

NEVADA DEPARTMENT OF TRANSPORTATION
Terms and Conditions Relating to the Drainage Aspects
of Right-of-Way Occupancy Permits

1. Introduction

The following guidelines have been developed to provide drainage guidelines relating to Department Right-of-Way Occupancy Permits. As such, technical information is not provided and only references are made to acceptable design manuals and publications. It is expected that the PERMITTEE and/or PERMITTEE's Engineer will be knowledgeable in the use of the referenced items. Additional drainage design guidance can be found in the Department's Drainage Manual. The Drainage Manual shall take precedence in the event of conflicting information.

These guidelines are intended to be followed to the fullest extent possible. Deviations from these guidelines may in some cases be unavoidable or otherwise justifiable. Deviations will only be acceptable if adequate justification can be demonstrated. Any deviation from these guidelines will require prior written approval of the NDOT Chief Hydraulic Engineer.

2. General Policy

It is the responsibility of the PERMITTEE to comply with the following Department general drainage policy:

- ! Existing natural and manmade drainage patterns within Department right-of-way shall be perpetuated to the extent possible.
- ! Flows up to the 100-year event must not be diverted into or obstructed from leaving Department right-of-way. This includes flows generated outside and within Department right-of-way.
- ! Department right-of-way must be protected from potential storm water damage due to the encroachment/development.
- ! The encroachment/development shall not increase the rate of flows entering Department right-of-way.
- ! Construction of hydraulic facilities within Department right-of-way is not allowed unless direct benefit to Department and the general public is demonstrated by the PERMITTEE.
- ! The encroachment/development drainage design shall have no adverse hydraulic impact to Department right-of-way or to the traveling public.
- ! The drainage design and runoff calculations for any facilities located within Department right-of-way shall meet current Department drainage standards, criteria, and guidelines. With adequate written justification, it may be acceptable to follow locally developed and adapted drainage design criteria in lieu of Department criteria. Local community criteria may only be used for NDOT roadways classified as AOther Principal Arterial@or lower and with the approval of the Department Chief Hydraulic Engineer.
- ! Construction of new facilities or modification of existing drainage structures within Department right-of-way shall be in compliance with current Department Standard Plans and Specifications.
- ! Proposed drainage facilities shall not be in conflict with applicable FEMA regulations or with existing and proposed local drainage master plan facilities.
- ! Existing drainage facilities shall not be decreased in size.

- ! Utility service pipes shall not be placed inside culverts used as drainage structures.
- ! Design of new facilities shall consider potential impacts of future development of the contributing basin.

The Department reserves the right to modify or revise drainage policy and encroachment permit application terms and conditions as necessary.

3. Hydrologic and Hydraulic Design Requirements

The following drainage design criteria are intended to address the issues most commonly encountered in Department right-of-way encroachment permit applications. The Department Hydraulics Section should be contacted early in the design process regarding any questions relating to drainage design issues affecting Department right-of-way.

Hydrologic calculations shall be performed using HEC-1, SCS (NRCS) TR-55, or the Rational Method procedures, as appropriate. Use of the Rational Method shall be limited to drainage basin areas no larger than 80 hectares (200 acres).

Peak flow rates to Department drainage facilities shall be determined for pre- and post-development conditions. The encroachment/development shall not increase flows to Department facilities up to the design return frequency. Onsite detention is recommended. The design storm return frequency used for analysis of existing facilities and for design of new facilities shall be in accordance with the following:

Cross Drainage Facilities (Culverts, channels, etc.)

<u>Roadway Classification</u> ¹	<u>Minimum Design Return Frequency (years)</u> ²
Interstate Highways ³	50
Principal Arterials & Other Freeways and Expressways ³	50
Other Principal Arterial	25
Minor Arterial	25
Rural Major Collector	25
Urban or Rural Minor Collector	10
Frontage Roads (if not classified)	10

¹ Please contact the Department District Permit Coordinator for the latest classification of roadways affected by the proposed encroachment.

² If a roadway is known to be designed for a higher return frequency than indicated in the above table, the higher return frequency shall be used for design.

³ Including ramps.

In addition to the above design storm, flow conditions for cross drainage facilities shall be analyzed for the 100-Year event. It must be demonstrated that the encroachment/development will not substantially aggravate the 100-year flow conditions within Department right-of-way, or mitigation must be provided.

Roadway Surface Drainage Facilities (curb and gutter sections, drop inlets, storm drains, etