevation transitions. The location of the superelevation transition may cause a flat roadway cross slope (0% cross slope) at the bottom of a vertical sag curve or top of a crest curve. This can be corrected by moving the vertical sag curve out of the superelevation transitions. See "Minimum Transition Grades," *2018 Green Book*, Page 3-87 for additional guidance. Vertical grades or cross slopes with less than 0.50% may cause drainage problems. For reverse superelevations on large, multi-lane facilities, short transitions are preferred for drainage, to minimize the areas with flat transverse slopes. The larger, flatter areas do not drain quickly, resulting in a potential increase for hydroplaning. Coordinate with Hydraulic Engineer.

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Ramps: Direct and semi-direct ramps generally are designed with a high speed exit and a high speed entrance and are designed with Method 5. For ramps designed for speeds less than 45 mph, Method 2 can be used for the ramp proper. For loop ramps with a design speed less than 45 mph, use "Table 3-13," *2018 Green Book*, Page 3-54 for superelevation. Superelevation development at ramp entrances and exit terminals is shown in "9.6.4 Superelevation for Turning Roadways at Intersections", *2018 Green Book*, Page 9-83.

Axis of Rotation: For undivided highways, the axis of rotation for superelevation is usually the centerline of the traveled way. However, in special cases where curves are preceded by long, relatively level tangents, the plane of superelevation may be rotated about the inside edge of the pavement to improve perception of the curve.

For divided highways, if future widening is to the inside median, then rotate dual roadbeds in a single plane about centerline. When considering facilities for future widening to the outside shoulder, roadbeds should be rotated independently to reduce earthwork, and to reduce the length of the superelevation transitions. For example, the longer superelevation transitions can have an adverse impact to closely spaced ramps. ("Methods of Attaining Superelevation", *2018 Green Book*, Page 3-81)

The preferred axis of rotation for ramps is along the outside shoulder line in the direction of travel. It is occasionally placed along the inside shoulder line to better facilitate drainage or earthwork concerns. The axis of rotation for multi-lane ramps and direct connects is usually at centerline and one lane for number of lanes rotated. Appearance and drainage should always be taken into consideration in selection of the axis of rotation.

3.6 Lanes

Width: Traffic lanes intended for use by motor vehicles should be 12' wide with an additional 2' added when the lane is directly adjacent to a curb or other physical feature. A project intended to be used as "Complete Streets" may reduce lane width less than 12'. See [FHWA Road Diet Informational Guide](#) for more information on "Complete Streets".

To make bicycle travel safer on urban streets, the Department has agreed to stripe State owned and maintained roadways within Clark County using a marking standard established by the RTC of Southern Nevada as a guideline. The intent is to provide a shared outside travel lane of 14' for bicyclists by reducing our standard 12' travel lanes to 11'. Any lane next to a median barrier or curb will be a minimum 12' wide with a desirable width of 13'. On preservation projects, it will not always be possible to provide the desired lane configuration and judgment will have to be used to determine an acceptable compromise between lane widths and the desire to provide a 14' outside travel lane. The Principal Road Design Engineer shall review all compromises.

On reconstruction projects or new roadway projects, it is desirable to use a 15' outside travel lane width while maintaining 12' travel lanes. If this will cause the need for new right-of-way or significantly increase the size of takes, then the RTC standard may be used as described in the paragraph above. If Federal funds are involved, then any planned bicycle facility must be accommodated.

Minimum Acceleration and Deceleration Lengths for Entrance and Exit Terminals: See "Table 10-4. Minimum Acceleration Lane Lengths for Entrance Terminals with Flat Grades of Less Than 3 Percent", *2018 Green Book*, Page 10-132 and "Table 10-6. Minimum Deceleration Lane Lengths for Exit Terminals with Flat Grades of Less Than 3 Percent", *2018 Green Book*, Page 10-138 for information on determining minimum lengths on entrance and exit terminals.

Auxiliary Lanes: Auxiliary lanes are defined as the portion of the roadway adjoining the traveled way for speed change, turning, and storage for turning, weaving, truck climbing, and other purposes supplementary to through traffic movements. The width of an auxiliary lane should be equal to the through lanes (12' preferred). An auxiliary lane may be provided to comply with the concept of lane balance, with capacity needs, or to accommodate speed changes, weaving and maneuvering of entering and exiting traffic. Where auxiliary lanes are provided next to freeway mainline lanes, the adjacent shoulder should desirably be 8'-12' in width, with a minimum 6' wide shoulder. ("10.9.5.10 Auxiliary Lanes," *2018 Green Book*, Page 10-90)

Lane Balance: To provide efficient traffic operation through and beyond an interchange, there shall be a balance in the number of lanes on the freeway and ramps. The basic number of lanes should be established for a substantial length of freeway and should not be changed through pairs of interchanges; variations in traffic demand should be accommodated by means of auxiliary lanes where needed.

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At a freeway entrance, the number of lanes beyond the entrance should not be less than the sum of the merging roadway lanes and the freeway minus one but may be equal to the sum of all traffic lanes on the merging roadway. At a freeway exit, the number of approach lanes before the exit should be equal to the number of the lanes on the freeway beyond the exit, plus the number of lanes on the exit, minus one.

Exceptions to these principles occur at cloverleaf loop ramp exits that follow a loop-ramp entrance and at exits between closely spaced interchanges. The traveled way on the freeway should not be reduced by more than one traffic lane at a time. Examples of proper lane balance can be seen in "10.9.5.9 Coordination of Lane Balance and Basic Number of Lanes," *2018 Green Book*, Page 10-87.

Lane Tapers: For freeway lane tapers, see "Figure 10-72. Typical Single-Lane Entrance Ramps," *2018 Green Book*, Page 10-129. Refer to the [Access Management System and Standards, current version](#) for lane tapers other than freeways.

Ramps: The desirable single lane ramp width is 24' (Striped 4'-12'-8'). On 3R projects, substandard ramp widths should be addressed during the Preliminary Design Field Study (PDFS) where it is economically feasible to widen them to meet current standards. See [Section 2.1](#) for shoulder width criteria.

Bike lanes: Bike lanes are used when it is desirable to delineate a portion of the pavement for preferential use by bicyclists or to provide for more predictable vehicle movements. Bike lanes are delineated with signs and pavement markings. They should be one-way facilities located within the limits of the paved shoulder. The minimum width of a bike lane is 4'. In areas with raised curb or longitudinal barriers, the minimum width is 5'. The open graded plantmix surface wearing course is to be paved flush with the lip of the gutter pan and inlet grates. A width of 5' or greater is preferred where substantial truck traffic is present, or where motor vehicle speeds exceed 50 mph.

On highways without full control of access where a bridge deck is being replaced or rehabilitated, and where bicycles are permitted to operate at each end, the bridge should be reconstructed so that bicycles can be safely accommodated when it can be done at a reasonable cost. Consultation with local groups of organized bicyclists is encouraged in the development of projects with bicycle facilities.

In situations where the lateral offset of an existing longitudinal traffic barrier from the shoulder stripe is less than 5' then, in consideration of bicycle traffic, the placement of a rumble strip must be justified by an engineering study. The study should consider: [a] the consequences of omitting the rumble strip adjacent to the traffic barrier, and [b] adjusting the lateral offset of the traffic barrier to at least 5'. On new roads or new traffic barrier installations on existing roads, the minimum distance from the shoulder line to the face of the traffic barrier is 6' if the road also serves as a bikeway.

Additional resources: For further guidance refer to AASHTO's Guide for Development of Bicycle Facilities. Information is requested through Transportation/Multimodal Planning for bicycle facilities, bus lanes and turnouts.

3.7 Shoulders

Interstate: An adopted criterion for Interstate highways specifies the paved width of the right shoulder shall not be less than 10'. Where truck traffic exceeds 250 DDHV a 12' right shoulder should be considered. On freeways with six or more lanes the usable paved width of the median shoulder should also be 10' and preferably 12' where the truck traffic exceeds 250 DDHV. On four-lane freeways, the left shoulder is normally 4' to 8' wide, at least 4' of which should be paved, and the remainder stabilized. ("8.2.4 Traveled Way and Shoulders", *2018 Green Book*, Pages 8-3 and 8-4) The Department prefers a 4' inside shoulder and 8' outside shoulders on NHS routes and 2' inside shoulders and 4' outside shoulder minimum on State Routes. In the event these widths cannot be achieved, coordinate with the Principal Road Design Engineer.

Drainage: Consult with the Hydraulic Division if shoulder widths adjacent to barrier rail or curb and gutter are proposed to be reduced as this may affect onsite drainage design criteria.

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3.8 Sight Distance

Stopping Sight Distance: The minimum stopping sight distance is the distance required by the driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the road becomes visible. Stopping sight distance is measured from the driver's eyes, which is 3.5' above the pavement surface, to an object 2' high on the road. Stopping sight distance design values can be obtained from "3.2.2 Stopping Sight Distance," *2018 Green Book*, Page 3-2. Increases or decreases in the stopping sight distances on grades greater than 3% are indicated in "Table 3-2. Stopping Sight Distance on Grades," *2018 Green Book*, Page 3-6.

Stopping Sight Distance on Horizontal Curves: Where there are sight obstructions (such as walls, cut slopes, buildings, bridge pier, and longitudinal barriers) on the inside of curves or the inside of the median lane on divided highways and their removal to increase sight distance is impractical, the design may need to adjust the normal highway cross section or the alignment. ("3.3.12 Sight Distance on Horizontal Curves," *2018 Green Book*, Page 3-113). The objective is to determine the clear distance from the centerline of inside lane to an obstruction for a given design speed. Using radius of curvature and sight distance for the design speed the horizontal sight line offset (HSO) can be calculated from "Equation 3-37," *2018 Green Book*, Page 3-115. When the design speed and the clear distance to a fixed obstruction are known, the required minimum radius which satisfies these conditions can be determined.

When the required stopping sight distance is not available because of an obstruction such as a railing or a longitudinal barrier, the following alternatives shall be considered: increase the offset to the obstruction, increase the horizontal radius, use lower height barrier rail, or do a combination of these. However, any alternative selected should not require the width of the shoulder on the inside of the curve to exceed 12', because the potential exists that motorists will use the shoulder in excess of 12' as a passing or travel lane.

When determining the required horizontal sight line offset distance on ramps, the location of the driver's eye is assumed to be positioned in the middle of the inside lane on horizontal curves. The designer is cautioned in using the values from "Figure 3-14," *2018 Green Book*, Page 3-116 since the stopping sight distances and HSO are based upon passenger vehicles.

Stopping Sight Distance at Undercrossing: See "Sight Distance at Undercrossings," *2018 Green Book*, Page 3-177.

Headlight Sight Distance: For sag vertical curves, formal design exceptions are required for curves that meet the comfort criteria but not the headlight criteria, unless lighting is provided. ("Table 3-37. Design Controls for Sag Vertical Curves," *2018 Green Book*, Page 3-176)

Passing Sight Distance: Passing sight distance is the minimum sight distance that must be available to enable the driver of one vehicle to pass another vehicle, safely and comfortably, without interfering with the speed of an oncoming vehicle traveling at the design speed, should it come into view after the overtaking maneuver is started. The sight distance available for passing at any place is the longest distance at which a driver whose eyes are 3.5' above the pavement surface can see the top of an object 3.5' high on the road. Passing sight distance is considered only on two-lane roads. ("3.2.4 Passing Sight Distance for Two-Lane Highways," *2018 Green Book*, Page 3-10) Adjustment factor for grades is not available, exercise judgment for adjusting distances.

See [Section 5.12 Planning \(Transportation and Multimodal Planning\)](#) for obtaining passing sight distance studies.

3.9 Intersection and Roundabout Design

Angles: Intersecting streets should meet at approximately a 90-degree angle. Intersection legs that operate under stop control should intersect at right angles wherever practical and should not intersect at an angle of less than 60 degrees. Pay particular attention to sight distance triangles and turning movements.

Grades: The intersection and approach areas where vehicles are stored while waiting to enter the intersection should be designed with a relatively flat grade; the maximum grade should not exceed 5% where practical. Where ice and snow may create poor driving conditions, the desirable grade on the approach leg should be 0.5% with no more than 2% wherever practical. Intersections should not be located just beyond a short crest vertical curve or sharp horizontal curve.

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Grading: If it is impractical to match the elevation of an intersecting road, the crossroad should be reconstructed for a suitable distance using adequate vertical geometry to make the grade adjustment. In general, a 4% maximum tangent grade break is allowed at the edges of signalized intersections to allow vehicles on the crossroads to pass through an intersection on a green signal. For un-signalized or stop condition intersections, a maximum grade break of 4% may be used.

Design vehicle path: The minimum edge of traveled way designs requires the use of simple curves with tapers or 3-centered curves for larger design vehicles. Use the appropriate edge design for the selected design vehicle so it does not encroach into oncoming lanes. ("9.6.1 Types of Turning Roadways", *2018 Green Book*, Page 9-60)

Lane Alignment: It is desirable that entering through traffic is aligned with the exit lanes. However, the entering and exit lanes may be offset up to 6' when the following conditions are met (see Figure 3.9):

- Illumination is provided
- The intersection is not within a horizontal curve, nor is it within a crest curve
- The taper rates provided in Table 3.9 are used
- There is a posted speed of 55 mph or less

Consider the use of "cat tracks" to delineate the path of travel.

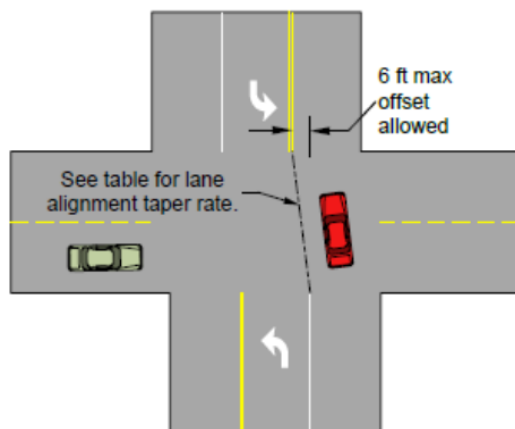


Figure 3.9

Posted Speed	Taper Rate
55 mph	55:1
50 mph	50:1
45 mph	45:1
40 mph	27:1
35 mph	21:1
30 mph	15:1
25 mph	11:1

Table 3.9

Other: Intersections on sharp horizontal curves should be avoided wherever practical because the superelevation and widening of pavements on curves complicate the intersection design and may reduce sight distance. ("9.4.2 Alignment," *2018 Green Book*, Page 9-31)

Type: For various types of intersection designs, see "9.3 Types and Examples of Intersections," *2018 Green Book*, Pages 9-11 through 9-30. In addition, innovative intersection designs may be appropriate in certain situations. The FHWA provides details on many innovative intersection designs on their website under "Innovative Intersections," *Intersection Safety*, FHWA Office of Safety, <https://safety.fhwa.dot.gov/intersection/>.

Intersection Sight Distance: Each intersection has the potential for several different types of vehicular conflicts. The possibility of conflicts can be reduced through the provision of proper sight distance and appropriate traffic controls. See "9.5 Intersection Sight Distance," *2018 Green Book*, Pages 9-35 through 9-59 for information on proper intersection sight distance.

Traffic barriers: The heights of longitudinal traffic barriers relative to the standard driver eye height of 42" requires that some consideration be given to sight distance when locating traffic barriers near intersections. This is especially true when the vertical alignments of the roadways exacerbate the effect of the traffic barriers in the lines of sight.

Roundabouts: A Roundabout is an intersection with a central island around which traffic must travel counterclockwise and in which entering traffic must yield to circulating traffic. See "9.10 Roundabout Design," *2018 Green Book*, Pages 9-141 through 9-151 for information on the design of roundabouts. Roundabouts are increasingly recognized as an intersection control strategy that can fulfill multiple performance goals related to sustainability,

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livability, safety, complete streets, context sensitive design, economic development and others. Designing the geometry of a roundabout involves choosing between trade-offs of safety and capacity. Roundabouts can be difficult to maneuver for disabled pedestrians, so the types and volumes of pedestrian traffic should be considered when designing the layout of pedestrian access at roundabouts. Additional information and tools for designing roundabouts can be found under "Roundabouts and Mini Roundabouts," *Intersection Safety*, FHWA Office of Safety, <https://safety.fhwa.dot.gov/intersection/innovative/roundabouts/>.

3.10 Ramps

Design speed: Ramp design speeds should approximate the low-volume running speed on the intersecting highways. It is not always practical to provide design speeds on ramps that are comparable to those on the through roadways. The minimum recommended ramp design speeds for various ramp configurations are as follows: Loop ramps should be no less than 25 mph, semi-direct are typically 30 to 40 mph, and direct connections should be a minimum of 40 mph. ("Table 10-1. Guide Values for Ramp Design Speed as Related to Highway Design Speed," *2018 Green Book*, Page 10-105) The designer should provide for design speeds in the upper range whenever possible.

Ramp Terminals: Ramp terminals can be classified as either the at-grade or free-flow type. Terminals are further classified as either single or multilane, and as either taper or parallel-type, according to the configuration of the speed-change lane. (10.9.6.4 Ramp Terminals," *2018 Green Book*, Page 10-123)

Speed-Change Lanes (Acceleration/Deceleration Lanes): Drivers leaving a highway are required to reduce speed as they exit onto a ramp, and drivers entering a highway must accelerate until the desired highway speed is reached. Because the change in speed is usually substantial, provision should be made for acceleration and deceleration to be accomplished on auxiliary lanes to minimize the interference with through traffic and to reduce crash potential ("10.9.6.4.7 Speed-Change Lanes," *2018 Green Book*, Page 10-128). The two general forms of speed-change lanes are taper-type and parallel-type. See "10.9.6.5 Single-Lane Free-Flow Terminals, Entrances," *2018 Green Book*, Pages 10-128 through 10-134 for design of entrance ramps, and "10.9.6.6 Single-Lane Free-Flow Terminals, Exits," *2018 Green Book*, Pages 10-135 through 10-150 for design of exit ramps.

Entrance ramps: Geometrics for taper-type entrance ramps should allow for the vehicular speed to be within 5 mph of the freeway speed and is obtained within the ramp before convergence. For consistency, the point of convergence is where the right edge of the ramp traveled way is 12' from the right edge of the through lane of the freeway (*2018 Green Book*, Page 10-130). Taper-type entrance ramps usually operate efficiently at all traffic volumes when designed properly ("10.9.6.5.1 Taper-Type Entrances," *2018 Green Book*, Page 10-128). However, A parallel-type entrance is preferred because it provides an added lane of sufficient length to enable a vehicle to accelerate to near-freeway speed prior to merging ("10.9.6.5.2 Parallel-Type Entrances," *2018 Green Book*, Page 10-130).

Exit ramps: Taper design fits the direct path preferred by most drivers. The divergence angle shall be between 2 and 5 degrees ("10.9.6.6.1 Taper-Type Exits," *2018 Green Book*, Page 10-135). Use a parallel design when deceleration length is needed before the ramp or additional storage length is needed ("10.9.6.6.2 Parallel-Type Exits," *2018 Green Book*, Page 10-136).

Future widths/lengths: When designing ramp/crossroad intersections that may ultimately be controlled by signals, consideration should be given to providing enough room to allow two lanes for the left turn from the ramp to the crossroad. If the 20-year traffic projection does not require two lanes, and the additional right-of-way needed is cost prohibitive, then the additional right-of-way would not be warranted. When additional right-of-way is not warranted, retaining walls are an option to be constructed, but will have to wait until the dual lanes are warranted by traffic volumes. For ramps at interchanges, consider designing them longer than required for an interim condition, such that it minimizes the impact when the ultimate section is constructed.

Sight distance: Sight distance along a ramp should be at least as great as the design stopping sight distance plus any additional storage length needed (See NDOT's [Access Management System and Standards, current version](#) for more information on storage length needs). The sight distance on a freeway preceding the approach nose of an existing ramp should exceed the minimum stopping sight distance for the through traffic design speed, desirably by 25 percent or more. Decision sight distance is desirable where feasible ("10.9.6.2.11 Sight Distance," *2018 Green Book*, Page 10-109).

Loop ramps: The upper range values of design speed generally are not attainable on loop ramps. Ramp design speeds above 30 mph for loops involve large areas, rarely available in urban areas. Larger radius loop ramps are

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costly, therefore minimum values usually control the size. ("10.9.6.2.4 Loop Ramps," *2018 Green Book*, Page 10-106)

Terminal Spacing: When two or more ramp terminals are placed in close succession, proper weaving length should be provided ("10.9.6.4.6 Distance Successive Ramp Terminals," *2018 Green Book*, Page 10-126). See "Figure 10-70. Recommended Minimum Ramp Terminal Spacing," *2018 Green Book*, Page 10-127 for minimum ramp terminal spacing. Avoid placing exit ramps on crest vertical curves.

Grade and profile design: Adequate sight distance is more important than a specific gradient control and should be favored in design. Usually, these two controls are compatible. With proper ramp terminal facilities, one-way ramps with short upgrades of 7 to 8% permit safe operation without slowing down passenger cars. Short upgrades (less than 2000') as much as 5% do not usually interfere with truck and bus operation. Ramps with gradients up to 8% are permissible in the South, but any grade above 6% is excessive in snow and ice prone areas.

The length of vertical curve for ramps that extend onto the freeway should preferably be designed with mainline design speeds. Limit downgrades to 4% on ramps with sharp horizontal curvature and heavy truck traffic.

It is desirable that upgrades on ramps with a design speed of 45 to 50 mph be limited to 3 to 5%; those for a 40-mph design speed to 4 to 6%; those for a 25 to 30 mph design speed to 5 to 7%. Where appropriate for topographic conditions, grades steeper than desirable may be used ("10.9.6.2.12 Grade and Profile Design," *2018 Green Book*, Page 10-109). In many areas consideration of snow or ice conditions may limit the choice of gradient regardless of the direction of the grade.

In areas of snow and ice, it is desirable to limit gradients near the ramp terminals to 2% where vehicles would normally come to a stop.

Gores: The term gore refers to the area between a through roadway and an exit ramp and may also be used to refer to the similar area between a through roadway and a converging entrance ramp. The physical gore nose should be paved up to a point between 4' to 8' in width. The neutral area refers to the triangular area between the painted nose (where the ramp shoulder and mainline shoulder lines meet) to the gore nose. The neutral area should be free of obstructions to provide a clear recovery area. The unpaved area beyond the physical nose to the gore nose ("Figure 10-63. Typical Exit Gore Area Characteristics," *2018 Green Book*, Page 10-114) should be graded as nearly as level to prevent overturning and abrupt stops. For marking the gore areas, refer to the *2009 MUTCD*.

In special situations, gore areas may require grading details when the mainline cross slope does not cross the gore area at a constant slope.

Mainline rollover to ramp: Check cross slope for maximum allowable rollover for entrance or exit ramps ("Table 9-18. Maximum Algebraic Difference in Cross Slope at Turning Roadway Terminals," *2018 Green Book*, Page 9-89). For example, when the freeway mainline cross-slope is 2% and the merging on-ramp is an 8% superelevation, this is an algebraic difference of 6%, which exceeds the maximum allowable rollover slope of 5%. Some superelevation is introduced at the nose gore, either by a single crown line centering on the nose or by a double break in the cross slope over the pavement wedge in front of the nose gore. Most of the superelevation should be gained beyond the nose ("Figures 9-28 through 9-31," *2018 Green Book*, Pages 9-85 through 9-88).

3.11 Median Islands

Raised Median Islands: Raised medians have application on arterial streets where it is desirable to regulate left turn movements ("9.6.3.5 Island Size and Designation," *2018 Green Book*, Pages 9-74 to 9-79). See [Section 4.8](#) for selecting curb type.

Elongated or divisional islands should not be less than 4' wide and 20' to 25' long. In special cases where space is limited, elongated islands may be reduced to a minimum width of 2'.

The approach nose of a curbed island should be in accordance with [NDOT Standard Plans for Road and Bridge Construction](#) and should be clear of vehicle paths, physically and visually, so drivers will not shy away from the island. The offset from the travel lane to the approach nose should be greater than that to the face of the curbed island, normally about 2'. For curbed median islands, the face of curb at the approach island nose should be offset at least

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2' and preferably 3' from normal median edge of the traveled way. The island should then be gradually widened to its full width. ("9.6.3.5 Island Size and Designation," *2018 Green Book*, Page 9-74)

Where a curbed corner island is proposed on an approach roadway with shoulders, the face of curb on the corner island should be offset by an amount equal to the shoulder width. If the corner island is preceded by a right turn deceleration lane, the shoulder offset should be at least 8'.

The Ramped Median Island Nose shown in [NDOT Standard Plans for Road and Bridge Construction](#) may be used in areas of snow.

Island Shapes and Types: It is important to consider the appropriate shape of median ends. Use Swept Path Analysis software to ensure they work for the design vehicle and intersection skew angle ("9.8.2.1 Shape of Median End," *2018 Green Book*, Page 9-120). Design for Left- and Right-turn Lanes. NDOT typically uses the Symmetrical reverse curve (R=300') taper method on curbed urban streets ("9.7.2.3 Taper Length," *2018 Green Book*, Page 9-100).

The smallest curbed corner island normally should have an area of approximately 50 square feet for urban and 75 square feet for rural intersections. However, a minimum of 100 square feet is preferable for both. Accordingly, corner triangular islands should not be less than 12', and preferably 15', on a side after the rounding of corners ("9.6.3.5 Island Size and Designation," *2018 Green Book*, Page 9-74).

3.12 Roadside Slopes

General: Roadside slopes refer to the slopes of areas adjacent to the shoulder and located between the shoulder and the right-of-way line. For safety reasons, it is desirable to design relatively flat areas adjacent to the travelway so that errant vehicles are less likely to turn over, vault, or impact a drainage channel. The Department determines desirable side slope limits for roadways based on the function and utilization of the facility in Table 3.12.

Where possible, the slopes should be flattened when the cost of flattening is less than the cost of guardrail construction and associated maintenance for a 20-year design life. In steep or deep cut sections, the top of the cut shall be rounded.

The Stormwater Division should be involved when any roadside slopes are to be disturbed. Disturbances, such as new cut and fill slopes, may have potential impacts to Waters of the US that will need to be mitigated.

Foreslopes: Foreslopes parallel to the flow of traffic may be identified as recoverable, non-recoverable, or critical. Recoverable Foreslopes are 4:1 or flatter. If these slopes are relatively smooth and traversable, the suggested clear-zone distance may be taken from "Table 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane," *2011 Roadside Design Guide*, Page 3-3. A non-recoverable foreslope is defined as one that is traversable but from which most vehicles will not be able to stop or return to the roadway easily. Foreslopes between 3:1 and 4:1 generally fall into this category. A critical foreslope is one on which an errant vehicle has a higher propensity to overturn. Foreslopes steeper than 3:1 generally fall into this category (Section 3.2.1 Foreslopes," *2011 Roadside Design Guide*, Pages 3-4 and 3-5).

The foreslope ratio should remain constant and uniform throughout a cut section except where variable slopes are needed to meet ditch grade elevations established by the hydraulic engineer. When the cut section is to be excavated for additional material or if for any other reason a flat bottom ditch is needed, the bottom should be graded to drain away from the roadbed at a 20:1 slope. Changes in slope ratio should be transitioned a minimum distance along the edge of the road at 50' for every unit change in ratio. For example, a 200' or greater transition length would be required when changing from a 2:1 fill slope to a 6:1 fill slope.

When contemplating constructing 4:1 foreslopes, the designer should consider using flatter slopes if possible. This is because additional shouldering material on future overlays will potentially render a portion of a 4:1 slope non-recoverable (3:1) thereby reducing the applied clear-zone. This can result in objects that were originally considered beyond the clear-zone to fall within the applied clear-zone. A roadside slope design using a "barn roof" type configuration to achieve clear-zone is considered poor engineering judgement and incompatible with highway safety. As an option, consider the clear-zone distance reaching a non-recoverable parallel foreslope and the subsequent clear runout area that may be provided at the toe of the non-recoverable slope to provide a suggested adjusted clear-zone distance ("Figure 3-2. Clear-Zone for Non-Recoverable Parallel Foreslope," *2011 Roadside Design Guide*,

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Page 3-6 and "Sections 3.3.2 Non-Recoverable Foreslopes and 3.3.4 Examples of Clear-Zone Application on Variable Slopes," *2011 Roadside Design Guide*, Pages 3-11 and 3-12).

Backslopes: When a highway is located in a cut section, the backslope may be traversable depending on its relative smoothness and the presence of fixed obstacles. Generally, if steep foreslopes are provided, the backslopes are relatively flat. If flat foreslopes are provided, the backslopes may be steeper. The slope ratio of the backslope may vary depending upon the geologic formation encountered. See Table 3.12 for desirable cut and fill slopes.

Table 3.12

Height (Feet)	Cut Slopes*		Fill Slopes
	Fore Slope	Back Slope	
0 to 5	10:1	10:1	10:1
5 to 10	6:1	6:1	6:1
10 to 15	4:1 or flatter	4:1	4:1
Over 15	4:1 or flatter	2:1**	2:1**

*Refer to Roadside Design Guide 2011, Figure 3-6 for preferred channel cross sections

**Slopes steeper than 2:1 require a Geotechnical evaluation

The use of benched backslopes requires the approval of the Chief Road Design Engineer in consideration of the right-of-way, geotechnical, hydraulics, stormwater and aesthetic impacts. Access to benches should be provided for maintenance.

Preferred Cross Sections for Channels: The preferred foreslopes and backslopes for basic ditch configurations can be calculated using "Figure 3-6. Preferred Cross Sections for Channels with Abrupt Slope Changes," *2011 Roadside Design Guide*, Page 3-9 and "Figure 3-7. Preferred Cross Sections for Channels with Gradual Slope Changes," *2011 Roadside Design Guide*, Page 3-10.

3.13 Weaving Sections

General: Weaving sections occur where one-way traffic streams cross by merging and diverging maneuvers. Principle types of weaving sections are illustrated in "2.4.6.1 Weaving Sections," *2018 Green Book*, Pages 2-38 through 2-40.

Length: The weaving section should have a length and number of lanes based on the appropriate level of service, as summarized in "Table 2-3. Guidelines for Selection of Design Levels of Service," *2018 Green Book*, Page 2-37. The 2010 Highway Capacity Manual (HCM) presents an equation for predicting the average running speed of weaving and non-weaving traffic based on roadway and traffic conditions. Level of service criteria for weaving section are based on the average running speeds. The Designer coordinates weaving sections with the Principal Traffic Operation Engineer and Traffic Division.

Ramps: The weaving section between ramps is shown in "Figure 10-70. Recommended Minimum Ramp Terminal Spacing," *2018 Green Book*, Page 10-127.

3.14 Interchanges

General: There are several basic interchange configurations to accommodate turning movements at a grade separation. The type of configuration best suited for a particular site is influenced by the number of intersection legs, expected traffic volumes of through and turning movements, type of truck traffic, topography, culture, design controls, and proper signing. "10.9 Interchanges," *2018 Green Book*, Pages 10-30 through 10-154 provides guidance on the selection and design of various types of interchanges.

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Innovative Interchanges: In addition to the interchanges described in the *2018 Green Book*, the FHWA provides resources on innovative interchange and intersection designs on their website under “Innovative Intersections,” *Intersection Safety*, FHWA Office of Safety, <https://safety.fhwa.dot.gov/intersection/>. These alternative designs can be considered where conventional interchanges may be insufficient.

3.15 Reports and Publications

General: The following is a listing of Publications for additional information regarding specific design standards adopted by NDOT. The current versions as of the publishing of this guide are shown:

AASHTO Publications

- *2018 A Policy on Geometric Design of Highways and Streets, 2018 7th Edition (2018 Green Book)*
- *2016 A Policy on Design Standards Interstate System, 6th Edition*
- *2011 Roadside Design Guide, 4th Edition*
- *2012 Guide for the Development of Bicycle Facilities, 4th Edition*
- *2004 Guide for the Planning, Design and Operation of Pedestrian Facilities*

Federal Highway Administration (FHWA)

- [*Federal-Aid Policy Guide*](#)
- [*2009 Manual on Uniform Traffic Control Devices \(MUTCD\), Revision 2*](#)
- *2013 Traffic Control Devices Handbook, 2nd Edition*
- [*2004 Standard Highway Signs and 2012 Supplement*](#)

United States Access Board

- [*2011 Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way \(PROWAG\)*](#)

NDOT Publications

- [*2006 NDOT Drainage Manual 2nd Edition*](#)
- [*2017 Access Management System and Standards*](#)
- [*2017 Standard Plans for Road and Bridge Construction*](#)
- [*2014 Standard Specifications for Road and Bridge Construction*](#)
- [*2015 Project Cost Estimation Manual*](#)
- [*2008 Structures Manual*](#)
- [*2006 Sign Supplement*](#)
- [*2017 Local Public Agency Manual*](#)
- [*2015 Work Zone Safety & Mobility Implementation Guide*](#)
- [*2017 Stormwater Quality Manuals Planning and Design Guide*](#)
- [*2010 Plan Preparation Guide*](#)

Other

- [*2010 Highway Capacity Manual \(HCM 2010\), Transportation Research Board \(TRB\)*](#)
- [*Transportation Research Board \(TRB\): All reports relating to Roadway Design*](#)
- [*National Cooperative Highway Research Program \(NCHRP\): All reports relating to Roadway Design*](#)

SECTION 4 PRACTICES AND BID ITEMS

4.0 Practices and Bid Items

General: This Section addresses common design details that may arise from the NDOT Standard Plans, Standard Specifications, field reviews, and construction. Also, this Section establishes standard design practices that are not necessarily part of the geometric design.

4.1 Adjust Covers

General: There are 3 methods for adjusting manholes and valve covers:

Method A. Use this method when removal of existing pavement by cold milling is not required. Pave over the cover. Once all paving is completed, locate and adjust to the final finished pavement level.

Method B. Use this method when removal of the existing pavement by cold milling is required.

Method C. Use this method of adjustment outside the areas as described in Methods A and B. (i.e. Roadbed Modification, Cold Recycle, and utilities in sidewalks)

Procedure: The Designer submits plans to the Right-of-Way utility agent to obtain ownership and location of manhole and valve locations. See the [NDOT Project Cost Estimation Manual](#) for obtaining 3rd party agreement numbers.

List the owner(s) of the utility on the Structure List.

4.2 Aggregate Base

Type: Type 1, Class B aggregate base is used on all projects unless otherwise directed by the Materials Division. Type 2, Class B aggregate base is used between median barrier rails, as shown in the [Standard Plans](#). However, if Type 1, Class B aggregate base is currently on the job, it may be utilized in lieu of Type 2. Coordinate with the Materials Division and the Construction Division.

Quantities: The quantity of aggregate base in District 2 and 3 shall be shown as CUYD. The quantity of aggregate base for District 1 shall be shown in TON. The TON unit shall include 8 percent for moisture content and requires the calculation for Slope Allowance when appropriate.

New construction and widening projects typically use Aggregate Base as the shouldering material. Consider doing shoulder stabilization.

4.3 Approaches and Access

Procedure: The minimum radius for an approach should not be less than 25' (measured at the face of curb or edge of pavement). Approaches should be keyed in by milling to the end of the curb or radius returns. The paving for approaches shall be transitioned within 10' or to right-of-way, whichever is less. Pave permitted gravel approaches to protect the edge of pavement.

Urban: Urban area approaches are generally paved to the back of the radius returns to restore crosswalks and stop bars. Consider right-of-way needs if paving to the radius returns puts the improvements beyond right-of-way. Temporary easements or permission to construct may be needed to perform this work or the scope might need to be modified to avoid work outside of right-of-way.

Rural: Approaches may be paved beyond the radius returns, not to exceed right-of-way limits. This is done in an effort to provide room for mud and dirt to shed from the tires to keep the stop bars clean and visible.

The Right-of-Way Division will perform the necessary title work to determine the names and addresses of the property owners served by the approaches without permits and shall contact the property owners. Right-of-Way encroachment permits can be found on [IRWIN](#).

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When a 3R or 4R project is outside of urban limits, existing non-permitted approaches shall be improved to the current standard. However, the owner of the approach shall obtain an encroachment permit and the fee will be waived. This work will be at the State's expense and the minimum necessary will be completed to bring the approach to the minimum standard. Do not encourage access where access is not commonly needed or presently used.

Refer to the [Access Management System and Standards](#) for type of approach, spacing, and application on various roadway facilities.

4.4 Cattle Guards

General: The installation and removal of cattle guards will be the responsibility of the Road Design Division on a site-specific basis. Coordinate the installation or removal of these facilities with the Right-of-Way Division, Bureau of Land Management (BLM), Nevada Highway Patrol (NHP), local sheriff, or the appropriate NDOT District. Send the location to the Traffic Safety Division.

Procedure: Approaches that enter a state highway within a project's limits in fenced areas should be reviewed for livestock protection. During the design of new facilities, attention must be given to approaches that intersect state highways, especially on controlled access facilities. Livestock may not be grazing in the immediate area however, the livestock in the surrounding area could get onto the highway. If an existing approach is used for stock drives, then a gate should be installed next to the cattle guard.

Cattle guards may be installed subject to the following conditions:

- In areas where right-of-way is fenced through grazing lands and where a gate on an approach is impractical (i.e. local roads, driveways, approaches, etc.)
- On entrance and exit ramps or preferably on approaches (cross streets) to the Interstate or other controlled access highways in areas where grazing lands may be encountered.

Cattle guards shall not be permitted across the travel lanes of any highway having full control of access. On the Interstate or other full control of access highway, gates may be permitted.

Steel cattle guards Type B, Type C, and Timber Foundation cattle guards are to be used in fence-line approach installations only. They are not appropriate for continuous, heavily traveled roadways.

Existing painted cattle guards will not be repainted, and new painted cattle guards will not be allowed, unless requested by Environmental Services as a better alternative to doing nothing.

Cattle guard wings are considered an obstruction. For roadways with less than 2' outside shoulders, the cattleguard shall extend a minimum of 2' beyond edge of traveled way. The extra width is necessary in maintenance and overlay operations. In order to facilitate truck-turning movements, the cattle guard should be constructed a minimum of 50' from the closest turning radius. All layouts should be tested with turning templates for WB-67 trucks to ensure that the largest vehicle will be crossing the cattle guard on the tangent. The preferred cattle guard placement in an interchange would be on each end of a crossroad. If the cattle guards are to be placed on the ramps, that decision should be fully documented by the designer.

The Designer should choose a location so that the installation is free draining. Some thought should be given to the function of the outlet pipe and the direction of drainage, any additional length of pipe should be specified in the plans.

4.5 Cold Milling

General: Check for any drainage problems around bridge structures from past overlay projects. Correct drainage issues by providing an adequate slope beyond the structure before transitioning back to the new finished grade elevation. The transitions at the beginning or end of a project may also require correction if the condition is warranted.

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Disposal of cold millings: Listed by priority:

1. Use for the Project
2. Give to the District
3. Give to the Local Entity (documentation/agreement with Local Agency)
4. Give to the Contractor

The millings tabulation should identify the amount of millings generated, the amount to be used as Recycled Asphalt Pavement (RAP), shouldering, stockpiled, or disposed of by the Contractor.

When contacting the District Maintenance Engineer or local government, verify the physical location where the cold millings will be placed and the contact information for the person responsible. Coordinate with the Specifications Supervisor, because the information will be added to the Special Provisions. In addition, consider the haul distance from the project to the stockpile location.

A summary with quantities of cold millings is required for all projects. The table should include the depth, quantity of cold millings generated by the project, where the cold millings will be used, the amount that will be used and what will remain after all the project needs are satisfied.

Cold millings used as Shoulder Material (Limitations): For aesthetic reasons cold millings may not be used along roadsides as shoulder material in certain scenic areas including Washoe Valley and the Tahoe Basin and in urban locations. Coordination with the Landscape Architect and the Environmental Engineer is required to determine if cold millings will be allowed on new construction projects.

Transitions: Normally mainline cold milling depth is carried to the physical gore before starting a different pavement section (transition) along ramps. Transitions are normally carried beyond the project limits to provide full structural section within the project. Complete the transition 100' before and after bridge structures.

On 3R projects, a grade break may be introduced to transition the structural roadbed improvement into the adjoining section of road at the following rates:

- 50' per inch where the posted speed limit is 45 mph or less
- 100' per inch where the posted speed limit is greater than 45 mph

Miscellaneous cold milling: This item can be expected when cold milling is required in areas where stripping or delamination is anticipated. Miscellaneous cold milling is not intended to correct cross slopes. The Designer will be notified of anticipated areas of stripping or delaminating by the Materials Division and will coordinate with them to determine a quantity or percentage of the project if an estimated amount is not provided.

4.6 Concrete Items

Major vs Minor bid item: Concrete for structures is classified as either major or minor depending on several considerations. The cost of minor concrete is significantly more than for major concrete to accommodate cost variables. A general distinction based on the pay quantity can be used as a starting point where less than 25 CY is minor and greater than 25 CY is major; this quantity is based on each structure or location and not on the contract quantity. In addition, the estimator must consider the complexity (special engineering, surveying, shop drawings and approvals) and amount of labor, equipment and materials included in the pour such as for forming (multiple angles, corners, vertical levels) and reinforcement (special doweling, multiple bends in reinforcing steel).

Some general examples of minor concrete include drop inlets (all types), pipe headwalls and small RCB headwalls, waterline caps and plugs, special manholes that are cast in place, special connections of pipes to RCB, and small drainage swales. In contrast, some examples of major concrete include a large cast-in-place RCB, approach slabs, wing walls, retaining walls, deck slabs, and a bridge barrier rail. A concrete slab with wire mesh reinforcing is a simple pour and, for a pay quantity moderately less than 25 cubic yards, could be considered major. Large junction boxes with multiple inlets, special separators for water quality improvements and special loadings are complex and, for a pay quantity moderately greater than 25 cubic yards, could be considered minor.

Class A vs Class AA bid item: Class AA is air-entrained concrete and is produced through the use of air-entraining portland cement, or by introducing air-entraining admixtures. The use of air-entraining agents results in concrete

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that is highly resistant to severe frost action and cycles of wetting and drying or freezing and thawing and has a high degree of workability and durability. Class A is not air-entrained concrete and is used primarily in Clark County. Class AA concrete is to be used in all other counties unless otherwise specified by Construction or Materials.

Crack and seat PCCP: This is a rehabilitation process performed on failing PCCP. A machine is utilized to break the pavement into blocks, which perform independently. Traffic is allowed to drive on this surface in order to seat it. A leveling course of plantmix is placed on this seated material and then the structural section plantmix is placed on top of the leveling course. A prime coat is placed between this seated concrete and the leveling course.

Rubblizing: This is a rehabilitation process performed on failing concrete pavement that is deemed to be in a worse condition than concrete slated for a crack and seat procedure. A machine is used to destroy the concrete to the point of making it into base material. A prime coat is then placed and then the structural section of plantmix is laid. Refer to Section 410 in the Standard Specifications for more information.

4.7 Culverts

Safety end sections: Use of safety end sections should generally be limited to those locations where the pipe ends are inside the clear zone. Install safety end sections on cross-drainage culverts greater than 30" in diameter. Parallel drainage features require a safety end section when greater than 24" in diameter.

4.8 Curb and Gutter, Dikes

Curb and Gutter: Type A or Type B glue down curbs and Type 2 or Type 3 foundation curbs are used for median islands and right corner (pork chop) islands. Coordinate with Construction and the appropriate District.

In areas where snow removal operations are expected, the use of mountable concrete curb (Type 6, 7, and 8) designs are preferred over vertical curbs (Type 1, 4, and 5). The mountable designs are less susceptible to damage from scraping by the snow plow blades thereby resulting in longer lasting curbs.

Curb Height: Curbs with a vertical face 6" or less in height may be used on urban arterials in areas where the posted speed limit is less than 45 mph.

Curb and Longitudinal Barrier Placement: Curbs installed in front of guardrail may cause vehicles to vault over the guardrail for some departure angles. Raised longitudinal features are not allowed within the end treatment area for any longitudinal traffic barrier. For operating speeds up to 50 mph, 1:1 slope faced curbs that are 6" or shorter can be used with a lateral offset of 0.0' (installed flush with the face of the guardrail.) (*NCHRP Report 537*). Guardrail installed behind curbs that are beyond the lateral offset of 0.0' (not flush with the face of the guardrail) should not be located closer than the following:

<u>Operating Speed</u>	<u>Minimum Offset</u>	<u>Allowable Curb height</u>
45 MPH or less	8'	6" or less with 1:1 sloping face
45 MPH to 55 MPH	12'	4" or less with 1:1 sloping face
55 MPH or greater	Not allowed	

The minimum offset shown above allows the suspension and bumper to return to their normal position after traversing over the curb allowing impacts with the barrier to proceed successfully.

Dikes: The standard height of dikes shall be 3" as this is suitable in most locations. For mountainous roadways with steep fill slopes, a 4" dike may be used with the approval of the Chief Hydraulic Engineer. A 6" dike may be placed at site-specific locations where its use can be justified for both hydraulic and erosion control purposes; approval must be obtained from the Chief Hydraulic Engineer first and then the Chief Roadway Design Engineer.

4.9 Curb Ramps

General: Curb ramps will be paid for as concrete ramp and will be paid in addition to curb, gutter, and sidewalk items. The bid item for detectable warnings is not included in the work and is required on all curb ramps new or retrofitted.

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4.10 Sidewalks

General: Schools, daycare facilities, senior homes, etc. can provide a variety of pedestrian, bike, and motorized chair movements. Any observation of unusual pedestrian activity including high volumes, special needs or mobility issues should prompt the designer to obtain actual pedestrian traffic data from Transportation and Multimodal Planning. Traffic generators that create intermittent peak demands, such as schools, may require special design considerations. Issues such as capacity, access and inter-modal continuity should be considered when determining what data is required to design an appropriate facility.

When feasible, pedestrian under-crossings should be designed so that continuous lighting is provided through the structure. Along freeways or expressways where frontage roads intersect local streets with walkways, it is desirable to construct walkways along the frontage road to provide continuity.

Width: The desired width of the sidewalk is 6' with 5' as the minimum, excluding the width of the curb. For areas with high pedestrian volumes, widths up to 12' should be considered. See the Department's Standard Plans regarding right-of-way restrictions. When determining the appropriate width for sidewalks, the designer should consider pedestrian volumes, the presence of pedestrian traffic generators (e.g., schools, hospitals, banks), the proximity of vehicular traffic, the placement of street hardware (e.g., fire hydrants, light standards and street signs), and the nature of the pedestrians expected to use the facility most often.

Grade: Where pedestrian access routes are contained within a street or highway right-of-way, the grade of the pedestrian access route is permitted to equal the general grade established for the adjacent street or highway, except that where pedestrian access routes are contained within pedestrian street crossings a maximum grade of 5% is required.

Cross Slope: The cross slope of pedestrian access routes (includes residential driveways) shall be 1.5% maximum.

Resources: Design issues and considerations for disabled persons are discussed in the *2018 Green Book* and *2011 Proposed Public Right-of-Way Accessibility Guidelines (PROWAG)*.

4.11 Excavation

General: Quantities are ultimately compiled by the design team and incorporated into the contract. It is important that duplicated quantities are not included in the contract totals. For this reason, the Structural Design team generates all quantities for their bridge related designs, Hydraulics generates quantities for culvert pipe installations, and the Roadway Design team calculates all other shared quantities based on the limits established by the structural and hydraulic design components.

Shrink / Swell factors: The Designer requests shrink/swell factors from the Geotechnical Engineer in the Materials Division when earthwork is required on a project. Shrink/swell factors are added to the Summary of Earthwork (3 Sheets).

4.12 Fences

Open Range: In areas of open range, as defined in NRS 568.355, any fence constructed outside Department right-of-way which intersects the right-of-way shall be terminated at the right-of-way line(s). The design and selection of gates will be the responsibility of the Road Design Division in communication with District Maintenance on a site-specific basis. Metal drive gates should be installed in right-of-way fences where property access may have frequent usage (excluding driveways, approaches, road intersections) and especially in those rural areas close to or bounded by urban or suburban areas. Missouri type gates may be installed in right-of-way fences in rural areas other than those stated above and where a relatively low incident of usage is required.

Steel posts are preferred for all fences.

Be aware of fence (especially chain link) that would obstruct drainage paths or culvert inlets and outlets.

In rural areas where both large and small animals exist, use Nevada 4-Wire Fence Type C-NV-4B as shown in the Standard Plans.

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Tortoise Fencing: The Environmental Services Division will perform an evaluation to determine if tortoise fencing may be required to be installed within the project limits and/or proposed NDOT material site(s). These projects are typically in Clark County.

Control of Access: Control of access fence is requested when it is necessary to prohibit access to the roadway lanes by pedestrians, animals and/or vehicles. Control of access is generally placed along the right-of-way lines. At interchanges, the control of access fence is normally extended a minimum of 750' past the radius returns in urban areas and 1320' in rural areas along major cross roads and/or frontage roads. In urban areas, a traffic study should be conducted to determine if any nearby access within these guidelines may pose a detriment to the operation of the interchange. The control of access may need to be lengthened or modified to accommodate operations. See "4.2.5. Spacing Standards near Interchanges," 2017 Access Management System and Standards, Pages 53 through 57 for more details.

In urban and suburban areas, a 6' chain link fence will normally be used to designate the control of access. Check for possible sight distance issues when installing fence around intersections. In rural areas where animals exist, use a minimum of a 4-wire fence per NDOT Standard Plans.

See "Figure 10-2. Factors Influencing Length of Access Control along an Interchange Crossroad", *2018 Green Book*, Page 10-10 for examples of locations to install control of access fencing at ramps and diamond interchanges.

Removal / modification: In many cases, both a permit and an agreement will be required before we will authorize removal of our control of access fence; the agreement is to be negotiated by the Right-of-Way Division. Removal of the state's access control fence in certain restrictive cases proposed by private, adjoining developers is subject to the following:

Case 1 – When a developer proposes to remove our control of access fence and replace it on our right-of-way line with a block or concrete wall, or a metal fence (chain link or decorative iron), NDOT will require that the new wall or fence become the property of NDOT with the developer being responsible for maintenance of the nonstandard wall or fence. A maintenance agreement with the developer, or some sort of property owners' association in the event the developer sells his interests to individual property owners, will be required for the continuing maintenance responsibility. A Right-of-Way occupancy permit will be issued for the actual construction.

The permit will cover removal of the existing fence, temporary fencing during construction, and traffic control requirements.

Case 2 – When a developer proposes that we allow removal of our control of access fence in favor of a fence to be constructed on his property, all conditions listed in case 1 will apply, except the developer will continue to own the replacement fence since it is on his property. NDOT will authorize removal of the fence only if it will be replaced by a block or concrete wall or metal fence (chainlike or decorative iron). NDOT will enter into the same type of agreement with the developer or property owner's association for maintenance specified in Case 1). Should it be necessary for safety or security, the agreement will require that the existing NDOT access control fence be physically tied to the replacement fence or wall.

Case 3 – In those cases where existing block or concrete walls, immediately outside NDOT's control of access fence, provide safe and durable access control barriers, NDOT may remove the access control fence to enhance aesthetics and/or for maintenance. Where necessary, we will, through our Right-of-way Division, enter into agreements with property owners allowing us to connect our remaining control of access fence to the existing block or concrete walls. In cases where we do remove our control of access fence in favor of existing block or concrete walls, our District personnel will take care to erect temporary fencing whenever breaks in the block or concrete walls are found. Should intentional access openings be developed in the block or concrete wall, or should necessary maintenance not be performed allowing some compromise to the access control, NDOT will immediately replace its permanent access control fence.

4.13 Guideposts

Placement: Guideposts should be placed along all roadways in accordance with the Standard Plans. Guideposts are calculated separately in a guardrail section. Reflectors are included with concrete barrier.

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Type: Rigid guideposts are normally placed in areas that have heavy snow removal, normally north of Tonopah. Request preference from the District. Flexible guideposts are for all other areas in the state.

Removal: There is no direct payment for the removal of guideposts. Include this directive in the general notes.

4.14 Headlight Glare Screen

General: NDOT installs the "paddle" type of headlight glare screen. Paddle type glare screen installation is described in the *NCHRP Synthesis of Highway Practice 66: Glare Screen Guidelines*, December 1979. Consideration for the installation should include safe stopping distance and accident data collected at night. Public complaints may also be an indication that glare screen is advisable.

4.15 Revegetation

General: All projects that remove or disturb existing vegetation need to be revegetated. This includes, but is not limited to, projects including slope flattening or new embankment. Coordinate surface treatment with the Landscape and Aesthetics Section and Stormwater Division. Depending on the site, revegetation may include aspects of erosion control, topsoil salvage, stockpiling, soil preparation, soil amendments, inoculants, mulches, seeding, erosion control fabrics, water application, rock treatment, and soil stabilizer.

Seeding: Depending on the project, seeding will be applied through drill seeding, hydraulically applied (hydroseeding), or by dry broadcast. Mixes for seed, hydromulch, tackifier, and mulch appropriate for the site must be specified on a project by project basis. Regardless of method, seeding shall occur from fall to winter, dependent upon permitting weather conditions.

4.16 Longitudinal Barriers

General: A longitudinal barrier (guardrail, concrete barrier rail or cable barrier) is used to shield motorists from obstacles located along either side of a traveled way. The barriers may also be used to protect pedestrians and bicyclists from vehicular traffic.

Cable Barrier: Cable barrier consists of a run of pre-stretched steel cables supported by weak posts and anchored at each end. It is cost-effective, easy to maintain, and highly effective at capturing errant vehicles when installed properly. Cable barrier is typically utilized in the median of divided roadways where vehicles crossing over is a concern and there is sufficient space to allow for deflection without an impacting vehicle entering the opposing traveled way.

General Guidelines:

- NDOT specifies Test Level-4 (TL-4) 4-strand cable only.
- Utilize 4 pre-stretched cables.
- Socket foundation shall be either steel or concrete.
- 300' is the minimum length of installation.
- All connections shall be field fit Swage fittings.
- NDOT requires a maximum 10.5' post spacing and no more than 12' deflection.
- A cable barrier system is composed of a Length of Need (LON) section and end anchors at each end of the run of cable. End anchor systems are gating and should not be counted as part of the LON. The Designer should continue the tension part of the cable 50' downstream of any obstruction before connecting to the end anchors.

Basic Installation Guidelines:

- Cable barrier systems shall not be placed on slopes steeper than 6:1.
- Cable barrier shall not be used to shield obstructions.
- A minimum clear distance equivalent to the likely barrier deflection shall be typically maintained between it and opposing EOP.
- To avoid the possibility of the vehicle overriding the cable, do not install cable barrier between 1' to 8' of the flow line. Preferably install the cable barrier on one side of the median slope. Installation of the cable barrier in the flow line can create maintenance issues.

Lateral Placement Guidelines:

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- Roadway departures are more common on the outside of a horizontal curve, therefore cable barriers on curves of divided highways should be placed on the inside of the outside roadway curve.
- When a curved cable barrier is impacted, the tension in the barrier immediately decreases as cables are separated from the posts and become slack, resulting in deflection in excess of the barrier's design deflection. This needs to be taken into consideration where deflection is an issue in its lateral placement.
- When cable barrier switches from one side of the median to the other as shown in Exhibit B, end anchors can be shielded from errant vehicles crossing the median by overlapping the installations. This is recommended to reduce the risk of the entire system being disabled if an end anchorage is impacted as well as reduce the risk of cross-median departures at that location.

Bid items: The associated bid items for a new cable barrier installation are CABLE BARRIER (LINFT) and CABLE BARRIER TERMINAL (EACH). Two terminals are needed for each run of cable barrier.

Concrete Barrier Rail: Concrete Barrier is generally recommended in high volume urban areas, especially freeways, because of frequent hits and minimal required maintenance. Considerations such as roadside drainage, flood plains, and accommodating future traffic control should be considered when contemplating its use versus other barrier systems such as guardrail or cable barrier.

42" Single Slope Concrete Barrier (Type B) shall be used on all NHS routes. 54" Single Slope Concrete Barrier shall be used adjacent to bridge substructures (abutments, supports, etc.). 36" Single Slope Concrete Barrier can be used when sight distance is a concern and on non-NHS roads.

Median Barriers: On controlled access highways, a median barrier shall be constructed in medians of 50' or less (Edge of Traveled Way (EoTW) to EoTW). On non-controlled access highways, concrete barriers may be used on medians of 50' or less; however, care should be exercised in their use to avoid creating a restriction in sight distance at median openings or on horizontal curves. The use of concrete barriers on non-controlled access facilities should be restricted to areas with potential safety concerns.

Median Application: Cable rail should be considered on all 4-lane divided highways separated with depressed medians using the following criteria:

- When the width of the median, measured from EoTW to EoTW is between 24' and 50'
- When the median width is between 50' and 70', a field study and discussions between the Safety Engineering Division, Standards Compliance Section, and the Design Team will determine if cable rail or another barrier is required.

Medians less than 24', as described above, are to be protected with concrete barrier rail or guardrail due to the deflection associated with cable rail. Outside shoulders are generally high hit locations and are not suitable for cable rail because of continual maintenance.

When considering the use of concrete barriers in a median, review "Section 6.2 Guidelines for Median Barrier Application," *2011 Roadside Design Guide*, Page 6-1 and consult the Traffic Safety Engineering Division.

Median concrete barrier rail shall not be used for carrying conduits as traffic control for certain types of work may require removal of portions of the barrier to construct temporary crossovers to accommodate traffic. Rerouting conduit runs at that time is very expensive and might reduce the available options for traffic control.

Paint and Integral Color: District 1 prefers paint on the concrete barrier rail and Districts 2 and 3 prefer an integral color treatment.

Fine surface finish: Shall be used at the discretion of the Bridge Division.

Impact Attenuators: The approach ends of longitudinal barriers should be flared out of the clear zone wherever practical and concrete barriers should only be fitted with a crash cushion when flaring is impractical. Flaring longitudinal traffic barriers beyond the clear zone also reduces the risk of vehicles passing behind the end terminal and being prevented from returning to the roadway thus eliminating the need to provide a safe run out area.

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Common applications of impact attenuators are at exit ramp gores and locations where bridge rail requires shielding and the use of guardrail is impractical. Combinations of barrier rail and impact attenuators are also frequently used to shield bridge columns within clear-zone.

There may be circumstances that require the designer to seek approval to designate a specific device (Sole Source) or limit the choices to those devices listed in the QPL that will perform satisfactorily. Examples are:

- If analysis indicates the device will be struck frequently, the designer should consider devices that have self-restoring properties and/or are quick, easy and inexpensive to maintain.
- If there is limited space for installing the crash cushion, the physical dimensions may preclude certain devices.
- If there is little room behind the crash cushion area, the location requires a device that can handle hits from both sides or there are other safety concerns with vehicles passing beyond the device then gating devices may be precluded.
- Current NDOT direction designates sole-sourcing the SCI-100GM on projects meeting the following criteria:
 - Locations on high-speed roadways where the posted speed limit (or 85th percentile speed) is greater than or equal to 55 mph and directional traffic volume is higher than 25,000 AADT in District 1 and District 2, and 12,500 AADT in District 3; and
 - Locations with a history or expectation of multiple impacts per year, repair time limitations, 10' or less off the traveled way, gore locations, and where night repairs are required; or
 - New construction or alterations where there is no crash history, but conditions or geometry are similar to locations meeting the above criteria.

Guardrail: The Midwest Guardrail System (MGS) is the preferred type of guardrail to be used on Nevada highways, except on NHS routes where 42" concrete barrier rail has been mandated.

The preference of flattening the slopes, extending culverts, or removing obstacles from the clear zone should be considered before installing any barriers. See [Section 3.12](#) for desirable side slopes.

Guardrail or another longitudinal barrier should be installed in areas where the result of an errant vehicle leaving the roadway and hitting an obstruction is judged to be more severe than impacting the barrier. Guardrail is recommended when runoff from melting snow or other drainage considerations are present.

Thrie-beam and 29" height W-beam as shown in the Standard Plans may only be used for repair purposes. If 50% or more of a thrie-beam or 29" height W-beam guardrail run needs repair, the entire run should be replaced with a new MGS installation.

Blocks: Existing thrie-beam steel post installations with 14" modified steel offset blocks meet the NCHRP 350 test requirements, but the department no longer uses this configuration due to the 2" height difference between it and the other thrie-beam configurations. Therefore, any such installation that is being altered in any way, either permanently or for temporary construction purposes, should have the offset blocks replaced with an approved offset block from the Qualified Product List (QPL). If the guardrail is determined to be in good condition and is to remain in place, the blocks are to be replaced using the pay item guardrail block. Address replacing blocks in the PDFS report.

End terminals: Flared and tangential guardrail end terminals each have advantages and disadvantages that must be considered when selecting the type of system to use. Tangential end terminals were developed to overcome the inflexible installation tolerances associated with the flared-type end terminals. The trade-off is that tangential end terminals are more likely to be struck than the flared type, resulting in higher maintenance costs. Generally, a flared-type end terminal is preferred to the tangential type and should be used unless problems installing or maintaining the system exist.

End anchors are used where it is not necessary to project the trailing end of the guardrail outside of clear zone in the opposing direction, typically on divided highways and interstate systems.

Buried end anchors should be used whenever possible. Refer to the Standard Plans.

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All new installations of end terminals shall be MASH-16 compliant. Existing NCHRP 350 compliant terminals can remain in-place if they are in serviceable condition. End terminals that are non-compliant with NCHRP 350 or MASH-16 shall be replaced with end terminals listed on the QPL.

Existing: Traffic barriers may not be 3" or more below standard height (see Standard Plans) after roadway improvements are completed. Traffic barriers must be brought into conformance with the current length of need criteria. Obsolete crash cushions, guardrail end terminals, and barrier transitions (guardrail to bridge rail or guard rail to concrete barrier rail connections) must be upgraded to current standards.

Grading. Material used to construct the graded areas around the end terminals and behind the run of guardrail posts normally consists of aggregate base, borrow, or cold millings. Shouldering material is not suitable for this purpose. Cold millings and plantmix should be avoided around guardrail posts. If it is necessary to place guardrail posts in plantmix, the area around the post must be grouted. See the special detail located on [ProjectWise](#). The quantities of grading material are included in the Summary Sheets. The use of longer posts for the end terminals is not allowed and the area must be graded per the Standard Plans detail.

Pay items. The remove and reset bid item is used for moving existing and/or new guardrail panels and blocks to accommodate the milling and paving operations. The remove and reset bid item is not required for roadways with new alignments and no traffic will be on the roadway. Projects with a combination of traffic and no traffic sections will have to be addressed accordingly.

The reconstruct guardrail bid item will require new guardrail posts; coordinate bid items with the Specifications Section.

Markers. Guide posts are calculated along guardrail runs. See the Standard Plans for details.

Miscellaneous. The distance behind the guardrail must allow for deflection necessary for proper function when guardrail is impacted. Methods 1-4 are shown in the Standard Plans for guardrail installation, deflections and back spacing. When designing guardrail runs adjacent to fixed obstructions, the Designer should state in the plans the preferred method to prompt the Contractor and Resident Engineer. The additional posts and/or nested rail in methods 2, 3, and 4 are at no direct payment.

4.17 Mailboxes

General: It is the responsibility of the Designer to contact the local Postmaster and coordinate the location of neighborhood collection boxes and turnouts within the project limits.

On projects where we cannot arrange for installation of neighborhood collection boxes, replace the mailboxes that required removal or relocation to facilitate construction using only approved tubular metal supports. Refer to Standard Plans for details.

Turn outs: Summarize the type and amount of base and surfacing in the summary sheets.

4.18 Maintenance Access

Roadway width: For controlled access facilities, provide maintenance access between fence lines (or right-of-way, whichever is less) to the adjacent slopes at the following widths:

<u>SLOPE</u>	<u>WIDTH</u>
Steeper than 3:1 fill slope	15'
3:1 fill slope or flatter	12'
Steeper than 3:1 cut slope	12'
3:1 cut slope or flatter	10'
Retaining walls	15'
Bridge structures	15'
Drainage structures	20'
Utilities	Determined by owner

SECTION 4 PRACTICES AND BID ITEMS

Maintenance roads generally consist of a 4" aggregate base course. Paved maintenance roads should be evaluated on a case by case basis. Overhead signs and power lines need to be evaluated to ensure adequate clearance can be maintained for service equipment.

4.19 Marking

Marking width: Interstates and freeways require 8" wide edge line and lane line stripes. Gore lines, auxiliary lane lines, and dotted lines leading up to the gore shall be 12" wide. For all other roadway types, edge line and lane lines are typically 6" wide.

Bike lane stripes are 6" wide. Consult "Part 9 – Traffic Control for Bicycle Facilities," *2009 MUTCD*, Pages 789-816 and the Standard Plans for permanent pavement markings for Bike Lanes.

Temporary marking: Temporary centerline and lane lines must be placed on pavement that is not the finished surface whenever traffic will utilize the pavement. If traffic will be on the new surface for more than 14 calendar days, then temporary marking should also be used for edge lines, crosswalks, stop bars, gore markings, railroad crossings, words, symbols, etc. Quantities of temporary marking must be calculated for all lifts of asphalt.

Temporary marking tape: TYPE 1 TEMPORARY STRIPING TAPE is more readily removable from the surface and is recommended for use on surfaces which are not designated to be covered or removed, and on temporary areas where traffic patterns are to be altered. TYPE 2 TEMPORARY STRIPING TAPE is much more difficult to remove from the surface and is recommended for use on surfaces which are to be covered or removed in which removal of the tape will not usually be required. The use of temporary pavement marking tape shall not be used on sections where cold milling conflicts with pavement markings. It will be necessary to paint pavement markings in these areas. The use of tape should be discussed during the traffic control meeting if it is determined to be used on the project.

Permanent marking: Markings and Raised Pavement Markers (RPM's) are used in Clark County. See standard plans for location of reflective and non-reflective pavement markers. For all other counties, epoxy paint for lane lines, shoulders, and gores is normally used on Interstates and NHS routes. WATERBORNE PAVEMENT STRIPING (TYPE II) is used for all other roadways when requested by District. POLYEUREA is typically used in District 1.

For Stop bars, cross-walks, arrows, "ONLY", and railroad pavement markings use Permanent Pavement Marking Film (Type 2) for new paving projects to receive open grade. The use of Thermoplastic Pavement Marking is generally used on roadways that receive other surface treatments such as chip seals, micro surfacing, and PCCP.

4.20 Medians and Raised Features

General: A median is defined as the portion of a divided highway separating the traveled way for traffic in opposing directions. The principle functions of a median are to provide separation from opposing traffic, provide a recovery area for out of control vehicles, provide a stopping area in case of emergencies, provide for special changes and storage of left turning and U-turning vehicles, minimize headlight glare, and to provide width for future travel lanes. Medians are highly desirable on arterials carrying four or more lanes. Concrete curbs and gutters should only be used when justified for controlling traffic movements (channelizing) and replacement of existing infrastructure. Raised islands will be provided only in those instances where a need to control access is warranted.

Width: The median width is the dimension between the through-lane edges including the left shoulders, if any. The preferred width for interstates and freeways in rural areas is 50'. See "4.11 Medians," *2018 Green Book*, Page 4-38 for median design considerations.

Slopes: A depressed median is generally preferred on freeways for more efficient drainage and snow removal. Median slopes preferably should be 6:1 or flatter. Drainage inlets in the median should be designed with the top of the inlet flush with the ground and cross culverts extended beyond clear-zone. See [Section 4.7](#) for the use of culvert safety end sections, where needed.

Emergency Cross-Over: When requested by NDOT Maintenance, the Nevada Highway Patrol, or emergency services, NDOT may provide emergency crossovers on rural freeways and principal arterials at an average spacing

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of not less than 2 miles where interchange spacing is 4 miles or greater. More information is available in "8.3.2 Medians," *2018 Green Book*, Page 8-9.

The actual spacing shall be adjusted to avoid curves and other locations with inadequate geometrics for this type of maneuver. Delineation and markings for emergency crossovers will be in accordance with the Standard Plans.

Median Islands: Ramped median island noses are generally used in snow prone areas. For islands less than 4' in width, use concrete paving. Refer to Standard Plans for island nose markings and delineators. Striping shall be offset from the front face of the curb. Use swept path analysis software to assist with island design.

4.21 Milepost Markers

Milepost markers and Post mile markers: The two bid items are now calculated by Traffic Operations as sign quantities. Milepost panel vinyl stickers shall be placed at major functionally classified intersections on the signal light poles in urban areas.

4.22 Object Markers

Object Markers: Object markers shall be placed to warn motorists of hazardous objects that are in clear-zone and not protected, such as bridge rails, underpass abutments, utility poles, and drainage structures. To the extent possible, the marker should be located so that if the motorist avoids the object marker they will also avoid the object.

An object marker may be required when:

- A culvert exists that is equal to or greater than 30" internal diameter with no provisions to allow passage of a vehicle over the culvert end, or
- Headwalls or wing walls protrude 4" or more above the graded slope, thus causing a snagging problem.

4.23 Portland Cement Concrete Paving

General: For concrete paving, widen 5' beyond the paving to facilitate the paving equipment. The 5' widened area will then be backfilled with aggregate base after paving. When concrete paving abuts retaining walls, a 5' area of miscellaneous concrete paving will be required in front of the wall.

Extend cement treated base one foot beyond the concrete paving. Do not use cold millings from plantmix as shoulder material on PCCP.

Use of cold millings material adjacent to the concrete pavements has led to water being trapped along the edge of the concrete slab which ultimately leads to pumping.

Divided roadways with PCCP separated by a concrete barrier should have the center of the crown coincide with one of the outside edges of the concrete barrier. This facilitates construction when placing barrier rail on PCCP.

Longitudinal weakened plane joints: For wide concrete pavement sections, the quantities for longitudinal weakened plane joints should be determined assuming that the contractor will pave in 24' maximum width pours. In the past, we have had overruns because the designer assumed the contractor paved half width freeway sections in the range of 56' plus wide in one pass. It is Construction's opinion that a 24' width would be appropriate for the determination of the weakened joint quantity. On rural freeways (2-Lanes each direction), the total width of 38' can be assumed to be paved in one pass.

Profile grind: Include Saw & Seal Longitudinal Joints and Transverse Joints bid items when profile grinding PCCP.

4.24 Plantmix and Asphalt Items

Shoulder dike: Shoulder dikes are paid for as wet tons of plantmix and a LINFT item, "Shoulder Dike". Seal coat for the plantmix dike is only required for existing shoulder dikes (new shoulder dikes do not require a seal coat), sand blotter is not required. (Asphalt type and application rate determined by Materials Division). See [Section 4.8](#) for locations and restrictions for shoulder dike.

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Cold recycles: The bid items for cold recycle jobs are covered under Section 404 in the Standard Specifications. Provide a bid item for sand blotter so traffic can travel on the recycled surface.

Roadbed modifications: The bid items for roadbed modifications are covered under Section 305 in the [Standard Specifications](#). Provide a bid item for sand blotter so traffic can travel on the modified surface. Include additional one foot of width on each side when calculating processing and paving items for roadbed modification.

Open-grade: Open-graded plantmix surface wearing course shall be placed on plantmix facilities, generally all arterial streets and highways. The open-graded plantmix surface may be eliminated from such roads if it is demonstrated that an alternate wearing course type (chip seal, etc.) would be more cost effective, as determined by the Materials Division.

The finished surface must be flush with the top of surface drainage inlets. In some cases, special details will be necessary to modify existing drainage facilities. In snow removal areas, the open-grade should be placed full width to eliminate drop-offs, grade breaks and other undesirable features that cause the snow removal equipment to snag and/or grade off plane (i.e. paved turn outs for chain up areas). Open-grade is also to be paved flush with the lip of gutter in all cases.

Profile-grade location: The profile grade is vertically located on the top of open-graded surface. On undivided roadways the profile is placed at the crown. On divided highways where the roadways are treated independently of each other, the profile grade is normally placed between lane 1 and lane 2 (or centerline). On ramps the profile grade is located at the outer edge of pavement or on the outside shoulder stripe.

Prime coats: Prime coats are applied between the base course and the first plantmix lift. Prime coats normally consist of MC-70; SS-1h may be used for prime coats in small areas. SS-1h requires two separate applications. (Asphalt type and application rate determined by Materials Division).

Tack coats: Tack coats are applied between plantmix lifts and between the final plantmix lift and the open graded surface. Plantmix lifts are placed in 3" maximum depths. Tack coat quantities are not included in the Engineer's Estimate. It is incidental to the plantmix quantity.

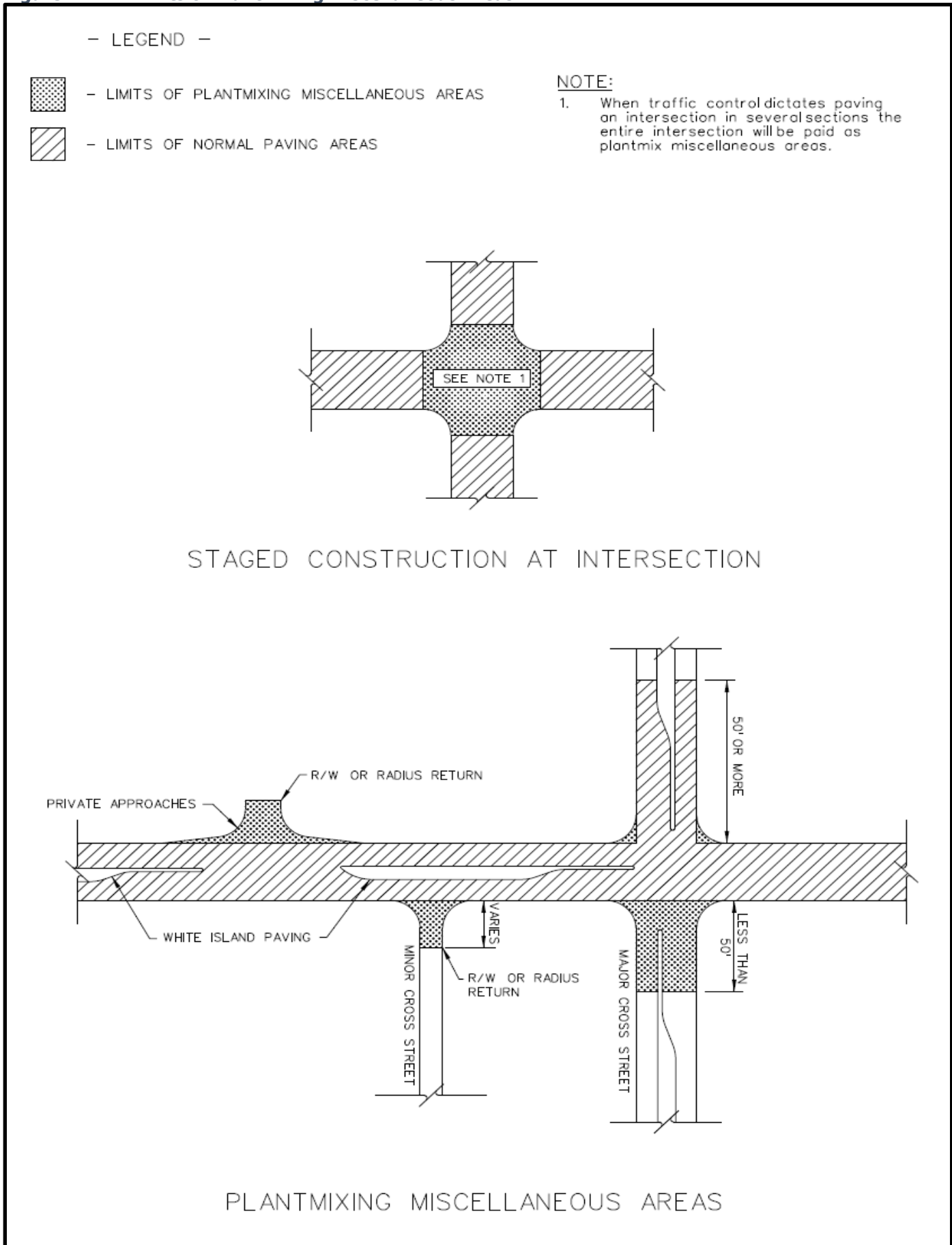
Seal coats / sand blotter: Seal coats are normally placed on plantmix surfaces that do not receive open-grade. The Materials Division will specify the type of seal coat material that will be used. Examples of such areas may include approaches, paved islands, paved ditches, and existing dikes. In these cases, include the sand blotter item.

Mineral filler/ asphalt cement: Incidental to the plantmix quantity and not included in the Engineer's Estimate. Provide on the summary sheets for informational purposes only. See [Project Cost Estimation Manual](#) for items and percentages.

Plantmixing Miscellaneous Area (PMA): Limits of PMA will be calculated as shown in Figure 4.24. The PMA bid item includes placement only and does not include material. It covers the extra labor required for placing the material.

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Figure 4.24 – Limits of Plantmixing Miscellaneous Areas



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4.25 Removal Items

Tree Removal: Tree removal is accomplished using REMOVAL TREES (EA) or (LS).

For all projects that require the removal of trees, a tree removal memo for trees with trunks greater than 4" in diameter is required. The Designer, in coordination with the Landscape Architect, is responsible for identifying trees that will be impacted. The memo must include species, health, trunk diameter, and quantity of trees designated to be removed by the project, as well as the recommended mitigation as a result of the tree removal. The mitigation recommendation for the tree removal is developed by the Landscape Architecture Section.

The Project Manager/Project Coordinator prepares the memo for approval by the Chief Roadway Design Engineer. The memo is typically prepared and approved during the preliminary design phase, but no later than the intermediate submittal. Attach the appropriate plan sheet(s) showing location(s) for the proposed removals.

Clearing and Grubbing: CLEARING AND GRUBBING covers the removal and disposal of all vegetation within construction limits, except such objects designated to remain. RURAL CLEARING or URBAN CLEARING may be required in some areas to remove other natural or manmade objects not compatible with the project. Clearing and Grubbing items should be discussed with the Construction Division and Specifications Section.

Composite Surface: REMOVAL OF COMPOSITE SURFACE is generally used to remove a combination of items such as curb, gutter, sidewalk, plantmix surface, and aggregate base. Using this bid item eliminates the need to itemize removal of separate items however, REMOVAL OF COMPOSITE SURFACE usually comes at a higher price. As an example, use this item or ROADWAY EXCAVATION when trenching and widening in an urban area where all these items would be encountered. However, if REMOVAL OF COMPOSITE SURFACE is used, do not also use REMOVAL OF CURB GUTTER or REMOVAL OF SIDEWALK on the same project.

Detours: The Designer shall coordinate with the District Engineer to determine whether any temporary detours will be allowed to remain or should be removed after construction. Any detours designated to be removed after construction will require bid item(s) for removal. Detours are usually removed under the bid items REMOVAL OF BITUMINOUS SURFACE and RENT EQUIPMENT (MOTOR GRADER) or ROADWAY EXCAVATION may be used.

Headwall Removal: REMOVAL OF HEADWALL is used when removing a headwall to extend a pipe, and no allowance is given for cutting the pipe. Headwalls are to be removed without damaging the existing pipe (RCP or CMP) and payment for removal of the headwall is all inclusive. Cutting the existing pipe, while permissible, is not desirable (especially RCP's) and should be avoided when extending existing culverts.

Plantmix dike: On all projects with existing plantmix shoulder dike, the dike should be evaluated by the Hydraulics Division to determine the necessity. Remove shoulder dike that is not warranted to eliminate it as a roadside obstacle using REMOVAL OF BITUMINOUS SHOULDER DIKE. See [Section 4.8](#) for more information on dikes.

Traffic lines: Raised pavement markers do not need to be removed as a separate bid item when cold milling. However, raised pavement markers will require removal with bid item REMOVE PAVEMENT MARKINGS (LINFT, SQFT) or REMOVAL OF RAISED PAVEMENT MARKER (EACH) for slurry seals or other surface treatments, or if temporary traffic control will require temporary marking.

4.26 Retaining Walls

General: The location of retaining walls and sound walls requires coordination of ground profiles and top and bottom alignment and elevations. Roadway Design will provide to the Geotechnical Section and the Bridge Division a horizontal alignment and profile of the wall and cross sections at 25' intervals for the length of the wall. Cross sections will include elevations of top of the wall, existing ground intersecting the plane of the wall, proposed ground at the exposed face at the base of the wall, bottom of the slope in front of the base (the slope supporting the wall), and the top of the slope above the wall (slope being retained by the wall). In addition, show any ditches behind or in front of any proposed walls. Topographical information for the existing and completed condition should be at least three times the wall height in front and behind the wall.

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4.27 Rumble Strips

Edge line: Rumble strips should be placed on all rural highways that have a shoulder width greater than or equal to 4'. In situations where the lateral offset of a longitudinal traffic barrier from the shoulder stripe is less than 5' then, in consideration of bicycle traffic, the placement of a rumble strip must be justified by an engineering study. The study should consider the consequences of omitting the rumble strip adjacent to the traffic barrier and adjusting the lateral offset of the traffic barrier to provide at least 5'. Rumble strips normally will not require a seal coat unless otherwise directed from the Materials Division.

Rumble strips should be avoided within 1000' of residential areas.

Center line: Center line rumble strip shall be installed per NDOT Standard Plans. On multi-lane highways, center line rumbles shall be included on the broken white line at the request of Traffic Safety Engineering. Center line rumbles in urban areas shall be at the request of Traffic Safety Engineering.

4.28 Shoulder Material

General: Overlays outside of curb and gutter areas usually require a quantity for shouldering material. Shouldering for new construction will be accomplished with the same material as used for the base course, not with shouldering material. Shouldering material cannot be used to grade roadsides for guardrail, end terminals, or contour fill over culvert extensions.

The use of milled plantmix material for shouldering material along concrete pavements is not allowed. Use of bituminous material adjacent to concrete pavements has led to water being trapped along the edge of the concrete slab that ultimately causes pumping.

Quantities: Shouldering material should typically be calculated using the tons per station per side as shown in the table below. Quantities should be evaluated on a case by case basis during the PDFS and excessive erosion or low shoulders should be considered. Quantities shown below include 1' shoulder widening as shown in the typical sections. Typically, 5 tons/station/side/inch of overlay is the quantity used.

SHOULDERING MATERIAL (TONS PER STATION PER SIDE)

<u>Height of overlay</u>	<u>Amount</u>
2"	10
3"	15
4"	20
5"	25
6"	30

4.29 Slope Flattening

General: For projects that require slope flattening to bring slopes into compliance; accomplish the work with a borrow embankment/roadway excavation item. If encountering rock slopes and the material will be used as fill, consider using aggregate base or shoulder material to cap the roadway slope to provide a smooth surface. Include the bid item CLEARING AND GRUBBING for areas under the new slopes. The depth of aggregate base or shouldering material should be discussed during the PDFS and reviewed by the Constructability Section. See [Section 3.12](#) for desirable roadside slopes.

Top Soil (Salvage): Typically, the top 6" of existing roadside slope material, if suitable, shall be removed using bid item TOP SOIL (SALVAGE) (CUYD) prior to slope flattening to be placed back on top of slope flattening material. This is to promote revegetation to prevent erosion.

4.30 Stockpiles

General: Maintenance stockpiles that are produced expressly for that purpose require a separate funding breakout because the FHWA will not participate, so State funds are used. Maintenance stockpiles that are produced incidental

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to the construction (such as with cold millings) require coordination with the District Engineer to ensure that an area will be available to accommodate the amount of material when the contractor is ready to deliver it.

4.31 Temporary Pollution Control

General: The Stormwater Division calculates the dollar amount to be included in the bid item for temporary pollution control. The Designer will coordinate with Stormwater during the QA/QC submittal to provide the necessary information. The final temporary pollution control estimate will include the temporary pollution control estimate prepared by Stormwater combined with the dust control estimate prepared by Roadway Design. These items will remain separate in the estimate until final design.

4.32 Temporary Traffic Control

General: Use NDOT Standard Plans and the MUTCD for the development of temporary traffic control plans. Analyze the impact that temporary measures are expected to have on traffic. Situations that require a lane reduction or detouring traffic onto a lower capacity facility are good examples of where the level of service will likely be reduced. By understanding the potential impacts of this reduction, the design team can establish additional measures to improve the temporary condition such as:

- Adjusting signal timings
- Restricting the hours of construction operations to avoid peak volumes
- Providing adequate storage area for turning movements
- Adjusting lane assignments to match morning/evening directional peak flows

If hourly counts are needed to determine limitations of operations for the temporary traffic control, the information should be requested for the anticipated time or use the [TRINA Traffic Information Map](#) when construction is expected to occur. The Principal Operations Engineer should be consulted for analysis of the data and the Construction Division should be consulted regarding appropriate working hours.

Temporary Pedestrian Access: All pedestrians should be provided with safe, accessible, and reasonably convenient paths that replicate as nearly as practical the most desirable characteristics of the existing pedestrian circulation facilities when temporary traffic control zones are planned and set up. See ATTSA's [Applying the American with Disabilities Act in Work Zones: A Practitioner Guide](#) for more information.

Arrow Boards: See Standard Plans for the type of arrow board to be used during construction.

Cones vs Drums: Cones are typically used where speed limits are below 50 mph. Use drums on all interstate and NHS routes. Rolling operations, such as marking, may use cones if approved during the temporary traffic control meeting.

Portable Barrier Rail: The Designer is cautioned when using portable barrier rail around intersections and approaches. Check for site distance issues that may arise during construction when barrier rail may be installed. When lump sum temporary traffic control items are used, note any potential site distance conflicts in the plans or special provisions. Select the appropriate end treatment from the Standard Plans.

Barrier rail is generally used when longitudinal drop offs exceed 3" with speeds greater than 35 mph. The use of portable barrier rail is evaluated on a case by case basis and should be discussed during the PDFS and traffic control meetings.

Low Profile Impact Attenuators: The use of low profile impact attenuators may be specified where sight distance is an issue such as around approaches or intersections. Consult the Standards and Manuals Section for options.

Contractor Furnished (LS): Projects in rural areas may use the lump sum method. Projects located in major urban areas, such as Las Vegas, Reno and Carson City, will typically provide individual bid items and plans. Projects located in small urban areas, such as Elko and Winnemucca, may use lump sum if this method is decided to be appropriate during the temporary traffic control meetings. Lump sum temporary traffic control is discussed and approved by the TMP Team.

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For contracts using lump sum temporary traffic control plans, a temporary traffic control matrix and device summary is unnecessary since the construction phasing and staging requirements will be the responsibility of the Contractor. The Contractor should be made aware that lump sum temporary traffic control will include portable concrete barrier rail, changeable message signs and pilot cars, etc. This can be addressed in the Special Provisions. The Construction Division is responsible for providing the Designer with the number of working days, project completion date, flagger hours and liquidated damages.

Temporary lane width reductions: The reduction of lane widths to accommodate construction should be evaluated carefully and reducing lane widths to less than 11' requires approval of the Chief Road Design Engineer. Refer to over dimensional permits under Administrative Services in [Section 5.2](#) concerning lane width reductions.

Policy and procedure: The temporary traffic control plans are incorporated into the TMP.

Speed reductions. Existing speed limits shall remain in effect through work zones on state highways except where those work zone activities create a condition that would be aggravated by retaining the existing speed limits. On those types of projects, the plans or specifications shall specify speed limit reductions through the work zone. Such conditions could include:

- Reduction in lane widths
- Reduction in the number of lanes and/or shifting of lanes from the designed alignment
- Uneven surfaces
- Temporary surfaces such as roadbed modifications, cement treated bases, chip seals, etc.

A temporary reduction in the regulatory speed limit may be established as part of the traffic control plan, including those furnished by contractors.

The regulatory speed limit in a project work area may be temporarily reduced by 10 mph or to 55 mph, whichever is lower, with concurrence from the Chief Traffic Operations Engineer; the Director must approve greater reductions based upon a recommendation from the Chief Traffic Operations Engineer. Any approved reductions are included in the TMP. This policy also applies to traffic control plans furnished by the contractor. See "2.5.1 Temporary Speed Reduction," [NDOT Work Zone Safety & Mobility Implementation Guide, 2015 Edition](#), Pages 19-20 for more details on the process.

4.33 Traffic Counting Loops and Pull Boxes

General: A request is sent to the Traffic Information Chief, Planning Division for traffic counting station information, using the [Request for Traffic Counting Stations Memo](#). Traffic loop and pull box locations will be provided. Additionally, the Planning Division may include new weigh-in-motion loop locations.

4.34 Traffic Control Supervisor and Uniformed Traffic Control Officer

Traffic Control Supervisor: Traffic Control Supervisors are required on all projects. For projects with lump sum traffic control, there is no direct payment for Traffic Control Supervisor. RENT TRAFFIC CONTROL SUPERVISOR (HOUR) will be used to pay for Traffic Control Supervisor on all other projects. Constructability will provide the number of hours to include on each project.

Uniformed Traffic Control Officer: Uniformed Traffic Control Officers, typically NHP or local law enforcement officers, positioned appropriately can help to increase awareness and slow down vehicles in work zones. An ancillary item for RENT UNIFORMED TRAFFIC CONTROL OFFICER (FA) should be included in the estimate for all projects. This is an unbiddable item and use of the Uniformed Traffic Control Officer will be at the discretion of the Resident Engineer.

5.0 Engineering Support, Divisional Resources and Other Agencies

General: This section describes the type of services and design support provided by each division. It also describes the type of correspondence or information that may be exchanged between the Design Division and the other Divisions listed below. For a listing of all Divisions, names of individuals, and work titles go to [SharePoint](#) and the respective Division.

5.1 Accounting Division

General: The Accounting Division is responsible for the overall administration of the accounting function within the department. The division is comprised of Operations, Payroll, and Project Accounting. The Accounting Division reports to the Assistant Director, Administration.

Project Accounting: The Project Accounting Section is responsible for processing financial transactions associated with projects and agreements, such as payment vouchers for services and construction progress payments. The Project Coordinator also works with Accounting to closeout projects when they are completed. See [Section 6.14](#) for project and agreement closeout procedures.

5.2 Administrative Services Division

General: The Administrative Services Division reports to the Assistant Director, Administration, and has six major areas of responsibility. The Building and Grounds Section, Purchasing and Reproduction Section, Records Management Section, Over-Dimensional Permits Section, Agreement Services, and Contract Services.

Agreement Services: The Project Coordinator coordinates any agreements through the Agreement Services Section to ensure proper review and execution of the document. See [Section 6.7](#) for developing agreements.

Over dimensional permits: The Designer is to notify Administrative Services Over Dimensional Permit Section of any permanent design features or temporary traffic control measures that may limit certain vehicles, especially over-dimensional vehicles. Report the following situations to advise the Over Dimensional Vehicles Permits Office in writing at OverDimensionalPermitsOffice@dot.nv.gov:

- Separated and protected single travel lane; either direction including shoulders \leq 20 feet.
- Opposing and unprotected single travel lanes; both directions including shoulders \leq 30 feet.
- Separated and protected double or more travel lanes; either direction including shoulders 30 feet.
- Opposing and unprotected double or more travel lanes; either direction including shoulder \leq 30 feet.
- Number, direction and width of each travel lane (not including shoulders).
- Maximum width and direction, including all available travel lanes and shoulders, between planned temporary barriers and/or road cones (if applicable).
- Whether restriction is delineated by immovable walls, temporary walls, or road cones (if applicable).
- Height and location of highest barrier (if applicable).

Central Records: The Central Records Section of the Administrative Services Division maintains the department's official records. These files include:

- A copy of the Design Division's archive of all pertinent project computer files on CDROM as they existed at the time the contract is awarded. All archives include the project design files and the special provisions, and later versions also include the applicable standards. For projects completed using ProjectWise, this data is maintained in the ProjectWise archive as well.
- The complete project files are stored in central records, upon completion of the contract, for 3 years after final payment. These files include the project workbooks and any information that was not incorporated into the contract documents such as cross sections, mass haul diagrams and Best Management Practices provisions.
- A set of contract plans marked up by the resident construction engineer to note differences between the design and the actual construction of the project. These plans are commonly referred to as "as built" or "as constructed" plans.

SECTION 5 ENGINEERING SUPPORT, DIVISIONAL RESOURCES, AND OTHER AGENCIES

- Original contract modifications are kept indefinitely.
- A complete set of contract documents as awarded including supplemental notifications.
- The Resident Engineer's field books for projects completed prior to implementation of e-construction.

Central Records archives can be a valuable resource for finding as-built project information for items that are missing from mapping files, old alignment data, and other old work that may not be available anywhere else that can be useful for new projects. Central files keep a record of any archived material that has been checked out and annually notifies recipients to return any overdue files. The recipient has the option of returning the material or checking it out for a longer period of time and is responsible for returning all archived material to its proper place and in good condition.

5.3 Construction Division

General: The Construction Division provides advice and assistance regarding highway construction, including engineering inspection of construction activities, constructability and guidance in the development and adoption of new and improved highway specifications. The Construction Division also provides the contract working days for inclusion into the special provisions for the contract. The Construction Manual and the Documentation Manual, which is on file with various design squads, details the division's operational policies and procedures. This division reports to the Assistant Director of Operations and has overall program authority, including the administration of statutory regulations and departmental policies that involve contract activities. As part of this overall program authority, the Construction Division provides assistance and advice regarding highway construction inspection and field testing; guidance in the development and adoption of new highway specifications; and oversight of contract modifications, dispute resolution, and claim resolution. This division is divided into four areas of responsibility, The Quality Assurance Section, Constructability Section, Construction Administration Section, and Partnering.

Pre-Bid: When the design is complete, NDOT advertises the project to solicit bids. On complex projects, NDOT holds Pre-Bid Conferences with prospective bidders. During the Pre-Bid Conference, NDOT representatives describe project details, and prospective bidders may ask questions to clarify understanding of the project. Bidder attendance at the Pre-Bid Conference may be mandatory to ensure that all bidders have equal access to information needed to prepare bids.

Partnering: The partnering program is a tool used by the Department and the contracting community to mitigate risks during the life of a construction contract. Partnering is a business model where the department and the contractor come together prior to working on the contract to discuss goals and priorities, identify known risks, and put in place methods for communication and for issue resolution. Partnering also requires regular monitoring of the project to evaluate the progress towards our common goals, as well as a close out process to document lessons learned. Partnering is our way of doing business so the specification goes in for every project. Contracts with a bid over \$10 million will require the contractor to hire an outside facilitator to help guide the partnering process. Contracts under \$10 million may be facilitated either professionally or internally. The line item amount for partnering will be provided by the Constructability section.

The Contract Administration: In addition to supporting the Resident Engineer's general administration functions, the Administration Section plays an active role in processing contract modifications and contractor requests.

Constructability: The Constructability Section provides input in developing construction documents. Construction documents must be adequate for contractors to prepare reasonable bids and to construct the project. The Constructability Section provides guidance during the design process on issues relating to specifications, construction details, plan interpretation, payment methods, and traffic control. Additionally, the Constructability Section provides assistance during construction on issues relating to design, scheduling, and traffic control. The Constructability Section provides support in researching claims. If a dispute is not resolved at the initial stage and escalates to a construction claim, the Constructability Section provides support in defending or otherwise resolving the claim.

The Constructability Section assists the Resident Engineer during the review and approval process of the contractor's schedule. As construction progresses, the contractor must submit updated schedules that revise or modify the sequence and timing of construction operations. The Constructability Section is available to assist the Resident Engineer in assessing the impacts of the schedule changes, including the contractor's resources to meet schedule requirements of the specifications.

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Contract Modifications: Changes requested by the Design Division come from the Chief Road Design Engineer who forwards a memo to the Chief Construction Engineer requesting the initiation of the necessary revisions. A copy of the memo should be forwarded to the District Engineer and the Resident Engineer. The design squad prepares the construction details and quantities for these contract modifications, and any design related contract modifications requested by the Construction Division, upon approval of the Chief Road Design Engineer. The request shall include sufficient detail to convey the exact nature of the change and the affected work units. Additional drawings, quantity calculations and other supporting information should be attached to the request. If a change order requires reissuing a previous plan sheet with changes to that sheet, the top right corner of the new sheet should show a revised date and the word "revised". If the change requires a new plan sheet, the top right corner of the sheet will show the following information: CHANGE ORDER No. # (the number is provided by the resident construction engineer) and the date.

No major changes or major extra work will be performed on Full oversight Federal Aid construction projects without formal approval from the FHWA. Approval will be made through form FHWA01365 by the Construction Division. Refer the Construction Manual for additional information.

Pre-construction review: The Construction Division schedules pre-construction reviews to cover certain aspects of the contract documents with the contractor. The Project Coordinator and Designer usually attend these meetings as they are scheduled. Roadway Design answers related questions and helps trouble shoot discrepancies in the plans.

Post-construction review: When a contract nears completion, Roadway Design administration automatically receives an email from the electronic bidding system. The Project Coordinator and the Standards Compliance Specialist are then notified in order to prepare for a post construction review meeting. Each appropriate Division or Section is normally invited to participate for contracts that have significant work on bridges, hydraulics, aesthetic and traffic facilities. Once construction of the contract has been completed the Construction Division will schedule the meeting to occur no later than 90 days after completion of the work. At the discretion of the Resident Engineer, the contractor may be invited to the meeting.

The goals of the post construction review meeting generally are to: [a] improve future designs through discussion of contract modifications, field adjustments, plan deficiencies and constructability problems, and [b] assess new designs, products and procedures by evaluating associated construction problems and successes. The Construction Division is responsible for scheduling, facilitating and documenting the meeting and its outcomes. The Project Coordinator may need to prepare a memo to the Chief Road Design Engineer to follow up certain issues as reported by the Construction Division.

Copies of this memo are sent to the Resident Engineer, Assistant Chief Construction Engineer, District Engineer, Standards and Manuals supervisor, and Principal Design Engineer.

The Resident Engineer will keep a punch list of items during the life of the project that should be addressed during the post construction review. This punch list should be sent to all participants one week prior to the review so that appropriate personnel and information may be available during the review.

The Assistant Chief Road Design Engineer prepares an annual summary of the resulting design process improvements for the Standards and Manuals Engineer to incorporate into the Design Guide. If necessary, a meeting with design personnel will be conducted to further explain problems encountered and to brainstorm other potential solutions.

5.4 Districts

General: The state is divided into three districts with sub-districts for the purpose of administering the transportation program on a local level. A District Engineer is appointed to manage each district and ensure that the state's interests are fully considered and protected in their district. The main responsibility of the District Engineer is the administration of the transportation program's construction and maintenance elements. Other responsibilities include encroachment permits, minor traffic studies and traffic control review. A Deputy Director is stationed in the Las Vegas metropolitan area to represent the department's general interests in that area.

Construction: Each district has an Assistant District Engineer that oversees the construction operations through the Resident Engineer that are directly responsible for the implementation and administration of construction contracts. This is generally to ensure that the contractors construct the various elements of the contracts in accordance with

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the plans and specifications. The headquarters construction office establishes the policies and procedures used by the districts for the administration of construction operations.

Field visits: If it is necessary to review the project during construction, the Project Coordinator should notify the Resident Engineer prior to the review as a courtesy.

Maintenance: Each district has an Assistant District Engineer that oversees the maintenance operations through the maintenance superintendents that are directly responsible for maintaining the condition of the state's road system. The headquarters maintenance office establishes the policies and procedures used by the districts for the administration of its maintenance operations. Each district has remote maintenance stations to facilitate the upkeep of Nevada's extensive road system.

Pipe condition survey: The Designer provides the District Engineer with a set of plans before the PDFS and the Hydraulic Engineer provides the District Engineer with a written request to examine the pipes within the project limits to locate any culverts that are in poor condition or that may not be properly functioning. The District Engineer is responsible for identifying deteriorated culverts prior to the PDFS and providing that information to the Hydraulic Engineer.

Betterment Projects: Betterment Projects are District-funded projects that serve to extend the life or provide minor improvements to the highway system, such as chip seals, bridge maintenance, slope flattening, and guardrail installations. Betterments are typically designed and administered by the Maintenance and Asset Management Division.

5.5 Maintenance and Asset Management Division

General: The Maintenance and Asset Management Division serves the purpose of providing support to the maintenance districts to assure that the Department-maintained highway system is maintained to as high a level as possible, consistent with work plans, policies, program objectives, budget, and available resources. This Division consists of the Architecture Section, Emergency Operations, Maintenance Management, and Asset Management.

Asset Management: The Asset Management Section is responsible for planning, coordinating, and managing asset management programs to ensure compliance with State and Federal regulations. This includes scoping, designing, scheduling and budgeting of District Betterment projects.

5.6 Environmental Services Division

General: Responsibilities of Environmental Services during the preconstruction phase are to ensure the Department complies with the National Environmental Policy Act process. This includes preparing and processing Categorical Exclusions, Environmental Assessments, Environmental Impact Statements, and Record of Decision. Other work performed includes:

- Completing environmental studies, documentation and coordination for permits and clearances.
- Determining mitigation measures for environmental impacts from NDOT projects and ensuring they are included in project construction contract documents.
- Arranging, advertising and conducting public involvement activities in accordance with NDOT policies and Federal-aid project requirements for projects processed under NEPA.
- Obtaining permits and clearances for material sites.

Dredge and fill report: The Designer prepares this information when requested by Environmental Services (as required under Section 404 of the Clean Water Act for dredging and fill within waters of the U.S.) This report is issued when the roadway, bridge and hydraulic designs are sufficiently developed to generate realistic estimates of the related project impacts measured as the footprint (area of work within the high-water mark) and the associated volumes of material. The report must contain a map indicating the locations involved a summary of the locations with a description of the work, the area of impact, and the volume of material to be removed and/or deposited within water of the U.S.

Coordination: The Designer is to provide Environmental Services a set of plans along with the approved PDFS report, so they can obtain necessary permits or clearances. For complex projects such as new construction, capacity

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projects, sound walls, etc., early and periodic coordination will need to occur during the preliminary design phase in an effort minimize environmental impacts.

5.7 Financial Management Division

Programming Section: Schedules the projects; programs, monitors, and revises federal aid and state-funded preliminary engineering, right-of-way and construction projects; prepares requests for special federal aid funds; formulates, monitors, maintains and controls a complete accounting system of apportioned and allocated federal aid highway and transit funds and all state funds authorized for preservation and/or improvement projects; maintains and controls project index and scheduling systems; and prepares quarterly FHWA audit reports.

Budget Section: Is under the general supervision of the Director and the Deputy Director, plans and organizes the activities associated with NDOT's budget planning, revises departmental annual budget work program and executive biennial budget, preparation, and execution. They also prepare financial forecasts of gas and motor vehicle tax revenue, highway funds and project expenditure rates. Funding for the department's operation is controlled by a line item biennial budget. This budget is prepared by the Financial Management Division and approved by the Director, Transportation Board and the Nevada State Legislature. Although the legislature approves a biennial budget, expenditure allocations are assigned on a fiscal year basis (July 1 through June 30 for State funds). Annual budgets are used to plan and control expenditures for a fiscal year unless modified by the Interim Finance Committee. Federal fiscal year is from October 1st through September 30st. The deadline to obligate for federal fiscal year is August 31st.

Scheduling: Scheduling a project is very important to many processes and reports, it should be done early in the project development. The scheduling of a project may occur at the same time as the programming of the PE/ROW project. However, when the programming is not going to occur soon, or the funding has not been identified but resources are being expended on a project, it is important to schedule the project. Scheduling a project allows the project to be assigned a PCEMS Number and be entered into the Financial Management System. The programming and scheduling form and instructions can be found [here](#).

Programming: When a project is ready for engineering and related services to start, the Project Coordinator submits a programming and scheduling form to Financial Management. See Program and Schedule in [Section 6.6](#) for more details.

5.8 Legal Division

General: The Legal Division is essentially NDOT's attorney. The division reports to the Director or Deputy Director and can be involved in almost every aspect of work being done by NDOT. It handles such issues as eminent domain, tort litigation, personnel matters, construction contract matters, project design and related issues, property acquisition and property disposals. Personnel matters may include civil rights, dismissals, demotions, and sexual harassment. The Legal Division provides counsel, advice and opinions for all divisions of NDOT. It prepares or reviews all agreements for the department and furnishes assistance to District Engineers and Resident Engineers in any legal problem that may arise. It also furnishes assistance in preparing for, attending, and defending the adequacy of public hearings and administrative regulations. In cooperation with other department personnel, the Legal Division develops proposals for legislative action to amend, add or repeal portions of the Nevada Revised Statutes to conform to federal legislation, regulations, or directives and to further enable the department to carry out its required duties. This division defends against all inverse condemnations, injunctions and restraining orders and represents the state in personal injury and property damage cases (torts) including those citing improper highway design. It also reviews manual changes, advises on how to handle collections, reviews specifications when necessary, and reviews wording in deeds, contracts and other right-of-way actions.

5.9 Location Division

Services provided: various in size and length of time in which it takes to produce. Upon informing the Location Division of services requested it is important to inform them of the time frame of which you need it as well as the accuracy and clarity of the deliverable products to you.

Survey Requests include but are not limited to the following:

Control Surveys:

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- Basic Control: Based directly on fixed HARN control, provides control for all other project surveys.
- Construction Control Survey: Based on previously adjusted and fixed basic control, includes reference monuments placed an average of every 1450 feet along the project length.
- Aerial Control: Based upon fixed higher order Construction control for the placement of aerial panels.
- Alignments: Retracement of existing Centerline using highway monuments and contract plans.

Cadastral Boundary Surveys:

- Based upon previously adjusted and fixed Construction control, providing for identifying properties and boundary locations.
- PLSS Corners: Government corners such as section corners and quarter corners
- Property Corners/Boundary: Private property/Indian reservations/city/county.
- Material Sites: Border pits for construction jobs.
- Right-of-Way: Establishes boundary between private and state ownership.

Engineering Surveys:

- Topographic Survey: Provides for the location of topographic features including but not limiting utilities, surfaces and other detail that may be found within or along NDOT right-of-way.
- Construction Survey/Stake Out: Marks the horizontal location (line) as well as the vertical location or elevation (grade) for proposed fixed works.

Requesting Location Division Services: Requests for Mapping or Survey should be coordinated through the Principal Design Engineer in charge of Mapping Requests. See Mapping Requests in [Section 6.6](#) for more details.

Request alignments: Existing alignments and retraced centerline alignments are requested from the Chief Location Engineer. Location control sheets are made part of the contract plans. See Plan Preparation Guide for examples. Location does not normally provide ramp alignment information; the Designer will need to best fit the ramp alignment from previous contracts to the retraced mainline alignment.

Alignment coordination: Office generated alignments and modification to existing alignments need to be checked by the Chief Geodesist around the intermediate design level. Location will verify that the correct control sheets are in the plans during the intermediate review. It is important to make certain that any right-of-way acquisitions use the same adopted centerline alignment.

Monuments: The Location Engineer is responsible for the establishment and preservation of monuments. The Designer reviews the control sheets provided by Location and determines if any monuments will be disturbed by the proposed scope of work. Any monuments that Design expects will be disturbed by the project will be reviewed again by Location to determine if they need to be perpetuated. If required, a bid item to perpetuate survey monuments is listed in the structure list with the appropriate station and offset.

5.10 Traffic Operations Division

General: When determining what traffic planning information is applicable to the project, the needs of pedestrians, bicycles, mass transit and motor vehicles during permanent and temporary (work zone traffic control) circumstances should be considered. The analysis of traffic operations is normally carried out by the Principal Traffic Engineer over traffic operations analysis. The types of traffic information that can be requested include:

- Traffic Impact Study Reviews & Comments
- Speed Study Reviews & Approvals
- Signal Warrant Reviews & Approvals
- All Related Highway Capacity Analysis
- Coordination with Planning for Benefit Cost Analysis on Major Projects
- Concurrence with Traffic Division on Traffic Control Approvals Prior to Advertising
- Input on Traffic Management Plans Associated with the NDOT Work Zone Safety & Mobility Implementation Guide

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- Review and Comments on Change-In-Access Reports
- Participation in Performing & Reviewing Project Related Traffic Analysis
- Intersection Control Evaluation (ICE) Reports
- Review and Comments on Change-In-Access Reports
- Participation in Performing & Reviewing Project Related Traffic Analysis

The analysis of traffic patterns is necessary to determine the features that will provide efficient operation of the roadway. Once the appropriate number of through travel lanes has been established, the need for special and exclusive use lanes is analyzed to optimize the level of service. The design team coordinates with the Principal Traffic Engineer and incorporates the results into the design. Some conventional design features that require such analysis are:

- Exclusive lanes for turning vehicles
- Adequate storage lengths for turning lanes to avoid blocking through lanes with overflow
- Providing additional length for deceleration outside of the through travel lanes
- Bicycle lanes or paths
- Walkways
- Improving or verifying passing sight distance based on current criteria
- Truck climbing lanes for roads with steep grades
- Turn-outs for roads with heavy recreational vehicle or truck use and few passing areas
- Improving approach geometry or relocating approaches to better locations
- Preventing cut-through traffic with traffic calming techniques
- Turn-out bus stop designs
- Widened shoulders for providing a multitude of operational benefits

AADT projections are needed for three intervals over a 20-year life cycle period: The current, mean and design years. The current year is when the project is expected to open to traffic after all construction is complete. For example, if an interchange project is expected to advertise in 2019 and take two years to construct, the current year would be 2021 and the mean and design years would be 2031 and 2041 respectively. Any observation of unusual bicycle activity, including high volumes, should prompt the Designer to obtain actual bicycle traffic data. Traffic generators that create intermittent peak demands, such as schools, may require special design considerations. Issues such as capacity, access and inter-modal continuity should be considered when determining what data is required to design an appropriate facility.

Refer to [Section 1.3](#) for policies and procedures regarding bike lanes and [Section 3.6](#) regarding the design of bike lanes.

Signing and Striping: The Signing and Striping Section provides the Designer new sign location sheets and quantities and oversee the development of the project TMPs. The Traffic Engineer assigned to the project also checks the traffic control and marking layout before it is submitted to QA/QC.

Signals, Lighting and ITS: Signals, Lighting, and ITS provides the Designer signals, lighting, and ITS sheets and quantities. The Traffic Engineer coordinates power sources with the Designer and the Right-of-way Utility Agent.

5.11 Materials Division

General: The materials engineer provides advice and assistance in the exploration; testing and quality control of all material used for construction or maintenance; recommends structural designs for new roads and structural repair or improvement strategies for existing roads; performs chemical and physical tests and investigates failures in trouble spots and determines the causes.

The Materials Division reports to the Assistant Director, Operations and is divided into eight areas of responsibility. The Structural/Chemical Section, Aggregate/Asphalt/Bituminous Testing Section, Foundations/Geotechnical Section, Roadbed Design/Pavement Analysis Section, Laboratory Services Section, the Las Vegas Testing Facility, and Research.

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Aggregate/Asphalt/Bituminous Testing Section: This section is responsible for processing and analyzing all soils and aggregates samples for specification compliance, providing and approving all bituminous mix designs for maintenance and construction projects, conducting asphalt research, and calculating structural support characteristics of soils.

The Project Coordinator can request updated material site information or new site locations for major projects from the aggregate testing section.

Roadbed Design/Pavement Analysis Section: This Section is responsible for collecting International Ride Index data and friction values for the Pavement Management System, which is used for project prioritization. The data is also used when calculating the Present Serviceability Index, which is a measure of pavement performance. In addition, the Pavement Analysis Section is responsible for researching project histories, conducting Falling Weight Deflect-o-Meter testing, and taking cores of the existing asphalt layer. This Section also designs roadbed structural sections and also manages the 3R program.

The Materials Division recommends a Structural Section for all project roadbed improvements. If additional work is added to a project, such as a detour or turn out, the design team needs to request additional recommendations for each proposed improvement. While the materials recommendations are normally used, if the proposed improvement will compromise a critical clearance, weight restriction, budget ceiling or other project limitation, the structural design may be modified, in cooperation with the Materials Division, with approval from the Chief Road Design Engineer. Structural sections are provided to the designer within 60 days of the PDFS. The structural design should be coordinated with the Constructability Engineer and Specifications Writer during the development of the traffic control plan. Identify special limitations for the proposed structural section such as the number of days traffic is allowed on the coldmilled surface, roadbed modified surface, leveling course, etc.

Geotechnical: The Geotechnical Section is responsible for exploring, sampling, and testing soils; underlying new and existing roadbeds and structures; locating and performing exploratory sampling of material sites; and conducting special studies. This Section also conducts pile load and embankment settlement tests and provides technical support when foundation or soil stability problems are encountered. It also submits depth checks of existing pavement structures, culvert condition surveys, and material deposit survey ties and sketches to the Roadbed Design Section.

The Designer coordinates ditch information (cut and fill slopes), horizontal and vertical information, drainage facilities, and proposed bridge locations on new projects for field exploration. On earthwork projects, Geotechnical provides the Designer shrink or swell factors.

Consult Geotechnical for cable rail projects, retaining walls, MSE walls, etc. since they require foundations.

5.12 Planning (Transportation and Multimodal Planning)

General: The Designer requests information from the Transportation and Multimodal Planning Division prior to the PDFS. This Division can provide information on projects such as any proposed bus lanes or turn outs, ADA improvements and missing pedestrian facilities that should be considered in the scope, and bicycle facilities that are on NDOT's and other Metropolitan and local bicycle plans. They will also provide any known special events that could impact traffic during construction such as bicycle races, triathlons, etc.

Traffic Information Systems: The Traffic Information Systems section provides the following services:

- **Traffic counts:** In addition to the annual traffic report, Traffic Information can provide updated traffic/truck counts and can also accommodate special requests for traffic volume information. This information can be used for developing traffic control strategies, establishing hours of operations, predicting detour traffic volumes and many other design related tasks. The traffic information analysts also provide additional design designation data for developing designs and establishing criteria levels such as traffic mix percentages and average running speeds. Note that all requests for traffic projections should be coordinated through the Traffic Operations Engineer of the Maintenance and Operations Engineering Section.
- **Speed studies:** Traffic Information can obtain empirical speed data on existing roads using special equipment and methods. This is especially important when establishing design speeds on roads that have different characteristics than the original design such as changed speed limits, increased traffic volumes or adjacent land development.

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- Traffic loop locations: Contact Traffic Information for guidance if any existing traffic counting loops will need to be replaced or installed as part of any 3R or new construction project.

Roadway Systems: The Roadway Systems section provides the following services:

- Milepost index: Roadway Systems maintains the statewide milepost index. The milepost index relates the field location of milepost panels with the actual mileage and the engineer's stationing. When creating new alignments or adopting retraced alignments over existing facilities, verify that there are logical "tie-in" points to the old alignment at the beginning and end of the project limits which shall include a descriptive reference point for the tie-ins.
- Road-life history: Roadway Systems maintains a history of all improvements made to each section of roadway including all maintenance and contracted work. This is helpful when the Designer needs to know what is there before the materials core report is available.
- Passing studies: To evaluate striping on existing roads for appropriate passing zones, the Designer can request passing zone data. Roadway Systems can obtain empirical passing sight distance data on existing roads using specially equipped vehicles. This is especially important when establishing striping details on roads that have different characteristics than the original design such as increased or decreased speed limits. Coordinate any changes to existing passing lanes with the District, Safety Engineering, and Nevada Highway Patrol (NHP).

Statewide transportation planning process: The state, in cooperation with local governments, develops the Statewide Transportation Improvement Plan (STIP). Each urbanized area with a population of more than 50,000 individuals may be designated a Metropolitan Planning Organization (MPO), usually titled as a Regional Transportation Commission. An MPO is required to maintain a 20-year Regional Transportation Plan (RTP) and a three-year Regional Transportation Improvement Program (RTIP). The RTIP is usually incorporated unchanged into the STIP. Additionally, the STIP is coordinated with federal, state, regional, Indian tribal and smaller local governments through the Statewide Transportation Technical Advisory Committee (STTAC).

Statewide transportation improvement plan: The Statewide Transportation Improvement Program (STIP) is the instrument used to implement plans resulting from the statewide transportation planning process and must comply with federal guidelines to be eligible for federal participation.

Annual work program: The Annual Work Program (AWP) is a project listing by county for the current fiscal year and includes information for the short range (3-year) and long range (10-year) elements. The list includes construction projects that NDOT intends to start work on, participate in, or award, as well as any major maintenance initiated by NDOT for the given year(s). The AWP is approved by the State Transportation Board and is considered the department's capital improvement program.

Transportation system projects workbook: The STIP, AWP, the Short-Range Program and the Long-Range Program are all contained in the Transportation System Projects Workbook (TSPW). The TSPW is updated each year and covers a period of 10 years.

5.13 Project Management

General: Project management will normally manage "major projects" with services provided by a consultant or projects that will be designed by Road Design. When a project is designed by a consultant through the Project Manager, Design will provide technical review as requested. For projects that are managed by a Project Coordinator, the Coordinator will have full responsibility for external and internal coordination.

Coordination: The Project Manager will coordinate the exchange of information with external entities such as counties, cities, and stakeholders. Road Design will provide technical support and/or engineering services and will coordinate internally with divisions, including Hydraulics, Stormwater, Materials, Environmental Services, Construction, and Landscape Architecture.

5.14 Right-of-Way Division

General: The Right-of-Way Division provides appraisal, negotiations, utility and railroad coordination, relocation and property management services for the Department. The Division, with exception of the Southern District Utilities and

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Property Management Section, is located in the Roop Annex Building, Carson City. The various duties of the Right-of-Way Sections and Districts are outlined as follows:

Survey Services Section (RWSS): Conducts land title searches and related property rights research; calculates right-of-way, land, and property rights boundaries, highway centerline alignments, and land areas; drafts mapping and exhibits; and prepares legal descriptions of land for land acquisition and disposal and leases and licenses; conducts property rights verifications, construction plan reviews, permit reviews, Local Public Agency (LPA) project reviews; certifies material sites for NDOT construction projects; maintains water rights and water usage records; and retains, maintains and is a public information office for all NDOT past and present land interests.

Appraisal Review Section: Examines all completed appraisal reports and conducts on-site investigations to determine completeness, validity, accuracy and correctness of material for approval of the reports or establishing the Reviewer's estimate of just compensation. The Review Section is also available for appraisal assignments.

Right-of-Way Control Section: Assists in the preparation, monitoring, and maintenance of the Right-of-Way Division's annual budget; gathers and compiles project cost estimates; programs funding for various right-of-way acquisition projects; monitoring of all right-of-way and Utility payments and processing of revenue receipts; preparation and maintenance of various Right-of-Way Control Ledgers; reviews and audits various reports for accuracy; and prepares and transmits various bills to other entities for their participation in project expenditures.

Southern Right-of-Way Utilities/Property Management Section: The Southern Right-of-Way Section has agents assigned to utility and railroad coordination and property management under the direction of the Supervisor of the Utilities Section. The Southern Right-of-Way District office is located in the District 1 complex, Las Vegas. These offices also house a Review Appraiser, Staff Specialist, Administration support and District Inspectors.

Right-of-Way Verification: The Designer requests right-of-way verification from Right-of-Way Survey Services once the project limits have been determined and base plans have been developed with alignments and existing right-of-way limits. A memo is sent to the Manager II R/W Survey Services requesting a R/W verification exceeding the project limits. RWSS will mark-up the best available plans or create new plans, indicating NDOT's property rights within the project limits (fee, easement, or prescriptive), and send them to the Designer.

Right-of-Way Setting: The right-of-way setting is a formal process to request the acquisition of right-of-way needed for a project. The right-of-way setting should take place around the intermediate design when the scope of the project will not change but no sooner than the completion of NEPA process and alternatives selection.

Right-of-way setting procedure: The Project Coordinator schedules a pre-right-of-way setting with the Chief Right-of-Way Agent to orient the project team with the right-of-way and utility issues. Minutes of the meeting are distributed and incorporated into the final right-of-way meeting. Projects that require minimal right-of-way may skip the pre-right-of-way setting at the discretion of the Chief Right-of-Way Agent.

The final right-of-way setting covers items generated from the pre-right-of-way setting meeting and finalizes outstanding issues to set right-of-way. The need for right-of-way must be discussed and documented as to the location, the required limits, the duration, and the purpose for which the right-of-way is needed.

List and/or indicate on R/W Setting exhibits, the beginning and end, by centerline station and offset, the various right-of-way acquisitions, along with the existing property boundaries and Assessor's Parcel Number(s), and existing right-of-way widths. Further indicate all overpasses, staging areas, alignment changes, and other features that will affect adjacent property owners and/or require additional right-of-way. List areas where multiple use of right-of-way is feasible and describe the possible use. It has been determined that it is in the best interest of the State and Department to acquire rights in FEE SIMPLE unless this option is not allowed, such as in the case of acquiring from an agency which will only transfer title as a permanent easement.

The different types and purposes of right-of-way to be acquired include:

- Temporary Easement (TE) – a temporary right of use over the property of another. Typical uses are construction, access, staging of equipment and personnel, material storage, etc.
- Permanent Easement (PE) – a permanent right of use over the property of another. Typical uses are maintenance, drainage, access, utilities, slopes, hydraulic features, etc.
- FEE SIMPLE – An absolute interest in land without limitation or condition.

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Additional rights that may impact a right-of-way setting include:

- Permission to Construct – Written permission from an owner of land to accomplish specific construction upon that owner's land. Design is responsible for ensuring information pertinent to the Permission to Construct is included on the construction plans. Note: The only time NDOT can pursue a Permission to Construct is when the requested work is for the sole advantage of the property owner and is not necessary for the Department's project (i.e. repaving approaches). If the project cannot be completed without the Permission to Construct, then the acquisition needs to be a TE or PE.
- "Prescriptive rights" means the Department has openly and continuously operated and maintained a highway for more than five years and though we have no documented rights to the land, we have a right through prescription to continue to operate and maintain the highway. The actual boundary of the Prescriptive Right would be the outer limits of the road surface, slope grading of shoulders, rehabilitation of ditches and dikes, maintenance of fencing and those areas regularly involved in the removal of bush, debris and rock; in short, whatever NDOT forces, or its contractors, have maintained.
- Prior right is a right that has established a legal right to use real property. This right must precede and take precedence over the right of another. Types of documents that may be used to establish the "prior right" or compensable interest are:
 - Franchise Agreements with a local government
 - Prescriptive Easements
 - Permanent Easements
 - Fee Ownership.
- A utility company will be reimbursed for its reasonable and necessary expenses only if it has "prior rights".

R/W setting check list: A copy of the right-of-way check list is available on [SharePoint](#). Following are the items that need to be accomplished prior to a right-of-way setting so that they are addressed at the actual meeting:

- Know what you are going to build and don't change the design.
- Identify and analyze existing permits and project impacts on them.
- Identify and justify any needs or changes for signage.
- Identify and justify any needs for telephone, electrical power and water.
- Request a right-of-way verification and incorporate into drawings.
- Identify utilities impacted.
- Identify and justify any hydraulic needs or changes.
- Identify and justify any control of access needs or changes.
- Identify and justify any maintenance needs or changes.
- Identify and justify any right-of-way needed for the proposed project and its construction needs.
- This could be fee, permanent easements, temporary easements or permission to construct.
- If appropriate, identify staging area.
- What alternative designs have been considered - - i.e., avoid a park.
- Have environmental approval.
- Have Inter-local Agreement in place and include the right to occupy City or County streets/property during construction.

R/W setting memo: The memo is prepared by the Project Manager or Project Coordinator and shall be addressed to the Assistant Director, Engineering. Approval signature lines for the Chief of Roadway Design, Chief of Environmental Services, Chief Right-of-Way Agent, Chief Hydraulic Engineer, and the Assistant Director, Engineering shall also be included.

The right-of-way memo should address the following:

- The date and attendees of the R/W Setting meeting.
- A brief description of the project and the R/W needs.
- Exhibits that identify areas and parcels to be acquired, with stations and offsets.

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- What is the acquisition and what is its purpose (i.e. Fee Title, Permanent Easement, Temporary or Construction Easement, Controlled Access, Permissions to Construct)
- What alternatives were evaluated to avoid right-of-way (i.e. retaining walls, shifting the alignment, reducing design speed or other design exceptions)
- What is the justification for pursuing this course of action (i.e. costs, slopes, avoidance of environmentally sensitive area)
- Were all the Divisions contacted to determine if the amount is appropriate (i.e. room for construction staging and utility replacements)
- Is there anticipation of changes or options that Right-of-Way can use in the negotiations?
- Will there be subsequent right-of-way settings?
- Is the current request part of an overall phasing plan? If yes, outline the plan.

5.15 Right-of-Way Utilities Section

General: The Utility Section is a section of the Right-of-Way Division. The primary purpose of the Utility Section is to determine and arrange for the resolution of conflicts between proposed highway construction and existing and proposed utility facilities. Additionally, this Section coordinates construction of highway projects with railroads that may be affected and arranges for the extension of new service lines or modification of existing service lines. This Section also coordinates the permitting of undocumented rural approaches on reconstruction projects.

The Utilities Section does not provide an engineering function but serves as the liaison between Roadway Design and utility and railroad company engineers to ensure that all potential conflicts are noted and that suitable arrangements are made to resolve the conflicts. This is accomplished through the relocation of utility or railroad facilities or the modification of NDOT design proposals to avoid conflicts, whichever is most cost effective for all parties. Although not engineering personnel, Utilities Section representatives do have experience and a basic understanding of the general requirements and capabilities regarding a wide range of utility facilities and engineering practices.

NDOT has a NO CUT policy regarding utility relocations on NDOT roadways. Any permits that would require cutting into the roadway within 5 years of the last paving project should not be allowed. When communicating with any permit holders and/or local agencies, it is essential this policy is presented to them.

Coordination: Early in project development, the Utilities Section requests plans that include information such as alignments, edge of oil, cut and fill lines, design mapping, right-of-way lines and section net in order to locate and provide alignments of all utilities within the project limits. These plans will be sent to the Utilities Section at Headquarters. The plans will then be provided to the appropriate utility companies who will locate and plot their utility facilities (type, size, horizontal locations) on the plans. The assigned right-of-way agent will utilize a combination of field surveys and utility company as-built plans to develop the location information. One set of the marked-up plans will be provided to the project Designer, so the utilities can be indicated on the plan sheets, and one set will be retained by the right-of-way agent for future reference.

In order to successfully complete the utility relocation function, it is imperative for the project Designer to keep the Utilities Section advised of proposed and adopted design changes and for the Utilities Section to keep the Designer informed of utility information as it becomes available. It is necessary to invite the Utilities Section or the Right-of-Way office to all PDFS's on projects and for the Designer to be available for joint field reviews with the Right-of-Way Agent, utility inspector and utility company representatives to review the project on-site. The most important facet is to establish and maintain continuous and effective communications between the design and Right-of-Way representatives to ensure that needs are fulfilled, changes are transmitted, and problems are identified and resolved as early as possible.

Other activities that must be considered and coordinated through the Utilities Section are the drafting of the Special Provisions that accurately describe the potential utility conflicts and concurrent work requirements so prospective bidders and the successful bidder are aware of potential disruptions or special work requirements due to utilities, the arrangement for acquisition of replacement rights of way for relocated utility facilities by NDOT, and the continuing coordination of utility relocation and location functions during NDOT project construction.

When the utility company plans, and estimates are provided to the Utilities Section, the Right-of-Way Agent will provide a set of the proposed relocation plans for each company to the project Designer for his review to ensure that

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the proposed relocations or adjustments will indeed resolve the conflicts. These plans will be submitted under a checklist that is designed to ensure that all appropriate points of conflict are reviewed. While the design reviews are being conducted, the agent will review the companies' claims for reimbursement and prepare the appropriate relocation agreement which will govern the relocation work and reimbursement.

When a project requires utility adjustments (valve covers or manhole covers) or there are relocations, Las Vegas Valley Water District (LVVWD), Southern Nevada Water Authority (SNWA), and Clark County Water Reclamation District (CCWRCD) may require a signature and date line on a "Exhibit" plan or plan sheets that is made part of an agreement. If a plan sheet is too cluttered, place the signature line on the separate note sheet.

When any of the above listed utility companies require relocations as part of the contract, this information will be shown on utility sheets along with a signature line. These signatures are in addition to the necessary utility agreements.

If a utility company has a prior compensable interest in a property for which a facility relocation is required for a Department project, the Department will perpetuate the existing rights of that utility.

For additional information see [Federal Highway Administration's "Highway Utility Guide", Federal Policies](#).

Utility designation and subsurface underground exploration: The Designer may request to have utility locations designated if there is a potential that the proposed construction improvements will conflict with existing utilities. The request is done in a form of a memo to the Chief Right-of-Way Agent. The Right-of-Way Agent assigned to the utilities function will hire a Service Provider to designate and pothole potentially effected utilities.

It is extremely important to have the proposed design improvements developed to a point where all geometrics are set and the cut and fills have been identified, all proposed hydrology improvements have been designed, along with any structures such as bridges, sound walls, retaining walls, lighting and signing have been identified.

The Service Provider that designates the utilities will normally request CADD files of the proposed improvements along with location control to tie the existing utilities to the project. The Service Provider will send the Designer a CADD file with the horizontal designation once this work has been completed.

The Designer evaluates the horizontal location of the utilities and determines if potholes will be needed to establish precise depths of underground utilities to further assess conflicts and relocation needs. Do not perform wide-spread potholing without first determining the actual need since potholing is an expensive and time-consuming process. Potholing typically costs \$1000.00 or more per location, involves coordination of company crews that are most often committed to other company priorities, causes disruption and inherent hazards to the motorists and workers involved in the operation, and invariably results in tearing up the existing streets and highways.

The designated utility locations will be updated in the contract plans. The location of underground utility lines should be indicated on the profile sections in addition to the plan sections of our design plans as practicable.

Relocation: When all pertinent utility location data is displayed on the design plans, the Right-of-Way Agent will order plans to provide them to each affected company and a set to the utility inspector. The plans must show all proposed construction such as new edge of pavement, vertical profiles, bridge structures, storm drain alignments and profiles along with laterals and drop inlets, location of light poles, signal poles and sign foundations. Consider detours and any other construction outside the immediate roadway work being done that also may adversely impact the utilities.

The Utilities Section authorizes the affected utility companies to proceed with their preliminary engineering to provide detailed plans and estimates for their required utility relocations. During the utility engineering process, the Utilities Section will provide a liaison and coordinates between the utility companies and NDOT.

Specific cross sections or other detail drawings may be requested from Design, and company requests for possible NDOT design changes may be coordinated to mitigate even greater utility disruptions. Provisions to accommodate utility company needs may be requested of Design or Structural Design as needed. It is important that the utility companies receive complete highway design information in order to adequately perform their internal engineering functions. Often the disruptions and demands our projects cause on utility facilities and manpower are equal to or greater than demands of the project on NDOT resources.

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Upon completion of the reviews and agreement process, the Right-of-Way Agent will authorize the utility companies to proceed with actual work.

Utility agreements: There are inherent time requirements necessary for the Utilities Section to process an agreement to a point where they can supply specifications to the utility owner with meaningful information. A period of 60 days from receipt of estimates from the utility companies for FHWA approval is not uncommon. This involves the various reviews and, because of pre-agreement review by Audit, the need for rebuttal and supplemental information can result in an even more time-consuming procedure.

When preliminary plans have been prepared to the extent utility adjustment work can begin, plans will be delivered by memo from the Principal Road Design Engineer to the Chief Right-of-Way Agent advising that plans are sufficient for necessary utility adjustment work to begin. Copies of the memo shall be forwarded to the Supervisory Right-of-Way Agent responsible for utilities and the Chief Road Design Engineer.

For all projects in the Las Vegas area, a copy of the memo will also need to be forwarded to the Las Vegas Supervisory Right-of-Way Agent. For projects with no apparent utility involvement, other than adjusting covers, the memo will indicate that no utility adjustments are anticipated.

In critical problem areas where sufficient data cannot be developed to totally define the work in a normal time frame, contact the Utilities Section to review the matter with them. This way they will at least be aware of the problem and, in many instances, they will be able to accomplish considerable "leg-work" prior to our submittal.

Railroads: The Utilities Section also coordinates with the railroad. The railroad coordinator prefers to have only one contact per project, however the NDOT Utility Section will coordinate administrative aspects such as obtaining permits and maintenance and operation agreements. The Project Coordinator will coordinate the technical aspects. Railroads should also be considered for inclusion as party agreements where they are involved.

Railroad agreement processing can require six or nine months after receipt of design information and requirements. In order to comply with completion date schedules, it is important that the Utilities Section has adequate lead-time to accomplish their pre-construction activities. This means that they will need the basic utility or railroad package sufficiently in advance to have completed agreements by the document date.

Guidelines for Railroad Projects can be found at [Guidelines For Railroad Grade Separation Projects](#). The purpose of these Guidelines is to inform Applicants, Contractors and other parties concerned with Railroad policies, requirements and standards for the design and construction of Grade Separation Projects. Compliance with these Guidelines is required to achieve uniformity in the preparation of construction documents for Grade Separation Projects and to expedite the review and approval by the Railroad of design and construction submittals.

Some pointers in processing railroad submittals are:

- Narratives should include construction sequencing, clearances, etc.
- Describe and annotate utility impacts, right-of-way and existing track profile.
- Include necessary local entity approvals.
- Provide a drainage plan (existing and proposed).
- Local reviews versus headquarters reviews affect the schedule. Local reviews can occur in two to four weeks if they are clean.
- For projects with multiple crossings a separate submittal is required for each structure.
- Keep submittals brief but complete; do not include unnecessary back-up data.
- Railroads can do an initial review with intermediate design plans.
- Railroads use more preliminary plans to resolve issues like clearance problems.
- Railroads require wet stamped copies of finals.

Do not use NDOT structure numbers or mileposts when referring to railroad crossings and structures; they have no meaning to the railroad staff. The UPRR prefers USDOT milepost numbers, but their mileposts or subdivision names are suitable as well. Obtain R/R dot numbers and milepost from the Traffic/Safety R/R Section. It may be necessary to include special provisions when disruption of service is possible on industrial spurs. When a temporary at-grade

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crossing is needed and only the contractor and NDOT will be using it, then it is considered a private crossing and either NDOT or the contractor must enter into a private crossing agreement.

Private crossings need not involve the PUC or USDOT-FRA. The railroad will usually install the required concrete panels. However, NDOT can purchase and reuse them when needed. When considering construction phasing, use the following schedule for temporary crossings:

- 30 days to develop plan and estimate
- 30 days for administration
- 30 days to get it on the ground (two days of actual construction time)

If the crossing is for light-duty vehicles only, a 9' crossing is adequate but a 10' crossing is required for heavy-duty vehicles. The 10' crossing requires removal of the existing ties to install longer ones.

Encroachment permits and approaches: A complete file of all permits issued by the department is maintained in the Utilities Section. The Designer can view the permits on the [Integrated Right-of-Way Information Network \(IRWIN\)](#) application. Designers should review the master index and provide the Permit Coordinator with a list of only those permits that are pertinent to the project design; otherwise the sheer volume of work would create a bottleneck and cause delays throughout the work program. Designers can request permits categorically within a range of mileposts, for example all approaches and underground utilities between SR430: WA-0.00 to WA-10.37. Designers should also ask for any information on pending permits within the project limits.

Regarding approaches, the NDOT policy requires that on highway reconstruction projects outside of curb and gutter section, we review the project to identify all approaches that are to be perpetuated and brought up to current standards. Refer to the [Access Management System and Standards](#) for determining the approach type for roadway category. Only regularly used approaches, not those infrequently or seasonally used, such as an approach allowing access to a farmer's fields, will be improved. The Designer must then check the Department's records to determine which of the approaches that qualify, or are perpetuated, are currently located under an encroachment permit.

The Designer provides a list of the undocumented approaches that should be paved, along with a set of plans with the undocumented approaches plotted on it, to Right-of-Way Engineering to enable them to perform assessor's checks to determine the property owners served by the undocumented approaches. The Right-of-Way Agent furnishes the set of design plans with both the undocumented approach locations and the assessor's information on property ownerships to the Utilities Section where the assigned Right-of-Way agent contacts the property owners to get the undocumented approaches under permit. The incentive that is offered to the owners is the paving or repaving of the approach to at least our minimum standards at our expense, rather than at the expense of the owner. We also waive the minimum permit fee. This information is needed at the earliest possible time as any owner who refuses to get the permit does not get his approach paved. The ultimate purpose of this policy is to get complete segments of roadway brought up to current standards as to construction and permitting of approaches, after which the individual Districts can more easily maintain that status.

Encroachment permits can be found on [IRWIN](#).

Encroachment permit reviews: If the Designer receives a permit from the Project Management Division that is doing a technical review for a particular project, email the Design Administrative Assistant so that they can log in the information (who the project manager is, permit number, permittee, and the description on the permit). Once the permit is returned to the Project Management Division, let the Design Administrative Assistant know and they will then log back out to the Project Management Division.

5.16 Roadway Design

General: Design reports to the Assistant Director of Engineering and is divided into two major sections: Roadway Design and Design Services. The Roadway Design Section is responsible for the preparation of highway construction plans utilizing in-house personnel as well as consultants. The Design Services Section is further divided into four subsections: Landscape and Aesthetics Section, Local Public Agency (LPA) Section, Scoping Section, which consists of Scoping, Visualization, and Scheduling and Estimating, and Specifications Section, which consists of Specifications, Standards and Manuals, and CADD Support.

The Road Design Division is responsible for the following:

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- Prepare, check and certify plans and special provisions in conformance with applicable policies, regulations, laws and engineering judgment.
- Design, coordinate, and determine necessary right-of-way on roadway projects.
- Develop and maintain Design Guidelines, Standard Plans, and Standard Specifications.
- Make recommendations for regulatory speed limits.
- Coordinate with the various divisions in development of project priorities.
- Coordinate with Environmental Services in the development of environmental documents and prepare purpose and need statement for the project.
- Participate in informational, location and design public hearings and prepare location and design recommendations for management approval.
- Determine need for design consultants and negotiate and administer required contract agreements.
- Investigate new products and engineering techniques.
- Coordinate design with private developers, local entities and governmental agencies and prepare related agreements.
- Obtain necessary permits from local, state and federal agencies for project construction (i.e., TRPA, US Army Corps of Engineers, FEMA, FAA).
- Prepare economic analysis such as benefit costs for inclusion of safety work in state 3R projects.
- Prepare necessary engineering estimates for future project work programs.
- Coordinate with other divisions and management to set project advertising dates. Prepare documentation to insure all steps have been completed prior to advertising.
- Review contract bids for accuracy, any indication of detrimental unbalancing, analyze low bids in excess of 7% of the Engineer's Estimate, and recommend awarding of contract.
- Prepare memorandums for or recommend approval of contract modifications on contracts and prepare supplemental notices for contracts.
- Serve as chairman of guardrail review committee and serve on appropriate Department committees such as high hazard and safety, surplus property, project prioritization, pit review, state 3R, and contract claims board, serve on appropriate state and national committees.
- Prepare engineering portion of the Department's defense for tort litigation and condemnation cases. Act as expert witness when needed.
- Assist Districts in areas such as design and landscape.
- Review for compliance all encroachment of right-of-way permits.
- Prepare and conduct training courses for design personnel as well as districts, other divisions and local entities.

Local Public Agency (LPA) Program: NDOT and FHWA have entered into a Stewardship Agreement, allowing NDOT to assume the responsibilities of the FHWA under Title 23 of the United States Code for the design, plans, specifications, estimates, contract awards and inspection of projects. The Stewardship Agreement further allows NDOT to delegate project review and administration to capable local public agencies. A capable local public agency is one that has mechanisms in place to assure project actions will be carried out in accordance with applicable laws, regulations, and policies. Under the Stewardship Agreement, the FHWA requires NDOT to administer Federal-Aid Highway funds available to a local public agency and to retain oversight responsibilities on projects. Oversight is defined as the act of ensuring the Federal Highway Program is delivered with consistent laws, regulations and policies.

Each project completed under the LPA Program is done through an agreement between NDOT and the local public agency. The design (including the development of plans, specifications, and estimates), advertising, awarding and construction monitoring of a contract is delegated to the local public agency. The local public agency is responsible for completing the surveys and permits required for compliance with NEPA. NDOT retains the responsibility for providing FHWA with certification the project was completed in conformance with applicable federal laws and regulations.

The main objective of NDOT's LPA Program is to assist local public agencies in completing each project successfully with as little administrative oversight as possible, while ensuring federal and state requirements are fulfilled. This delegation is documented in the [LPA Manual](#) by defining the procedures NDOT and the local public agency must

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follow to comply with the intent of the Stewardship Agreement. A project completed under the LPA Program is referred to as an LPA Project.

Landscape and Aesthetics: The Landscape and Aesthetics Section oversees landscape and aesthetic treatments associated with all components of the state highway system, including NDOT-managed right-of-way, road services, maintenance stations, headquarters, and District Offices. The Section manages the Landscape and Aesthetics Program, maintains the Landscape and Aesthetics Master Plan, develops Landscape and Aesthetics Corridor Plans, and coordinates their implementation within the state. In addition, the Section directs, supervises, or develops Landscape and Aesthetics designs for all aspects of the Landscape and Aesthetics program; reviews all project plans and encroachment permits for impacts to the landscape and for consistency with corridor plans; reviews all developer, cooperative, and interlocal agreements related to Landscape and Aesthetics. Finally, the Landscape and Aesthetics Section participates in all design consultant, construction contractor, and maintenance contractor selection and oversight processes that contain or affect a Landscape and Aesthetics component.

The Project Coordinator coordinates with the Landscape Architect Supervisor on all matters pertaining to landscape treatments and aesthetics. The Project Coordinator is responsible for obtaining reviews from the Landscape Architecture Section on all new construction, capacity improvements, and stewardship projects. Landscape and Aesthetics must be integrated into planning, design, construction, and maintenance at the beginning of every project, not added as an afterthought. Engineering design should incorporate Landscape and Aesthetics to create highway structures and facilities that are effective, safe, and aesthetically appealing. The ability of a roadway and other facilities to blend successfully into the surrounding landscape or integrate appropriately with surrounding land uses should be addressed at the outset of every project.

Scoping Section: Project Scoping is responsible for defining the scope and cost of projects so the department can achieve on time project delivery within budget. Typically, the Project Scoping Section leads a multidisciplinary scoping team in identifying project need, evaluating alternatives for risk, cost and benefit, and defining a project scope that best addresses the need with minimal impacts. The Project Scoping Section is responsible for providing technical support and developing estimates for the 3R program, Intersection Control Evaluation Reports, Road Safety Assessment program, and other tasks as assigned.

The Visualization group within the Scoping Section can take conceptual or preliminary level designs and create three-dimensional visual representations of a completed project. A visualization can be developed to a varying range of sophistication, including still photographs, rendered animations, and interactive 3D models. Visualizations are initiated and developed to different levels based on the following driving factors: scoping alternatives, public hearings (NEPA), public information releases, stakeholder meetings, ROW settings, legal procedures, or high-profile/politically-driven projects. Visualizations have the benefits of being able to explain complex ideas, show project impacts, and gain understanding of project scope. A visualization may be requested at any time during the course of a project provided the visualization meets one of the initiation criteria stated above. Different visualizations will require a varying amount of time and resources; adequate time must be allowed for the creation of the needed visualization. Visualizations may be requested by using the [Visualization Request Form](#) located on the [Visualization Portal](#) of the Roadway Design SharePoint. Please consult with the Scoping Section for further guidance on visualizations.

Project Scheduling and Estimating Section: The Project Scheduling and Estimating Section provides guidance and instruction to staff for efficiently and consistently developing project cost estimates and inputting that estimate into the Project Estimating System. Project Scheduling and Estimating trains on project estimate building and using the Project Estimating System, and checks project cost estimates before preliminary agreement estimate and agreement estimate submittals. This section also maintains the database system for the 5-year plan and performance measure 13 (PM13) reporting, as well as administering the project scheduling and management system.

Specifications: The Principal Specifications Engineer controls the listing of work units that can be used in the department's contracts. This authority includes adding, deleting and modifying the work unit database and identifying and documenting special considerations that accompany the various work units. The Principal Specifications Engineer is also responsible for maintaining the Standard Specifications for Road and Bridge Construction.

The Specifications writers develop the Special Provisions for items that are not covered in the Standard Specifications. Limitations of operations, along with any special items that need to be included in the special provisions, are coordinated with the specifications writers.

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The QA/QC Specialist (Specifications Checker) is responsible for the QA/QC of the plans. The checker reviews both intermediate and final plan submittals and provides comments and recommendations to the Designer. The checker also:

- Meets with the Designer at the end of the quality assurance review to discuss the findings of the review and discuss any proposed changes.
- Ensures that the final plans correctly reflect any changes expected and agreed upon during the quality assurance review meeting and that all changes were fully implemented.
- Ensures that all written comments received from other Sections or Divisions are returned to the Project Coordinator and that the agreed changes have been incorporated into the plans.

Standards and Manuals: The Standards and Manuals Section evaluates all contracts for roadside safety and ADA compliance early in the design process and shall be invited to attend the PDFS on all contracts. If unable to attend, the Standards Compliance Specialist will independently visit the project site and submit written observations to the Project Coordinator and Designer. These comments should be incorporated into the PDFS report when possible. The Standards and Manuals Section ensures that all the Department's standards are up to date and are being implemented, etc.

The Standards and Manuals Section also maintains the Department's Standard Plans for Road and Bridge Construction that include construction details for road design, lighting and signals, roadside signs, work zone traffic control, railroad crossings, permanent marking, and bridges. The Standards and Manuals Section is also responsible for maintaining other Design-related documents, including this Road Design Guide.

The Standards Compliance Specialist reviews the intermediate design on all contracts and preliminary plans for capacity projects. This review should occur prior to the intermediate design review meeting and early enough to allow for discussion of the findings at the review meeting. The Resident Engineer and Project Coordinator or Designer is expected to attend. The Project Coordinator should inform the Standards Compliance Specialist when contracts roadside and pedestrian facility intermediate designs are sufficiently complete to initiate this review. Designers should be prepared to furnish copies of relevant worksheets and CADD files. The Standards Compliance Specialist also reviews the 100% plans for inclusion of the items recommended during the 100% review.

CADD Management/Support: This Section is responsible for maintaining and providing support for all Computer-Aided Design and Drafting software and the ProjectWise Engineering Document Management system. CADD Support will assist all users with setting up their CADD profiles and provide them with the necessary training to utilize the software efficiently. CADD Support is also responsible for maintaining the Plan Preparation Guide and CADD Standards and Drafting manuals.

5.17 Traffic Safety Engineering

Crash data: The Designer can request crash information by downloading the [crash data request form](#) from SharePoint and email the request to crashinfo@dot.nv.gov. The information for the project limits spanning a time frame of not less than three years will be provided by the Safety Engineering Division. This request should occur no later than 4 weeks prior to the PDFS to allow time for processing and analysis of the data. The early request also allows time to locate the crash data on the PDFS plan set. The Traffic Safety Division also maintains an online web map of crash data located [here](#).

Railroad: This subdivision of Safety Engineering provides the Designer information such as R/R DOT numbers and mileposts.

Road Safety Audit: This subdivision of Safety Engineering coordinates with the Designer to perform road safety audits. Safety audits are performed independently of the PDFS and recommendations are forwarded to the Project Coordinator. The Project Coordinator prepares a recommendation for the items to be included in the project scope and is approved by the Chief Road Design Engineer.

5.18 Hydraulics Division

General: Hydraulics provides design input for Environmental, Roadway Design, Bridge, Safety and District projects. It also initiates bridge scour, river training, erosion control, water quality, and flood control projects. This Division

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also reviews encroachment permits and drainage studies; deals with litigations, flooding complaints and maintenance issues; participates in research projects; and evaluates drainage products.

Coordination: The Designer coordinates new roadway geometrics as they are developed to resolve conflicts with vertical clearances, cut and fill slopes, location of drop inlets, and other roadside features. Culvert extensions, location of plantmix dikes, and erosion control are other items that are coordinated with Hydraulics. Quantities are coordinated between the Hydraulics Engineer and the Designer for inclusion in the structure list and engineer's estimate.

5.19 Stormwater Division

General: Responsibilities of the Stormwater Division during the preconstruction phase are to ensure the Department complies with the National Environmental Policy Act (NEPA) process related to water quality and complies with Clean Water Act permits. This includes preparing and processing USACE Section 404, Section 401 water quality certification, as well as ensuring compliance with Construction Stormwater General permit and Municipal Separate Storm Sewer System (MS4) permit requirements.

The Stormwater Division also determines the need for permanent Best Management Practices (BMPs) on projects by evaluating the project scope and characteristics of the receiving waters. The Stormwater Division will perform hydrologic and hydraulic analysis for runoff volume and flow rates for water quality storm events as necessary for the layout and design of BMPs. Individual projects that exclusively focus on erosion control and/or water quality will also be initiated by the Stormwater Division.

Coordination: Stormwater Designers will coordinate with Roadway Design, L&A, and Materials regarding Low Impact Development (LID), slope treatment, and all structural BMPs. Stormwater will coordinate with Hydraulics when incorporating permanent BMPs in line with existing/proposed hydraulic facilities. Once PS&E design is complete, Stormwater will provide Roadway Design with a Temporary Pollution Control (TPC) estimate.

5.20 Structural Design Division

General: Structural Design is responsible for the design and maintenance of bridge structures. They also provide additional services such as designing retaining walls, sound walls, and special hydraulic structures.

Coordination: On new capacity projects, Roadway Design coordinates horizontal and vertical alignments in the preliminary design phase. On 3R projects, the Designer requests bridge sheets for any proposed improvements on structures such as, stripping the deck of plantmix, replacement of strip seals, concrete repair, etc. Quantities are coordinated between the Designer and the Structure Division for inclusion in the structure list and engineer's estimate.

5.21 Other Governmental Agencies

Airports: Construction activities that interfere with FAA airport or heliport glide paths will require a "Notice of Proposed Construction or Alteration", ([Form 7460-1](#)). Instructions for the process are included on the form.

Adjacent states: When a project limit occurs at the boundary to an adjacent state, the department is required to coordinate the work with that neighbor. The minimum impact to that state's road system will be traffic control, but drainage and other components may become involved as well. The Project Coordinator must contact the appropriate agency representative. A listing of the various out of state counties and other agencies can be found in [Phone Directories](#).

Commission/Boards: Occasionally, a project will involve a state commission or board and the Project Coordinator must represent the project to them on behalf of the department. When attending an official meeting, the Project Coordinator should keep in mind that these proceedings are always on record (and often covered by the media) and should prepare accordingly. It is usually necessary to make contact at least four weeks prior to a meeting to be placed on the agenda for an action item. If the commission or board has some authority over the project, the Project Coordinator should provide them with appropriate material in advance for them to study so they may take informed actions at the meetings.

Federal Highway Administration: If the FHWA is involved in reviewing and approving plans, specifications and estimates for any NHS project, then FHWA must also review and approve design exceptions to the ten controlling

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criteria standards applicable to that project. On all other projects, the Chief Road Design Engineer must approve design exceptions for these ten controlling criteria. Evaluation and documentation requirements for those approvals will be as if doing it for the FHWA.

The Chief Road Design Engineer may approve design exceptions for elements other than the ten controlling criteria. Those exceptions should be addressed to the Chief Road Design Engineer, from the originating Project Coordinator or Principal Engineer, and recommended by the appropriate Assistant Chief Road Design Engineer.

Design exceptions approved by NDOT for the FHWA are still subject to FHWA oversight through periodic process reviews. See [Section 1.6](#) for processing design exceptions.

Local Public Agencies (LPA): When a project impacts a local jurisdiction (City, County, or Town), coordination should take place with the LPA to communicate the project, other current/future local projects and any impacts to local streets/right of way.

If a local agency is awarded Federal-Aid Highway funds for a project, the Department's LPA Program shall oversee the LPA's design and administration of the project. The Stewardship and Oversight Agreement between FHWA and NDOT delegates this oversight authority to the Department with the responsibility of ensuring the Federal Highway Program is delivered consistent with laws, regulations and policies.

Irrigation districts: In most cases the department is exempt from obtaining permits from irrigation districts but is required to coordinate with them on activities that will affect their systems. The irrigation districts have a special status with the EPA regarding water quality and are usually concerned about protecting that status. Care should be taken to inform the irrigation district of the exact nature of work affecting their facility. The contractor is required to coordinate with the irrigation district during construction; the appropriate contact information should be made as part of the Special Provisions.

Native Americans: Any project occurring on tribal lands requires some coordination with the tribe. Certain requirements, such as the Tribal Employment Rights Ordinance (TERO) tax, may be applicable and should be stipulated in the contract documents. The tribe may also have cultural considerations that could be affected by the project. The Planning Division should be included when a project becomes involved with a tribe to ensure that the tribal considerations are adequately and appropriately addressed.

US Army Corps of Engineers (USACE): In general, projects that impact jurisdiction Waters of the United States require permitting through the USACE. Coordination with the Stormwater Division should be done early in design to determine impacts to schedule.

Tahoe Regional Planning Agency: Generally, any project in the Tahoe basin, regardless of whether it's public or private, must be permitted by the TRPA. Its jurisdiction extends from the upper rim of the basin to the shoreline of Lake Tahoe. The TRPA is generally concerned with water quality, hard coverage, soft coverage land capability, riparian zones, erosion and aesthetics. However, all aspects of environmental quality are potential issues. The Department and the TRPA signed a memorandum of understanding that defines what activities the Department can undertake without needing to obtain a permit.

The process of coordinating with TRPA can vary by project, but the general process is:

- Notify TRPA of the project immediately so it can assign the project to one of its staff
- Invite the TRPA representative to the PDFS
- Acquire a TRPA permit (typically requires two to three months)
- Obtain and complete a permit application
- Submit application along with complete plans (TRPA is flexible on this)
- TRPA staff review (two to three weeks); may require supplemental information
- TRPA staff writes recommendation for approval or denial
- TRPA staff presents project at monthly TRPA board meeting
- If approved, TRPA staff stamps three sets of plans for use during construction

During construction a set of stamped plans must be on the project site at all times. One set remains with TRPA, another is given to the resident construction engineer and the Project Coordinator keeps the third. All TRPA issues will be resolved using these sets of plans.

Coordinate with the Hydraulics and Stormwater Divisions for all TRPA permits.

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6.0 Work Flow

General: This section describes the major steps for all projects. These steps are generally in the order they occur. Milestone dates follow the PSAMS dashboard. A milestone timeline showing Intermediate Submittal through Advertise Date is in Appendix D.

6.1 Project Documentation

General: Project related documents and files shall be stored in ProjectWise Explorer. Examples of information include the project overview, correspondence, estimates, calculation spreadsheets, project specific design criteria, constraints imposed by management, information from the Materials Division, traffic data, traverse, earthwork, information from the Structures and Hydraulics Divisions, Right-of-Way and utility information, Landscaping and Aesthetics information, design exceptions, geometric approvals, and any other decisions made during the design of the project. All required reports and documents need to be neatly organized so that they can be found easily and checked either by another design squad or during Quality Assurance/Quality Control (QA/QC).

Examples of the documents listed in this section can be found on [Project Development Memos](#).

Design Notes to Specifications: These notes are prepared by the Designer and are required to inform the specifications writer of special or non-standard construction materials or construction methods being used on the contract. They need to be of sufficient detail for the Specifications writer to incorporate them completely into the contract as a Special Provision. When writing them it is essential to refer to the [Standard Specifications for Road and Bridge Construction](#) to ensure that conflicting information is resolved and that the note conforms to the format of the Standard Specifications.

6.2 Project Initiation

General: A project is initiated through the NDOT Planning Division where a project's need is identified from a corridor study, or a project sponsor such as a Metropolitan Planning Organization (MPO), Regional Transportation Commission (RTC), city, county, Native American Tribe or developer. The project sponsor documents key project information (problem/need, cost, proposed scope, etc.) in the Planning and Needs Assessment (PLANA) online application and submits it to the NDOT Planning for further development. The proposed need/project is verified for funding eligibility and whether it coincides with regional/local master plans. Once verified, the need/project is then forwarded to Project Scoping for further development.

Scoping Process: The Scoping Manager forms a scoping team comprised of a Scoping Coordinator, a Design Coordinator/Designer, relative disciplines and stakeholders which are determined by the preliminary Needs and Risk assessments. The Scoping Coordinator will facilitate the process, manage the meetings and keep the Scoping Manager and the Assistant Chief Road Design Engineer involved with details and updates for each project. The scoping team will take a detailed look at a proposed project by gathering pertinent data, conducting field studies, coordinating with major disciplines including stakeholders, developing alternatives, documenting the risk, preparing cost estimates, and analyzing information to recommend the best alternative. This information is documented in a Scoping Report. The Scoping Report is completed, and the recommendation(s) are presented to the Project Development Committee (PDC) for scope approval and prioritization in the 5 Year Plan. Once approved by the PDC then the project will be added to the STIP.

Conceptual Alignments: Horizontal and vertical profiles are generated by Roadway Design to a minimal alternative analysis level. The main purpose of this milestone is to establish potential corridors or alternative design features, so they can be studied to determine which have the least amount of impact to the surrounding environment, utilities, need for additional right-of-way, while balancing the needs of the project. Low Impact Development strategies should be used in selecting alignments. Design distributes conceptual alignments, profiles, and modeled surfaces to Hydraulics, Stormwater, Geotechnical, Utilities, Right-of-Way, Structural Design, and Traffic Operations so they can start preliminary research, design, and cost estimates for each alternative.

Refined Alignment Development: Roadway systems shall be kept aware if the project's selected alignment will change the roadway geometry significantly, if there are changes to the mileage, or if there will be any road transfer

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with local agencies as a result of the project. Early coordination with the Roadway Systems Division will ensure that specific responsibilities of ownership and maintenance are addressed in the agreement.

Coordinate with the Traffic Operations Analysis Section while developing each alternative to ensure they meet minimum traffic capacity.

Design compiles the design work from the other divisions and develops cost estimates for each alternative design. A summary of the alternatives and costs are submitted to the Chief Road Design Engineer for concurrence.

Alternatives analysis: The alternatives from the conceptual alignments are studied in the field to determine potential impacts to infrastructure, right-of-way, and the environment. Prior to and during the field study, a set of plans is required to facilitate review and discussions by the project team, so they can identify issues with the various alternatives. The Scoping Coordinator distributes a comment sheet and collects it at the end of the review. The comment sheet will allow input of critical field-observed data to help set a first-draft list of project priorities addressing the concerns of each contributing party or agency. An Alternative Analysis Field Study report documents the potential impacts discovered during the field review.

Alternatives are studied further with the project team to determine if there are flaws or if refinements can be made. Alternatives should provide sufficient information, so they can be studied in the field to determine impacts to features on the ground such as utilities, right-of-way, drainage features, traffic control, adjacent developments, etc. The alternatives are evaluated by the project team based on input from the public, public agencies and regulatory agencies. This may include studying additional proposed alternatives, which may not have been considered and presented at the public informational meeting. Based on the Public Information Meeting input and sound engineering judgment, a “preferred” alternative is selected through the NEPA process, during preliminary design and proceeds to Intermediate Design phase. Consult the FHWA for proposed changes to the control of access as part of the alternative analysis.

Conceptual alignment development is usually not applicable on 3R projects and proceeds to the roadside safety audit and PDFS.

Project checklists: The project checklist is not technically a report but is intended for the Designer to use during the development of the project. The intent of the checklist is to help guide the Designer on major items that are commonly done on most 3R and capacity type projects. The checklist shall be updated regularly and completed on each project.

6.3 Project Scoping

General: Project scoping consists of evaluating a project’s need(s), evaluating alternatives, and defining a project scope that best addresses the need(s). Project scoping identifies risks associated with the defined scope as early as possible. This allows the risk to be managed reducing the impact to a project’s scope, schedule and budget.

Scoping Process:

Project Verification Phase - Scoping receives the Planning and Needs Assessment (PLANA) from the Planning Division and verifies the purpose/need, proposed scope, cost estimate, potential project impacts, and assesses preliminary risks. All findings and information are compiled into the Project Verification Summary. The proposed need is presented to the Project Development Committee for approval to advance to the Scope Development Phase, to include in the NDOT 5 Year Plan and advance to the design phase, to return to the sponsor for resubmittal, or to be deferred.

Scope Development Phase - The Scoping Project Coordinator forms a scoping team to include a Project Manager and/or Senior Roadway Designer, representatives from relevant disciplines, and stakeholders. The Scoping Project Coordinator facilitates the scoping process, manages the scoping workshops and keeps management involved with details and updates for each project. The scoping team takes a detailed look at a transportation need or idea by gathering and evaluating available data, conducting field studies, identifying the planning purpose and need, coordinating with major disciplines and stakeholders, developing alternatives, determining the risk(s), and preparing cost estimates for the alternatives.

Preliminary Scoping Report: The Scoping Project Coordinator prepares a Project Scoping Report as the final documentation of findings and recommendations from the Scope Development phase. The report will document the issues/need(s), all developed and dismissed alternatives, supporting data, cost estimates, identified risks

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(environmental and right-of-way impacts, etc.), benefit-cost, and recommendations. The Scoping Manager will submit the finalized report to the Project Development Committee for approval and inclusion into the NDOT 5 Year Plan.

6.4 Project Visualizations

General: The Visualization group within the Scoping Section takes conceptual or preliminary level designs and creates three-dimensional visual representations of a completed project. A visualization can be developed to a varying range of sophistication including still photographs, rendered animations, and interactive 3D models. Visualizations are an effective tool for communicating complex transportation concepts, innovative intersections and technology, aesthetics, design conflicts, and roadway user perspective.

Visualizations are initiated and are developed to different levels based on the following project needs and criteria; Scoping Alternatives, Public Hearings (NEPA), Public Information Releases, Stakeholder meetings, ROW Settings, Legal Procedures, or High Profile/Politically driven projects. A visualization may be requested at any time during the course of a project provided the visualization meets one of the initiation criteria stated above. Different visualizations will require a varying amount of time and resources; adequate time must be allowed for the creation of the needed visualization. Visualizations may be requested by using the visualization request form located on the Visualization Portal on the Roadway Design SharePoint. Consult with the Scoping Section for further guidance on visualizations.

6.5 National Environmental Policy Act (NEPA)

General: The NEPA process should begin at the scoping phase and extend up to the point where the preferred alternative is selected. During the preliminary design phase, NEPA is ongoing and all reasonable and feasible alternatives are studied equally. This is a dynamic process and requires close coordination between Roadway Design, Stormwater, and Environmental Services during the development of alternatives to setting the right-of-way. Changes to the final scope or right-of-way setting that produces additional impacts to the project footprint, changes to capacity, access points, and utilities, could be cause for a re-evaluation of NEPA approvals.

Before NEPA approvals are done, the final footprint of the project must be established and agreed to by the FHWA, NDOT Divisions, the project team, and public entities involved. The footprint for staging areas and detours for construction of the project have been identified. Utility relocations have been established and agreed to by the utility companies. Public meetings have taken place and written comments have been included in the Environmental documentation.

Environmental Services initiates a formal notification for the project. The general public, public agencies and regulatory agencies are notified and entered into the project records. The approved alternatives are presented through the use of displays, photos and plans to the public at an informational meeting. The questions and issues, which are gathered from the public, public agencies, and regulatory agencies are answered by the appropriate Division and documented for inclusion in the environmental documents.

Environmental Services schedules the public meeting which is usually held at a public facility (i.e. school, city hall, etc.) Design provides displays for the various alternatives and technical support for the project.

Environmental Services has identified the permits that will be required to construct the project and begin the process to acquire the necessary permits before the Doc date.

6.6 Preliminary Design

Program and Schedule: The Project Manager/Coordinator programs and schedules a project to begin preliminary engineering and related services by submitting a programming and scheduling form to Financial Management. The programming and scheduling form and instructions can be found in [Project Development Related Links](#) on SharePoint. A project must be on the STIP to be programmed for federal participation and must either be in the annual work program or have written approval from the Director to be programmed for state funding. Once the programming and scheduling request is processed by Financial Management, a project identification number, project number and PCEMS number are assigned to the project, and appropriate funding is scheduled. Financial Management will notify the Project Manager/Coordinator by e-mail that the programming and scheduling has been completed.

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Project Kick-off Meeting: The Project Manager/Coordinator contacts the appropriate divisions to form a project team. A meeting is held to establish who will be the point of contact and go over the scope of the project. The Project Manager/Coordinator invites project stakeholders such as the county, city, FHWA, public utility, etc., to identify whether other agencies will have input into the design process and to develop a contact list of local agency personnel as needed. The existence of local area master plans and associated project impacts should be determined in this meeting.

Scope and Budget Change (SBC): If significant changes occur to the scope during the project development, notify Financial Management of items such as need for right-of-way, utility relocations, change in project scope or limits, and costs. For changes in costs greater than \$250,000 or 20% of the project, whichever is less, an SBC form is prepared by the Project Coordinator and forwarded to Program Development and Financial Management for approval. The form must also be completed by July 1, for federal projects scheduled for advertisement before October 1 of that same year. The Right-of-Way Division may request the Project Coordinator to update the cost for right-of-way acquisitions and utilities as their estimate is developed.

The SBC form can be found on [Scope and Budget Change Form](#).

Project End Date: Federal aid projects require an end date. The end date is the last date that federal funds will participate in eligible costs incurred on the project. The Project Coordinator is responsible for providing the anticipated end date for the design phase of a project. The Project Coordinator should take into consideration the time for design, right-of-way activities and other project milestones that could impact the delivery of a project. The end date for the design phase typically coincides with the advertisement date. The Construction Division is responsible for developing the end date for the construction phase.

Project Scheduling and Management System (PSAMS) Dashboard: Newly scheduled construction projects are entered into PSAMS Dashboard by Financial Management. The Project Manager/Coordinator then populates the project with the appropriate milestones and project team members. The Project Manager page needs to be completed once the project has been scheduled. There are multiple templates available depending on the type of project. For assistance or if there are questions on how the templates drive the status of a project, please contact the Scheduling and Estimating Section of Design. This information is used by the various divisions at NDOT to track progress and schedules. It is important to keep project information as up to date as possible. Notes in Dashboard are to include when preliminary plans were sent to the various divisions, future changes to scope or budget, or change in footprint that may affect obtaining environmental clearance. The approved Doc and Advertise date is updated by Financial Management. Email PCEMS DL to request updates to the approved milestones.

5-year plan: The 5-year plan is a forecast of projects for which NDOT controls the funding. It is updated quarterly following the Project Development Committee (PDC) meeting. NDOT uses this plan to identify current projects and projects anticipated in the following four years. It is a planning and resource tool used to determine project priorities from a funding and resource allocation perspective. It is important to check the 5-year plan periodically to ensure project dates and costs match what is shown in the dashboard. Reconcile project dates, scope, and costs accordingly. The 5-year plan is located [here](#).

Request Information: The Designer sends out requests for information to various divisions to gather specific information to incorporate into the base design. The various requests can be found on the QA/QC Checklist in Appendix C. Example documents for requesting information can be found in [Project Development Memos](#). The timing of this step will vary on the complexity of a project and may come after project scoping once the preferred alignment has been established. See Section 5 for engineering support and requesting information from other divisions.

As-Built Contracts: As-built contracts should be reviewed when designing new projects. These are available through Central Records or IRWIN. As-built contracts document changes that were made during construction that would not otherwise be known when developing a project. To avoid developing certain sheets from scratch, existing electronic copies of as-designed contracts may be available from the archive files in the Specifications Section or on ProjectWise. To find contracts that were done in certain counties or routes, Contract search is available at [Contract Search](#).

Mapping Requests: The Project Coordinator prepares a memo (example located in [Project Development Memos](#)) detailing the specifics of the mapping request. The memo should include project information (project number, milepost limits, description), a description of the mapping limits, the type of work to be performed, and specifics of the data needed (mapping, surface, ortho photos, pipes, utilities, etc.). Mapping limits typically go to right-of-way

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but may be requested for areas outside of right-of-way for sound walls, hydraulic features, or other features that may extend beyond right-of-way limits.

In addition to the memo, the Project Coordinator prepares a kmz file showing a boundary with the limits of the area mapping is needed for. The kmz file is generated using Google Earth (instructions located in [Location Public on Datsrv1](#)).

After the memo and kmz file have been created, the Project Coordinator sends the files to the Principal Road Design Engineer in charge of prioritizing mapping projects. The PRDE will set a priority on the request and forward it to the Design Mapping Manager in Location for processing.

Subsurface Utility Exploration (SUE): If the location of existing utilities cannot be obtained from permits or other field information, SUE may be requested to horizontally and vertically locate utilities. Right of Way Utilities has an on-call list of contractors that can provide this service. It is important to develop a clear scope of work to the service provider and include preliminary roadway plan sheets where the work is being performed. As part of the scope, ensure the information is to be delivered to the designer in Microstation DGN format so the horizontal and vertical location can be referenced within the design. The number of potholes is also estimated and made part of the scope. Once the request is made, allow several months to obtain info.

SUE information is delivered in 2 phases. The first phase is locating the utilities horizontally and is made available to the designer for review. The second phase is determining the location of potholes based on horizontal information. The SUE contractor will then vertically locate the utility and provide depth and elevation of the facility. It is critical that the SUE is tied to NDOT monuments and the LPN that will be used on the project.

Value analysis: A value analysis is required on any federally funded project on the NHS with an estimated total project cost of \$50,000,000 or more. It is also required on any federally funded bridge project on the NHS with an estimated total project cost of \$40,000,000 or more. NDOT encourages a value analysis be considered on projects over \$10,000,000 or if the project complexity warrants it. The Project Coordinator should initiate the value analysis with the Performance Analysis Division. The Project Coordinator should receive a copy of the completed analysis for their records. Projects requiring a value analysis are usually scheduled during the alignment development period.

Refined Geometry Development: Roadway Design refines horizontal and vertical alignments and models cut and fill slopes to establish roadway widths. Geometrics, including superelevations, are verified at interchanges and intersections to satisfy sight distance requirements. Changes in access points, control of access, and analysis of retaining walls versus right-of-way are refined to determine the need for additional right-of-way.

Design coordinates with Traffic Operations to analyze each design alternative and determine the optimum configurations. Sight distance is checked at intersections, ramps, mainline alignments, etc.

Structural design begins the preliminary selection for the type of bridge and a front sheet is developed. Structures spanning over rivers and canals are checked by Hydraulics to ensure they meet adequate freeboard and foundation scour analysis.

Hydraulics begins preliminary design for on-site and off-site drainage features. Roadway profiles are verified and adjusted accordingly to accommodate proposed drainage structures that cross the roadway prism. Major drainage features have been designed to a level to established final grades.

Preliminary special drainage structures have been sent to Structures for review. Refer to the [Drainage Manual](#) for more information.

Construction has identified areas that require staging areas or platforms for construction. The Traffic Division locates overhead sign structures that may be required on the project and are examined for impacts to utilities or other design features.

Landscape and Aesthetics alternatives have been reviewed by the public entities and an alternative has been chosen. Preliminary landscape and aesthetics design proceeds to a level, which will provide a proposed "toe of slope" or an area of impact to related design features. Proposed landscape and aesthetic features should be checked for sight distance issues when refining alignments.

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3R projects: For 3R projects and other maintenance projects, alignment refinement is usually not applicable and progress up to the Intermediate design level before there is a submittal requirement.

Identify preferred alignment: Once the preferred alignment(s) is select through the NEPA process, the project is formally field investigated through a RSA and PDFS.

Roadside Safety Assessment (RSA): The Safety/Traffic Division conducts an audit for most 3R and capacity projects around the time of the PDFS. Safety coordinates with Roadway Design for obtaining information and plan sets so they can conduct their audit. Recommendations are forwarded to Design for approval by the Chief Road Design Engineer. The Standard Compliance Section will also attend the road safety audit to ensure non-compliant roadside features and ADA issues are addressed in the report. The Project Coordinator should check with the Safety Division if safety funds are available to mitigate high crash locations. The Designer will respond to the Safety Division regarding each issue identified in the RSA report.

Project Kick-off: Prior to holding the Preliminary Design Field Study (PDFS), the Project Coordinator should do a field review of the project limits to gain a better understanding of the project scope and identify any additional areas that may need to be addressed that were not originally considered in the development of the project.

Crash information, pipe condition survey, and planning information is requested and received from the Traffic Safety Division, appropriate District involved, and the Transportation and Multimodal Planning Division respectively. See [Section 5](#) for engineering support and requesting information from other divisions.

Once the information is received, the Project Coordinator will schedule a Project Kick-off meeting. This meeting is intended to notify and provide the appropriate divisions and other key stakeholders with the project limits, scope, preliminary schedule, specific areas of concern, the location of project information collected to date, and when the PDFS is scheduled. Adequate time shall be provided between the kick-off meeting and the PDFS to allow individual divisions to do any additional project research needed prior to the PDFS (approximately 4 weeks).

Preliminary Design Field Study (PDFS): The PDFS should be a two-part review beginning with a meeting to go over the agenda and discuss the specific areas you plan to review in the field. This is an appropriate time to update everyone on the project limits, scope, preliminary schedule, and discuss any specific areas of concern that other divisions have found since the kick-off meeting. The second part of the review consists of physically going out in the field to review the areas of concern and further discuss the issues and viable solutions. A PDFS comment sheet and checklist should be distributed to the project team and collected at the end of the review. The comment sheet will allow input of critical field-observed data to help draft a list of project priorities, addressing the concerns of each contributing party or agency. Plans of the preliminary design should accompany the PDFS invitation memo.

Example PDFS requests can be found under [Project Development Memo Templates](#) on SharePoint.

Preliminary Design Field Study (PDFS) Report: The Project Manager/Coordinator consolidates the findings of the field study into a report that includes proposed scope of work and recommendations or conclusions discussed during the field review. The report will describe the itemized areas for work to be included in the contract along with photographs. An estimate of cost will be shown when the initial scope of the project has been modified with an estimated impact to the schedule and other divisions. In addition, findings and recommendations from the Road Safety Assessment shall be included into the PDFS report. Any design constraints discovered during the field review should be described in the report.

The report is reviewed by the PDFS team prior being sent to the Chief Roadway Design Engineer for approval. The Project Coordinator will arrange to have a meeting with the Chief Roadway Design Engineer, Assistant Chief Roadway Design Engineer, and the design squad to discuss and resolve issues presented in the report, if needed. The PDFS report may be amended during the design process.

Water Quality Design & Permitting: All new slope disturbances may be subject to Clean Water Act permitting. The stabilization strategies will vary depending on a number of factors including: project scope, potential impacts to Waters of the US, slope steepness, slope length, climate conditions, etc. The chosen slope stabilization strategy (ie: slope paving, riprap slope armoring, revegetation) may have significant impact on project cost. The Project Coordinator schedules a meeting prior to intermediate design with all applicable divisions including: Stormwater, Hydraulics, Materials, Landscape and Aesthetics, Construction and Maintenance in order to determine the appropriate strategy for each project.

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Based on the project scope identified during preliminary design, the requirement for treatment control BMPs such as water quality vaults and basins may be triggered. This requirement is based on potential impacts to downstream water bodies as well as the amount of new impervious area created by the project. Since treatment control BMPs can add significant cost to a project, this requirement is determined, and the associated facility design is initiated during the preliminary design process.

Dredge and fill within Waters of the US may require permitting and potential mitigation of impacts as required under Section 401 and Section 404 of the Clean Water Act and Section 14 of the Rivers and Harbors Act. This permitting process and potential mitigation actions can have significant impact on the project delivery schedule. Once project scope has been sufficiently developed, estimates of the related project impacts within the jurisdictional ordinary high-water mark are provided to the Stormwater Division so that permitting and mitigation impacts to the project schedule can be estimated. Documentation and application by the Stormwater Division to regulatory agencies is not initiated until project design has been finalized to the point where no changes in design within the jurisdictional ordinary high-water mark will occur (usually after the intermediate design review).

Transportation Management Plan (TMP): A TMP consists of a traffic control plan, a traffic operations component, and addresses public information issues. A TMP is required on all projects. The Traffic Operations Division is responsible for developing the TMP in coordination with Design, Construction, and the District Engineer.

More information on the TMP can be found in the [Work Zone Safety and Mobility Implementation Guide](#).

Cost update: The Project Coordinator updates the Scope and Budget Change form (SBC) once an approved scope is finalized and project costs are updated. A revised SBC should be submitted at each project milestone and anytime the estimated project costs change by 20% or \$250,000. Major changes late in project development affecting the STIP can lead to project delays, as the STIP is only updated quarterly. Therefore, it is important to submit an SBC as soon as possible. The SBC and instructions are located on [SharePoint](#).

Engineer's Estimate: An Engineer's Estimate should be entered into the Project Estimating System ([iPD](#)) after the scope of the project has been approved. Instructions for developing an Engineer's Estimate can be found in the [Project Cost Estimation Manual](#).

Structural Sections: The Roadbed Design Section of the Materials Division develops the structural section design for the project. The Chief Materials Engineer will transmit the recommended structural section to the Project Coordinator by memo.

Preliminary (30%) Plan Submittal Requirements: The purpose of the preliminary plans is to establish the roadway geometrics and propose to the other divisions (Hydraulics, Structural Design, etc.) the alignment information, roadway widths, clearances, etc. Preliminary plans are used to evaluate any sight distance issues and present the basic foot print of the project in order to begin identifying impacts to utilities and right-of-way.

Once the scope is approved and the preliminary design work is sufficiently completed per submittal requirements below to identify impacts to right-of-way and utilities, the plans are submitted to the various divisions such as Hydraulics, Stormwater, Structural Design, Geotechnical, Construction, Traffic, and District for review. Once the divisions have reviewed and submitted comments, Roadway Design, Hydraulics, and Structural Design begin making refinements to prepare the plans for Intermediate design.

Submittal requirements require engineering judgment based on type of project and are subject to the needs of the Project Coordinator and project team. The following are guidelines for what should be contained in a set of preliminary plans and the status of each sheet:

<u>Sheet #</u>	<u>Description</u>	<u>Status</u>
1	TITLE SHEET	Completed as practical but shall include. Items not needed may include design designation, mile posting, refined index of sheets, and length of construction

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1A	LOCATION SKETCH	Completed as practical. Items not needed may include material sites, mile posting, and structure numbers
2	TYPICAL SECTIONS	Completed as practical. Items not needed may include stationing, exact widths, longitudinal sections
3	SUMMARY SHEETS & GENERAL NOTES	Not needed
4	PLAN SHEETS	Completed as practical. Items not needed may include plan notes, refined cut and fill lines, new right-of-way or temporary easements, island geometrics, curb ramps, slopes, curbs, gutters, dikes, begin/end construction, utility relocations, temporary detours, refined hydraulic layout, guardrail/barrier rail locations, and control of access
5	PROFILE SHEETS	Completed as practical. Items not needed are ditch notes and earthwork quantities.
6	GRADING PLAN	Not needed
7	GEOMETRIC SHEETS	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
LC1	LOCATION CONTROL	Not needed
SD1	SPECIAL DETAILS	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
SP1	SITE PREPARATIONS (REMOVALS)	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
L1	LANDSCAPE PLANS	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
D1	DRAINAGE PLANS	Refer to NDOT Drainage Manual
RW1	RIGHT-OF-WAY	Not needed
ST1	PERMANENT MARKING DETAILS	Completed as practical
TC1	WORK ZONE TRAFFIC CONTROL	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
T1	SIGNALS, LIGHTING, AND ITS	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
TS1	PERMANENT SIGNING	Not needed unless it demonstrates any unique changes to geometrics and right-of-way impacts
B1	BRIDGE STRUCTURES	Not Needed
S1	STRUCTURE LIST	Not needed

Preliminary (30%) Estimate: Estimates at this level can be accomplished with “order of magnitude,” which means that detailed bid items and quantities are usually not required. Costs are captured based on the major items that make up approximately 80% of the project costs, such as earthwork, base and surfacing, and concrete structures. Percentages are applied to other items such as traffic control, landscaping, signing, drainage, etc., that make up the remainder of the project costs.

6.7 Develop Agreements

General: The need for an agreement is established by the Project Coordinator; details of the agreement are identified, put in writing, reviewed, and agreed upon by all parties. It is important to clearly identify ownership and maintenance responsibilities if there will be temporary or permanent Right-of-Way transfer, acquisition or relinquishment as a result of the project. The agreement is reviewed by Agreement Services, Legal, and other

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divisions as needed. After the edits and corrections have been made, the agreement is signed by all applicable parties.

Example agreements entered between NDOT and outside entities are:

Inter-local: These are used when NDOT is “obtaining service” from or “providing service” to another state or local government agency.

Cooperative: These are used when a joint exercise of powers, privilege and authority by NDOT and another agency is contemplated, such as with state agencies, other states, local governments, Native American tribes and federal agencies.

Independent Contractor: These are used to procure private providers of services such as janitorial, landscaping, etc.

Consultant: These are used to procure private providers of engineering services such as for design, construction management, etc. Request for proposals (RFP) for consultant services are written and executed if applicable.

Private-party Agreements: These are used when NDOT is entering into an agreement with non-governmental parties, such as property developers, in order to coordinate and share in the cost of improvements to the transportation system with mutual benefit of both parties. It is important that third party agreements are properly entered into the financial system with a separate breakout.

Utility Agreement: These are used when utility work needs to be performed within NDOT right-of-way either by the Contractor or by the utility company. These agreements are handled by the Right-of-Way Utilities Section. See [Section 5.15 Right-of-Way Utilities](#) for more details.

Agreement shells and instructions are found on [Agreement Services SharePoint](#).

6.8 Intermediate Design

General: The purpose of intermediate plans is to refine quantities, geometrics, and incorporate all information from the other Divisions to demonstrate the outcome of the project in more detail. The plans should contain the basic information for all of the possible types of sheets mentioned in the Preliminary Submittal Requirements. Any special details are also conceptually developed. Most importantly, the plans need to have sufficient information to identify all impacts to right-of-way and utilities.

The following are general guidelines for what should be contained in a set of Intermediate plans and what other divisions should have accomplished. A complete list of requirements for Intermediate submittal is outlined in the Intermediate Review Submittal Requirements and Checklist in Appendix B:

- Roadway Design details the locations for barrier rail, guardrail, sound walls and retaining walls. All pedestrian facilities and bike plan facilities have been incorporated into the design. Roadway design along with Hydraulics and Structural design compile a list of locations for potholing utilities in conflict. Property boundaries, existing right-of-way, proposed right-of-way, and control of access have been sufficiently detailed.
- Any special structures such as retaining walls and sound walls have been forwarded to Structural design. Adequate bridge design and estimates have been completed and provided to Roadway Design.
- Footprints for onsite and offsite drainage facilities is finalized. Refer to the Drainage Manual for other required items and coordination for the hydraulic design.
- Location has reviewed all monuments on Location Control sheets that will be impacted by the project and forwarded a list to Roadway Design of all monuments that will need to be perpetuated or reconstructed.
- Geotechnical exploration and analysis are conducted, and the draft geotechnical report has been forwarded to Structures, Hydraulics and Design for design completion.
- The Construction Division, along with Roadway Design and the Traffic Division, develop a traffic control plan. A constructability meeting takes place and agreement has been reached and documented on how the project will be constructed. Limitations of operations are developed, and a draft traffic control matrix is based on

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traffic control scenarios during each phase of construction. Preliminary time frames and construction sequencing is developed for the length of time temporary easements will be needed.

- Conflicts with underground utilities have been resolved, and any associated adjustments to the proposed project improvements are reflected in the design. Plans for utility relocation work are sufficiently developed to determine any right-of-way needs. Request for water, power and telephone sources for NDOT facilities have been forwarded to utility companies by R/W or District, and preliminary approvals have been returned. In addition, the utility companies have provided plans showing proposed utility relocations. Any work requiring R/W should be finalized so R/W can be set.
- Adequate landscaping plans, bid items, quantities, and notes for the specifications have been developed. Location of water sources, power source locations and telephone lines have been identified.
- The NEPA process is complete and a final Record of Decision, FONSI, or Categorical Exclusion have been issued and approved.
- All geometrics and earthwork should be complete and earthwork quantities finalized and entered into the estimate.
- Electrical service points for signs, signals, lighting, and ITS have been identified by Traffic Engineering and Utilities and are coordinated with the Project Coordinator.
- All design within jurisdictional Waters of the U.S. has been finalized and provided to the Stormwater Division so that the permitting process may be initiated with all applicable regulatory agencies.

Traffic Control/Constructability Meeting: The Project Coordinator holds the traffic control/constructability meeting with the Construction and Traffic Operations Divisions to determine the limitations of operations and accommodation of public traffic criteria as they relate to the construction staging and the Temporary Traffic Control Plan (TTCP). The traffic representative is responsible for determining if the TTCP conforms to the MUTCD and develops the TMP. The construction representative is responsible for determining if the TTCP provides a reasonable approach for the contractor to control traffic during construction. The Project Coordinator is responsible for providing support to the Traffic Operations Engineer throughout the development of the TMP.

Intermediate (60%) Estimate: Estimates at this level are required to be entered into the Project Estimating System ([iPD](#)). Quantities should be refined as much as possible and unit bid prices should be preliminarily reviewed by the Principal Design Engineer.

Intermediate submittal: The following is the procedure for processing intermediate submittals for 3R projects. A similar sequence of activity should be followed for capacity projects using appropriate adjustments to the time frame based on the project's particular requirements. The Project Coordinator decides when a given project meets intermediate design submittal requirements at which point Road Design will deliver the following items to Specifications:

- A written request for Specifications to set an intermediate design review meeting to be held 6 to 7 weeks from the date of the request.
- A copy of the plans, intermediate review estimate (bid item summary), and notes related to Limitations of Operations, Traffic Control, or other Special Provision items that may have been agreed to at the PDFS or otherwise provided by the Construction Division, Materials Division, District, or others.
- A completed electronic copy of the Intermediate Review Submittal Checklist shown in Appendix B

The Project Coordinator will discuss the bid items in detail with Specifications at the time of the initial submittal to ensure the estimate is complete and the units of work are appropriate for the intended work. It will also be determined if additional notes to specifications are required.

Specifications will:

- Select a date, time, and reserve a meeting place for the intermediate design review.
- Develop preliminary Special Provisions based on the provided bid item summary within 2 weeks.
- Provide a limited Quality Assurance check within 2 weeks, if time allows. Continue checking up to the review meeting.
- Email the project participants the electronic link to the Plans, Special Provisions and Estimate upon receiving corrected plans from Design.

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- Conduct the specifications portion of the review meeting.
- Coordinate specification related comments and make revisions as necessary.

Road Design will:

- Provide electronic plan set with corrections from QA check to Specifications within 1 week of receiving comments.
- Conduct the plan review portion of the meeting.
- Document plan and estimate review comments.
- Make plan and estimate revisions as necessary.

Review Period: The total time for this process is 6 to 7 weeks once the project is submitted to QA/QC to when the review meeting is held. Allow 3 weeks once the plans, specs, and estimate are sent on review; large or complex projects should allow for 4 weeks.

Geometric approval and design exceptions: The Principal Road Design Engineer prepares a memorandum outlining the geometric design for the project. Geometric approval and design exceptions are prepared in a memorandum after intermediate design review and must be approved prior to Doc date. See [Section 1.6](#) for design exceptions and [Section 1.8](#) concerning geometric approvals.

Change in control of access: The Principal Road Design Engineer prepares a memorandum for any change in control of access. Instructions for preparing a change in control of access can be found in [Section 1.5 Change in Control of Access](#).

Right-of-way setting: The Principal Road Design Engineer prepares a right-of-way setting memo for the Assistant Director, Engineering for approval. Right-of-way memos can be found on SharePoint. See [Section 5.14](#) for additional information concerning right-of-way settings.

Update engineer's estimate: The Designer updates the engineer's estimate with approved unit prices from the Principal Design Engineer. See [Project Cost Estimation Manual](#) for more information.

Program final design: Financial Management programs the project funds for final design and right-of-way acquisition once the Project Coordinator submits the program request form. Final design utilizing Federal Aid Funds cannot proceed until the NEPA process is complete.

6.9 Final Design

General: After the Intermediate review meeting is held, the individual divisions such as Structures, Traffic Operations, and Hydraulics finalize their plans and quantities and submit them to Roadway Design to be combined into the plan set. Roadway updates the engineer's estimate. See [Project Cost Estimation Manual](#). Details of the project are finished and compiled into the plans and are ready for the discipline review.

Discipline submittals: This step applies to large or complex projects. Discipline submittals are specific to the division in charge and do not require that multiple sets be submitted to other divisions. Structures reviews the drafted structural details for the bridge design, retaining walls, sound wall, special drainage structures, special structures, sign bridges, signal bridges, etc. and revises them before they are finalized for quantities & quality assurance review. Hydraulics reviews the drafted drainage details and special drainage structure details, etc. and revises them before they are finalized for quantities & quality assurance review. Stormwater reviews and revises permanent and temporary erosion control details. Right-of-Way Engineering reviews and revises proposed parcel maps prior to going to the appraisal stage. Signals, Lighting, and ITS reviews lighting diagrams, signal timing diagrams, electrical schedules, and ITS details.

Discipline submittals are usually done on complex projects to assist other divisions to ensure accuracy. The discipline reviews need to be done and changes incorporated before proceeding to QA/QC. 3R projects do not require discipline submittals.

Cross checking: Before submitting the project documentation and plans, the Designer ensures quantity calculations have been cross checked and the documentation is neatly organized and updated. It is preferable that another design group checks the plans along with the engineer's estimate.

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The Project Coordinator will check the plans and estimate for completeness and conformance with the Road Design Guide (also verifying the Structure List and the estimate match and quantities are correct) before submitting to Specifications.

6.10 Quality Assurance/Quality Control (QA/QC) Specifications Review Process

QA/QC Submittal: A memo along with 3 sets of plans, notes to Specifications, and 2 bid item summaries from the QA Estimate are submitted to Specifications. Generic QA/QC memos are found at [Project Development Memos](#).

The completed QA/QC Submittal Checklist in Appendix C should also be delivered to Specifications at this time.

Specifications performs the QA on the plans and starts writing the final specifications for the project.

Specifications will continue checking the plans and estimate, and work with design throughout the QA/QC process.

Plans, Specifications, and Estimate (PS&E) review:

Specifications will:

- Select a date, time, and reserve a meeting place for the PS&E review.
- Update Special Provisions based on the provided bid item summary within 2 weeks.
- Provide a Quality Assurance check within 2 weeks. Continue checking up to the review meeting.
- Email the project participants the electronic link to the Plans, Special Provisions and Estimate upon receiving corrected plans from Design.
- Conduct the Specifications portion of the review meeting.
- Coordinate specification related comments and make revisions as necessary.

Road Design will:

- Provide electronic plan set with corrections from QA check to Specifications within 1-2 weeks of receiving comments.
- Conduct the plan review portion of the meeting.
- Document plan and estimate review comments.
- Make plan and estimate revisions as necessary.
- Update and finalize price checks.

Plans, specifications, and estimates have been reviewed by all Divisions and errors, revisions or recommendations have been forwarded to the appropriate Division for corrections.

Allow 3 weeks once the plans, specs, and estimate are sent on review; large or complex projects should allow 4 weeks.

Specifications review meeting. A formal meeting is held to review and discuss issues brought up during the review period. The meeting determines which corrections and additional information needs to go into the final project documents.

Processing memo: The Specifications Supervisor notifies Administrative Services to prepare the processing memo at the time the specs review meeting is scheduled. The memo sets the advertising date, the advertising period, the date of reproduction for small sets, the date for approval of the traffic control by the Chief Traffic Engineer and the date for submittal of the preliminary agreement estimate to Financial Management. The Title Sheet is signed by the director once it is finalized. The contract number is issued to Specifications to put onto the title sheet. Design's Administrative Assistant will notify the Project Coordinator by email and will request information such as final construction cost, project scope, and location.

Submittals: After incorporation and verification of the specification review meeting changes and final price check, the design squad submits the preliminary agreement estimate to Financial Management and the electronic plan files to the Specifications Writer along with the changes in the Project Estimating System. At this point, all contact regarding plan reproduction must be directly made with Administrative Services concerning changes, schedule modifications, supplemental notices, plan sheet additions, etc. Refer to the Plan Preparation Guide for electronic submittal guidelines.

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Prior to advertising the project, the participating agency, such as county, city, or 3rd party, will be given an opportunity to review the proposed contract plans for the facilities in which it is participating. At the time of advertising, the agency should be notified and given a copy of small sets, special provisions and an estimate showing the amount of its participation.

Estimate: The Principal Design Engineer checks the unit prices used by the Designer and forwards changes to the design squad to update the estimate in the Project Estimating System (iPD). The Principal Design Engineer sets the final prices for the preliminary agreement estimate and locks the estimate. The preliminary estimate is submitted to the Project Estimation Specialist (PES) in Scheduling and Estimating for review. The PES will make comments concerning any changes or deviation from the [Project Estimation and Estimate Building Procedures](#) manual.

6.11 Documentation Date (Doc Date)

General: The documentation date is when the complete plan set is sent to Administrative Services. The doc date is established shortly after QA/QC and is specified in the processing memo. The plans, quantities and estimates for all Divisions have been updated, corrected and submitted to Design and combined into a final Plans & Estimate package and delivered to Specifications. All Specifications have been updated, corrected and combined with the Plans and Estimate and are ready to be sent to Administrative Services.

Right-of-way certification: The Chief Right-of-way Agent is responsible for certifying the project is in compliance with applicable right-of-way and utility criteria.

Federal aid projects, including full oversight projects but not including local public agency projects, will be processed as follows: once a final processing memo is received by the Right-of-Way Division, a certification letter will be sent to the Administrative Services Division. Electronic copies will be sent to the Project Manager, the Financial Management Division, and the FHWA Division Administrator to the attention of the Right-of-Way Program Manager.

Federal aid local public agency projects will be processed as follows: Once a processing memo is received by the Right-of-Way Division, a certification letter will be sent to the Principal Intergovernmental Programs Engineer in the Road Design Division. An electronic copy will be sent to the Financial Management Division and the FHWA Division Administrator to the attention of the Right-of-Way Program Manager.

State funded projects, not including local public agency projects, will be processed as follows: once a processing memo is received by the Right-of-Way Division, a certification memo will be sent to the Administrative Services Division. Electronic copies will be sent to the Project Manager and the Financial Management Division.

State funded local public agency projects will be processed as follows: once a processing memo is received by the Right-of-Way Division, a certification memo will be sent to the Principal Intergovernmental Programs Engineer in the Road Design Division. An electronic copy will be sent to the Financial Management Division.

6.12 Advertise Date

General: The advertise date is when the contract documents are released to the public. The contract cannot advertise until the project certifications are complete. Contracts with FHWA for Federal oversight projects will usually require additional time to certify. Most contracts are advertised for a period of 3-4 weeks. Administrative Services will forward two copies of the final plans and specifications to the Project Coordinator and Designer, so they will have current information to answer the Contractor RFI during the advertising, pre-bid, pre-con, and construction phases of the contract.

Request for information (RFI): During the advertising period, the Project Coordinator is required to answer contractor's questions in accordance with sub-section 102.05 of the Standard Specifications for Road and Bridge Construction. An email is sent to the assigned Project Coordinators informing them that a question has been posted to NDOT's web site. The Project Coordinator responds in writing to the questions as they arise using the [eBidding Portal](#).

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Supplemental Notices: Based on questions that may arise from the pre-bid conference or RFI's the Project Coordinator or other divisions may issue a supplemental notice to correct or clarify the project plans prior to bids being received. There are three main factors to consider in deciding to issue a supplemental notice:

- Is the information provided to bidders accurate so that contracts can be bid and built as designed?
- Do contractors have adequate time to prepare their bids after receiving the information?
- Will the contract be awarded in time for the construction season?

When a supplemental is needed, the matter must be dealt with promptly. The following steps should be used to implement a supplemental:

- Submit a request for a supplemental to the Specification Writer on the contract.
- Specifications will review the matter with the Chief Road Design Engineer.
- The Specification Writer emails a notice that a supplemental is being written to other divisions to solicit additional changes that need to be incorporated.
- The Specification Writer will pool requests, check with other divisions to see if items needing correction have been identified, and have the revisions reviewed by the Principal Specification Engineer.
- The Chief or Assistant Chief Road Design Engineer will approve the supplemental notice as written, sign off, and deliver it to Contract Services. If the request occurs during the week of the bid opening, front office approval must be obtained for maintaining the bid date or postponing the opening.
- Contract Services will prepare the supplemental for vendor distribution and release it.

Close coordination with Administrative Services is vital to ensure proper timeframes and procedures are met.

Bid opening: Administrative Services receives bids from the contractors and the bids are opened at the bid-opening meeting and the apparent low bidder is announced.

Award contract: Within two working days of a bid opening, Administrative Services provides the bid tabulation, including percentage variances from the engineer's estimate for each bid item, to the co-chair of the Bid Review Analysis Team (BRAT). They also notify the BRAT co-chair of any defects or challenges that would or may render any of the bids non-responsive or otherwise affect the award of the contract.

If requested by the BRAT committee, the Designer will review quantities and prices of certain items to determine if there was an error in the contract that is prompting bidding discrepancies. The BRAT reports to the director listing the effects of re-advertising on construction scheduling and the likelihood of receiving better bids with one of the following recommendations:

- Award to the apparent low bidder
- Award to the apparent second low bidder (or next responsive bid that is not materially unbalanced)
- Reject all bids, re-advertise and notify any agencies that are under agreement to provide funding.

Third party involvement: Any agreement with a local government (or private party) that is participating in the costs should review the bid and give concurrence to award the contract. Any such stipulation must be honored in accordance with the agreement.

Notice to proceed: The Construction Division sets the notice to proceed date. Contracts typically have a 30-day notice to proceed. Contracts in the Las Vegas area usually have a 45-day notice to proceed due to additional permitting processes.

6.13 Construction Support

General: Once a contract has been awarded, it becomes the responsibility of the Resident Engineer to coordinate the activities. The design team provides the construction team with support throughout the remaining life of the contract.

Contract Modifications: Contract Modifications requested by Roadway Design go through the Chief Road Design Engineer to the Chief Construction Engineer. Examples of contract modifications can be found on SharePoint under standard project memo templates.

SECTION 6 WORK FLOW

6.14 Agreement Close Out

Agreement close out: An agreement report is issued by the Administrative Services Officer on a quarterly basis. The Project Coordinator reviews the listing of agreements to see if they can be closed out or if they need to be amended. If the agreement is receivable, the Project Coordinator will contact Accounting to see whether there are still any monies associated with that agreement that have not yet been received. At that point, they will determine whether the agreement can be closed and, if it can be, the Accounting Division will start the process. For all other agreements, the Project Coordinator needs to determine what the status of the agreement is. If the Project Coordinator feels they should be closed, contact Design's Administrative Assistant to see if a final audit is pending or was requested. If no audit was done, a memo is sent to Internal Audit requesting the final "post" audit review. (cc the office Administrative Assistant on that request). When Internal Audit agrees to close out the agreement, contact the office Administrative Assistant so they can start the agreement closeout process.

6.15 Archiving

General: Roadway Design archives pertinent project computer files on ProjectWise (PW) after construction is completed. All requirements shown in the [NDOT Records Retention and Disposition Schedule](#) should be followed when archiving. The Designer should only use the file retention guidelines below as a general guide. Forethought should be used when deciding which files might be helpful to Designers on future projects.

The Designer should clean out the completed project folder in PW by removing any files not found in the [NDOT Records Retention and Disposition Schedule](#) or file retention guidelines, except those that would be considered beneficial in the future. Files should be named according to the File Naming guidelines and folders should be named such that information can be easily identified. The Designer should coordinate with other divisions when archiving projects to ensure that pertinent engineering documents are included.

Certain documents related to the development of the project may need to be retained for legal purposes for a period of time after the contract completion date but may not be useful for future work. The Designer will create a Purge Folder inside the completed project's folder named "PurgeAfter_ *purge-date*," where *purge-date* is the day the folder can be deleted in YYYYMMDD format (i.e. PurgeAfter_20250704). The *purge-date* is typically 7 years after the date in which work on the contract is completed. The Designer will then move all the folders and files that should be deleted after the set date into the Purge Folder.

When only relevant files remain in the completed project folder, the Designer will send a request to the ProjectWise Administrator (PW Admin) by email that the project is ready to be archived.

The PW Admin will review the project folder and delete any obviously overlooked files and any empty folders. Any photos will be exported for the use of the Public Information Division and then the photo folder and remaining pictures will be deleted from the project folder. Once a month, the PW Admin will check for any archived folders that contain a Purge Folder with a purge-date that is equal to or prior to the current date and purge it from the archived folder.

File Retention Guidelines:

- Keep all CADD files except those that have been "voided" or are files from previous contracts.
- Keep all files involved in the production of the plan set.
- Keep all files related to the calculation of quantities and estimates (may only be needed in Purge folder).
- Keep all Specials, Permits, Geometric Approvals and Design Exception files (may only be needed in Purge folder).
- Keep all emails related to any decision making (may only be needed in Purge folder).
- Keep only final versions and remove any non-current files.
- Keep all photos for submission to the Public Information Division.

APPENDIX A ABBREVIATIONS

Appendix A – Abbreviations

3R	Resurfacing, Restoration and Rehabilitation
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ACRDE	Assistant Chief Roadway Design Engineer
ADA	Americans with Disabilities Act Accessibility Guidelines
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BRAT	Bid Review and Analysis Team
CADD	Computer Aided Design and Drafting
CCPW	Clark County Public Works
CCRFC	Clark County Regional Flood Control District
CCWRCD	Clark County Water Reclamation District
CMA	Corrugated Metal Arch Pipe
CMP	Corrugated Metal Pipe
CRDE	Chief Roadway Design Engineer
DDHV	Directional Design Hourly Volume
DHV	Design Hourly Volume
DTM	Digital Terrain Model
FAA	Federal Aviation Administration
FAST	Freeway and Arterial System Transportation
FHWA	Federal Highway Administration
Green Book	AASHTO A Policy on Geometric Design of Highways and Streets
GIS	Geographic Information System
GPS	Global Positioning System
HARN	High Accuracy Reference Network
iPD	Integrated Project Development (E-Bidding)
IRWIN	Integrated Right-of-Way Information Network
LOS	Level of Service
LPA	Local Public Agency
LS	Lump Sum
MASH	Manual for Assessing Safety Hardware
MPO	Metropolitan Planning Organization
MSE	Mechanically Stabilized Earth
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NDOT	Nevada Department of Transportation
NEPA	National Environmental Policy Act
NHP	Nevada Highway Patrol
NHS	National Highway System
NRS	Nevada Revised Statute
OMAP	Oval Metal Arch Pipe
PCCP	Portland Cement Concrete Paving
PDF	Portable Document Format (Adobe)
PDFS	Preliminary Design Field Study

APPENDIX A ABBREVIATIONS

PEC	Product Evaluation Committee
PRDE	Principal Roadway Design Engineer
PS&E	Plans, Specifications and Estimate
PSAMS	Project Scheduling and Management System
PROWAG	Public Rights-of-Way Accessibility Guidelines
PSR	Project Scoping Report
PUC	Public Utilities Commission
QA/QC	Quality Assurance and Quality Control
QPL	Qualified Products List
RCB	Reinforced Concrete Box
RCP	Reinforced Concrete Pipe
RFI	Request for Information
ROD	Record of Decision
RSA	Roadside Safety Audit
RTC	Regional Transportation Commission
RTIP	Regional Transportation Improvement Program
SHSP	Strategic Highway Safety Plan
SNWA	Sothern Nevada Water Authority
SPUI	Single Point Urban Interchange
STIP	State Transportation Improvement Program
STPW	Statewide Transportation Projects Workbook
SUE	Subsurface Underground Exploration
TERO	Tribal Employment Rights Ordinance
TMP	Transportation Management Plan
TRPA	Tahoe Regional Planning Agency
TTCP	Temporary Traffic Control Plan
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
USDOT	United States Department of Transportation
USDOT-FRA	United States Department of Transportation - Federal Railroad Administration
VA	Value Analysis

Appendix B – Intermediate Review Submittal Requirements and Checklist

PURPOSE

The primary purpose of this submittal is to provide guidance for review and approval of an essentially complete design before establishing the right-of-way requirements. In addition, the final design is determined prior to committing effort to calculating, compiling, detailing, tabulating, editing, and checking the final project content and information. The roadside design will be reviewed for proper implementation of traffic barriers and other roadside safety features. Perform cross-squad check. Significant changes generally are not allowed following this review.

ROAD DESIGN

- Cross sectional view details
- Typical as-constructed and proposed improvement sections
- Structural section design and material application data
- Roadway widths and width transitions
- Roadside designs (slopes, curbs, gutters, dikes, traffic barriers, etc.)
- Sound and retaining wall details and locations
- Pedestrian improvement details and locations
- Beginning and ending stationing limits of each typical, drop down, etc.
- Plan view details
- Title sheet
- Location sketch
- Horizontal alignments (stationing, curve data, bearings and distances) for all roadways
- Alignment control sheets (revised if necessary from preliminary design submittal).
- Limits of project, limits of construction and proposed control of access.
- Final road widths with curve data, bearings, distances and station/offsets for angle points, tapers and curves.
- Locations for curbs, gutters, dikes, driveways, sidewalk and curb ramps.
- Cut and fill slope limits or grading plans as appropriate.
- Lane arrangements (turn lanes, storage lengths, acceleration lanes, deceleration lanes, special use lanes, etc.).
Complete striping plans.
- Intersection and local street modification layouts.
- Existing R/W limits with dimensions to centerline.
- Geometrics (alignments, channeling islands, curb returns, turn lanes, etc.)
- Removal details
- Proposed roadside objects (traffic barriers, crash cushions, overhead sign structures, utility poles, bridge piers, etc.)
- Preliminary traffic striping diagrams
- Traffic control details
- Phasing and staging diagram
- Detours, shoe-flies and crossovers: plan, profile and structural sections.
- Typical situation layouts
- Site specific layouts
- Design vehicle analysis: turning radii, size and weight restrictions, etc.
- Construction access and staging areas
- Temporary signal system details
- Bicycle and pedestrian details
- List of special signs and permanent sign modification details
- Profile view details (profiles)
- Grades and curve data
- Existing ground
- Sight distance notes
- Ditch notes: slopes, curbs, widening, exceptions, etc.
- Super-elevation diagrams
- Locations of proposed drainage facilities
- Bridge structures

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

- Special details
- Completed drawings and notes for all non-standard construction details
- Elevation control plans
- Grading plans
- Draft special provisions and notes to specifications
- A list of all non-standard use of bid items (noted in the estimate)
- Tabulation
- A substantially complete structure list
- Probable items
- Preliminary construction notes
- Preliminary quantities
- Preliminary utility owner and payment information
- Base and surface summaries
- Preliminary earthwork summary
- Core data summary
- Preliminary traffic control device matrix
- Utility adjustments and payment information
- Supporting documents
- Criteria and constraint summary
- Design notes to specifications

SUBMITTAL COMPONENTS

PLANS

A complete set of finished design plans including:

- Title sheets
- Location sketch
- Summary Sheets
- Roadway sheets
- Bridge sheets
- Drainage sheets
- Traffic sheets
- Landscaping sheets (If applicable)
- Structure List

SPECIFICATIONS

- Complete compilation of notes to specifications
- Summary of contractor limitations and public traffic accommodations

ESTIMATE

- Complete set of finished plans, specifications and estimate; price checked
- Make electronic files available
- Cross sections (if requested)

R/W

- Initiate Line extension coordination
- Initiate R/W setting and documentation

INTERMEDIATE REVIEW CHECKLIST

Project ID Number: _____
Project Number: _____
Project Description: _____
Spec. Writer: _____
Checker: _____
Date Started: _____
Date Finished: _____

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

The following check list should be used on every project, initial everything checked, put N/A in box if not applicable to the project, or put I/T in box if insufficient time to check (note the reason in final report). It is the responsibility of the Senior Designer to determine whether or not a submittal meets the requirements of the Intermediate Submittal. Specifications (Checking) will verify the quality. Place a completed electronic copy of this checklist in the ProjectWise environment as part of the Intermediate Submittal.

Shown in Plans (Y or N)	Checked by	Check the following at the Intermediate (60%) Submittal	
		General	
		Maintenance Review	Meet in the field with Maintenance personnel to go over/explain how the plans will affect Maintenance.
		Template Meeting	Meet with RE to ensure Design and Construction are on the same page regarding how original ground is modeled.
		Environmental Review (as applicable)	Meet with Chief Environmental Engineer to ensure Environmental understands project limits, cut/fill limits, pipe extensions, etc. Attach to this submittal the marked-up set of plans used during this meeting. Ensure the date these plans were submitted to Env. is recorded in PSAMS.
		Water Quality (erosion control) and/or re-vegetation	Design will determine/depict the impacts; Stormwater and Env. will determine how to mitigate the impacts.
		TERO	Senior Designer responsible for coordination; Specifications ensure language is in Special Provisions.
		Railroad involvement	Senior Designer coordinate with Safety (RR Coordinator)
		SUE (utilities)	Senior Designer coordinate with R/W utilities. Include line extension agreement coordination. Ensure information is recorded in PSAMS.
		ADA involvement	Coordinate with Standards and Manuals. When mapping requested, also request the hard survey information. Record the date requested and received in PSAMS.
		Change in Control of Access (as applicable)	Senior Designer draft the memo and have it reviewed.
		Bike Checklist	
		Geometrics	
		Preliminary Geometric Approval and Design Exception (as applicable)	Memo prepared by Senior Designer, technical information checked by PRDE
		Horizontal alignment (Checked by PRDE)	See NDOT's Design Guidel and Green book
		Conformance to adopted criteria	Green Book, Bicycle Design Guide, Design Guide, Access Management Guide, and Roadside Design Guide

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Based on appropriate functional classification	Interstate, Arterial, Collector, bike path, etc.
		Based on established design speed and traffic data	
		Incorporate control from geodesy or approved existing bearing source	
		Coordinate and bearing equations resolved	
		Future build-out considerations	Lanes under bridges, sound wall locations, etc.
		Plan alignments match location control	
		Vertical alignment (Checked by PRDE)	See NDOT's Design Guide and Green book
		Conformance to adopted criteria	Green Book, Bicycle Design Guide, Design Guide, Access Management Guide, and Roadside Design Guide
		Based on appropriate functional classification	Interstate, Arterial, Collector, bike path, etc.
		Based on appropriate design speed and traffic data	Design speed is usually developed with traffic engineering
		Coordination with horizontal alignment	
		Run grades and check elevations	Attach calculations for areas checked
		Check K values	
		Check algebraic difference – is a vertical curve required	
		Intersection transitions	
		Spot check grade at critical locations (particularly at intersections)	
		Spot check grade at the begin and end of each sheet	
		Proper vertical clearances at bridges	For new construction consider lighting and signal heads under bridge.
		Correct transitions from built-up overlays	Usually at change from bituminous to concrete surface.
		Drainage considerations at vertical sag	
		Sight distance (Checked by PRDE)	See NDOT's Plan Preparation Guide and Green book

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Conformance to adopted criteria	Green Book, Bicycle Design Guide, Design Guide, Access Management Guide, and Roadside Design Guide
		Based on appropriate design speed	
		Considerations on horizontal curvature	Middle Ordinate
		Considerations on vertical curvature	Backslopes, traffic barriers, trees, etc.
		<ul style="list-style-type: none"> • Passing (Sag ~ Crest) 	Considered only on 2-lane roads
		<ul style="list-style-type: none"> • Stopping (Sag ~ Crest) 	
		<ul style="list-style-type: none"> • Headlight (Sag ~ Crest) 	
		Intersection sight triangle	
		Decision making sight distance	Usually at intersections or approaches
		Pedestrians	
		Super-elevations (Checked by PRDE)	See NDOT's Plan Preparation Guide and Green book
		Conformance to adopted criteria	Green Book, Design Guide, Access Management Guide, and Roadside Design Guide
		Axis of Rotation (consideration for future lanes)(different axis with or without median)	
		Future travel lanes considered in developing super elevations	
		Spot check gore details	
		Roadway	
		Structural Section	
		Intersection details	Transitions usually needed if change in profile
		Correct broken back cross slopes	Eliminate barn roof effect
		Check for drainage issues at bridge structures	From past overlays; should not transition directly into bridge)
		Correct built-up overlays by re-establishing profile	Usually at cross streets and gutter sections
		Transition milling depth around radius returns	Only in curb and gutter

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Earthwork (Check Quantities Required for Project)	
		Shrink and swell factors	Obtained from materials
		Do ditch notes make sense, appropriate transitions, etc.	
		Ditches and channels	Is excavation suitable for embankment
		Drainage basins	Is excavation suitable for embankment
		Mailbox turnouts	Quantities on structure list
		Sign islands	
		Grading for roadside safety hardware	Quantities on structure list
		Contour fill	Over cross pipes in the clear zone; quantities on structure list
		Median crossovers	Discuss during TC/TMP meeting(s).
		Detours	Construct and remove
		Approaches	Quantities on structure list
		Auxiliary lanes	Passing, truck climbing, turning, etc.
		Parking areas	Scenic overlooks, rest areas, etc.
		Chain up areas	
		Select borrow at bridge structures	See standard plans
		Mandatory waste material	As identified by materials, shown on profile
		Balance points	
		Traffic	
		Operational Design	
		Check design vehicle turning movements	
		Existing median openings	Hi-Tee configurations, storage lengths, closures, etc.

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Conflicting left turn movements	
		Proper island offsets and nose designs	
		Minimum design widths	
		Intersection sight triangle/at-grade intersection sight distance	Possible elimination of roadside parking near intersections
		Critical length of grade	Based on power to weight ratio of design vehicle
		Work Zone Traffic Control	
		Do median islands or traffic barriers need to be removed	For either traffic operations or contractor operations
		Detours	Designed to permanent road criteria; approval of local street owner
		Constructability and staging, has TMP been initiated	Should be discussed at T. C. Meeting
		Flagger hours, R/R flagger hours, and uniform T/C officer	Are they required for this project
		Motor vehicle, bicycle and pedestrian operations	Can all modes safely and physically negotiate the work zone?
		TC maintenance	Separate item or inclusive
		Traffic control supervisor	Separate item or inclusive

Shown in Plans (Y or N)	Checked by	Contract Preparation	
		Contract sheets (Refer to the Design Guide)	
		Title sheet	
		Index of sheets	
		Verify use of current edition	
		Checked by roadway systems and incorporated changes	
		R/R milepost/DOT milepost included	
		Equation for complete route alignment as revised, alignment bar	

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Incorporate traffic information in design designation (When required)
		Design criteria information
		Designer and coordinator names and phone number (when location sketch is not used)
		Begin and end project and construction limits, history box
		Location sketch
		List side streets
		Incorporate material deposits (on or off project limits)(Materials if new/right of way if existing)
		Bridge structures and numbers (over 10' foot span)(need to assign bridge number if none exists)
		Exception areas
		Detour alignments
		Material Site location
		Equations are shown and match plans
		Section net; township and range, and county lines
		Railroad crossings
		Designer and coordinator names and phone number
		Cumulative milepost and milepost summary (only if core data is included and this information is included with the core data)
		Begin/end project
		Typical cross section views
		Incorporate approved structural roadbed design; match latest version of structural memo
		Safety edge included
		Make sure all roadway sections are covered by typicals
		Summary sheets match typical sections (widths, depths, and stations)

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Legends match typical sections
		Summaries
		Breakout by project
		Breakouts for county line or third party
		Station continuity
		Base and surface (in order of decreasing depth)
		Shoulder material (coldmilling summary)
		Incorporated theoretical material application from Materials
		Guidepost, object markers, raised pavement markings (non-reflective – reflective)
		Earthwork summary (Earthwork notes (sources such as roadway excavation, borrow embankment) and balance quantities)
		Standard general notes
		Incorporated core data sheets from Materials
		Miscellaneous coldmilling and associated plantmix summary
		Slope allowance accounted for
		Moisture content for aggregate base (8%)
		Estimate of asphalt and mineral filler for wet ton plantmix items
		Road design plan views
		Incorporated mapping from Geodesy
		Incorporated permitted features (approaches, developments, utilities)
		Show covers/valves to be adjusted
		Curve data matches alignment, bearings and distances add up
		Bearing equations / station equations

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Reference notes to special detail sheets
		Sheets requiring elevation control are shown
		Bearing source if no control sheet is provided (do not reference old contract number)
		Show location of loops, pull boxes, and weather sensors (new/existing)
		Show existing /new pipes (show size, length, skew angle and headwall type)
		Cut and fill slopes shown
		Legends are correct
		Proper section net and labels
		Right of way dimensioned and labeled (if no R/W sheets)
		Incorporate verified right of way
		Permission to construct dimensioned and labeled (if no R/W sheets)
		Is work within right of way (permanent signs, pipes, slopes, etc.)
		Construction notes match structure list
		Begin and end limits match title sheet, location sketch, etc. (begin and end construction is shown if different from project limits)
		Avoidance areas shown
		Show fenced areas, control of access, etc.
		Show Limits of paving and plantmix miscellaneous areas
		Ditches, dikes, channels, and retention ponds are shown and labeled
		3rd party work identified on plans
		Sound walls, retaining walls, concrete barrier rail, etc.
		Large sign support structures and signal bridges
		Roadway profile views

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Ditch notes
		Show ditch grades if different from mainline profile grade
		Super-elevation annotation (axis of rotation, transitions, edge of oil)
		Line designation shown
		Show limits of bridge, pipes, cross streets
		Show limits of select borrow at bridge structures
		Bridge profile including footings, piers, abutments and superstructure
		Structure numbers shown
		Profile for ramps are shown or referenced; indicate mainline control of ramp grade and cross slope
		Spot check grade at beginning and end of each sheet
		Check main line profile grade against intersections and cross roads (does it require grading plan)
		Show vertical curve location and information, vertical point of intersection, and tangents
		Temporary detours
		Additional plan and profile views
		Frontage roads, detours, interchanges and grade separations
		Removal of detour addressed in documents
		Provisions for temporary drainages
		Special details
		Sections for miscellaneous work (such as islands, patching, etc)
		Reference to material types, properties, etc.
		Sufficient detail for construction
		Site preparation and removals

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Proper legends
		Removal depths and limits properly shown
		Project limits match plans
		Identify removals if by third party
		Quantities are coordinated and checked for overlap
		Quantities are transferred to estimate
		Landscape details
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Drainage details
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Road grading details
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Existing topography "clipped" from interior of proposed improvements
		Right-of-way
		Checked by right-of-way engineering if incorporated into road design plan view sheets
		Accounted for in the index of sheets if separate section
		Permanent pavement markings
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Work zone traffic control
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Signals, lighting and ITS
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

		Permanent signing
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		New signs have borrow or aggregate base for sign islands
		Structural design
		Bridge details
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Retaining and sound walls
		Sheets are accounted for and match index of sheets (check quantities if available and check if correct bid items are being used)
		Boring logs
		Sheets are accounted for and are in the index of sheets
		Structure list
		All items accounted for in engineers estimate and summary sheets (no unused bid items left in structure list)
		Break out by project
		Construction notes are separated by type of work if appropriate (adjust covers)
		Reference to special details or plan sheets
		Conforms to standard construction note format
		3rd party work identified by breakout (usually for utility adjustments)
		Breakout for separate county's

		Special Provisions
		Inform the specifications writer of any special work units or details reflected in the plans that may need to be addressed in the special provisions
		Engineer's Estimate

APPENDIX B INTERMEDIATE REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

	Is one provided, has it been checked, are the prices checked, are the items correct and accounted for, does it match the Special Provisions
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APPENDIX C QA/QC REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

Appendix C – QA/QC Submittal Requirements and Checklist

Purpose

To facilitate the quality assurance procedures, the drafting standards review, and the design standards compliance audit; begin development of final specifications.

Submittal components

Plans

A complete set of finished design plans including:

- Title sheets
- Location sketch
- Typical Cross Sections
- Summary Sheets
- Roadway sheets
- Bridge sheets
- Drainage sheets
- Traffic sheets
- Landscaping sheets
- Structure List

Project documentation

- Criteria and constraint summary
- ProjectWise (Project workbooks)

Specifications

- Complete compilation of notes to specifications
- Summary of contractor limitations and public traffic accommodations

Estimate

- iPD estimate price checked

R/W

- Ensure Line extension agreements and R/W setting documents are complete (as applicable)

QA/QC Review Checklist

Project ID Number: _____

Project Number: _____

Project Description: _____

Spec. Writer: _____

Checker: _____

Date Started: _____

Date Finished: _____

The following check list should be used on every project, initial everything checked, put N/A in box if not applicable to the project, or put I/T in box if insufficient time to check (note the reason in final report). It is the responsibility of the Senior Designer to determine whether or not a submittal meets the requirements of the

APPENDIX C QA/QC REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

QA/QC Submittal. Specifications (Checking) will verify the quality. Include a completed electronic copy of this document to Specifications with the QA/QC submittal.

Checked By	Check the following at the 100% Submittal
	Geometrics
	Ensure all changes from Intermediate (60%) Submittal are correctly updated in the plans.
	Earthwork
	Check all Quantities are correctly updated in Plans and Estimate from the Intermediate (60%) Submittal Review.
	Traffic
	Ensure all changes from Intermediate (60%) Submittal are correctly reflected in the plans.
	Work zone traffic control
	Check all Quantities are correctly updated in Plans and Estimate (especially 108.04 – limitations of operation)

Checked By	Contract Preparation
	Contract sheets Refer to the Design Guide
	Title sheet
	FHWA signature (for projects of divisional interest – PODI) (FHWA area manager will coordinate with NDOT project manager, who will then let us know if FHWA will sign the Title Sheet)
	Design Criteria
	Begin and end construction and project
	All changes from Intermediate Review are incorporated
	Designer and coordinator names and phone number (when location sketch is not used)
	Location sketch
	List side streets
	Incorporate material deposits (on or off project limits) (Materials if new/right of way if existing)

APPENDIX C QA/QC REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

	Bridge structures and numbers (over 20' foot span) (Bridge needs to assign a structure number if none exists)
	Exception areas
	Detour alignments
	Material site location
	Equations are shown and match plans
	Section net; township and range, and county lines
	Railroad crossings
	Designer and coordinator names and phone number
	Cumulative milepost and milepost summary (only in conjunction with core data)
	Begin/end construction
	Designer and coordinator names and phone number
	Typical cross section views
	Incorporate approved structural roadbed design; match latest version of structural memo
	Station continuity (list exceptions, bridges, etc.)
	Indicate areas of over excavation with note
	Summary sheets match Typical Sections (widths, depths, and stations (stations do not appear on Typical Sections))
	Legends match typical sections
	Summaries (Check all Quantities and make sure they match the Estimate)
	Base and surface (in order of decreasing depth)
	Shoulder material (coldmilling summary)
	Traffic control device summary
	Guidepost, object markers, raised pavement markings (non-reflective – reflective)

APPENDIX C QA/QC REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

	Earthwork summary
	Standard general notes
	Incorporated core data sheets from Materials
	Miscellaneous coldmilling summary
	Plantmix overrun summary
	Moisture content for aggregate base (8%)
	Estimate of asphalt and mineral filler for wet ton plantmix items
	Road design plan views
	All notes match Structure List Notes
	Special details
	Sections for miscellaneous work (such as islands, patching, etc)
	Sufficient detail for construction
	Check all Quantities are correctly reflected in Plans and Estimate
	Site preparation and removals
	Check all Quantities are correctly reflected in Plans and Estimate
	Landscape details
	Sheets are accounted for in the index of sheets
	Check all Quantities are correctly reflected in Plans and Estimate
	Drainage details
	Quantities are coordinated and checked for overlap
	Check all Quantities are correctly reflected in Plans and Estimate
	Permanent pavement markings

APPENDIX C QA/QC REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

	Check all Quantities are correctly reflected in Plans and Estimate
	Work zone traffic control
	Phase/stage diagram
	Traffic control device matrix: arrow boards, barricades, drums, cones, flaggers, temp impact attenuators, etc.
	Incorporate items from traffic control meeting notes, including final TMP meeting.
	Transportation Management Plan: Coordinate with: [a] Traffic for MUTCD and authorship, [b] Construction for constructability, and [c] Districts for their input
	Do existing pavement markings need to be removed beyond project limits to accommodate traffic control
	Work units(s) to remove detour
	Pedestrian accommodations
	Bicycle accommodations
	Dimensions: work zone, buffer, shifts, tapers,
	Legends
	Show direction of traffic
	Device type and spacing
	Temporary striping sheets if major changes to existing striping
	Overhead power lines or other utilities in conflict with construction
	Check turning movements; detour vehicles as necessary
	Proper taper ratio on traffic barriers
	Truck mounted impact attenuators versus temporary impact attenuators
	Signals, lighting and ITS
	Sheets are accounted for in the index of sheets and all quantities checked
	Permanent signing

APPENDIX C QA/QC REVIEW SUBMITTAL REQUIREMENTS AND CHECKLIST

	New signs have borrow or aggregate base for sign islands
	Structural design
	Bridge details
	Sheets are accounted for and match index of sheets
	Quantities are coordinated and checked for overlap
	Quantities are transferred to estimate
	Retaining and sound walls
	Sheets are accounted for and match index of sheets
	Quantities are coordinated and checked for overlap
	Quantities are transferred to estimate
	Structure list
	All items accounted for in engineers estimate and summary sheets (no unused bid items left in structure list)
	Sub totals add up (no longer need Use Totals)
	Break out by project
	Construction notes are separated by type of work if appropriate (Guardrail, adjust covers, fence, pipes)
	Reference to special details or plan sheets
	Conforms to standard construction note format
	3rd party work identified by breakout (usually for utility adjustments)
	Breakout for separate counties (in the estimate)

	Special Provisions
	Inform the specifications writer of any special work units or details reflected in the plans that may need to be addressed in the special provisions

	Final Check after Specs Review
	Check to make sure all comments from the PS&E Review are addressed and corrected in the plans.

PS&E Review

Purpose

This provides the opportunity for the department to review the plans, Specifications, and estimate as a complete package prior to advertising. The Construction Division may elect to perform a bidder's perspective review on this submittal.

Submittal components

- Complete set of finished plans, specifications and estimate

Final Design Submittal

Plans

Complete set of contract document originals necessary to construct the roadway, drainage, traffic, landscaping, and bridge improvements identified for each project prepared in accordance with the Nevada Revised Statutes pertaining to Professional Engineering documents.

- Make electronic files available
- Cross sections

Appendix D – Milestone Timeline

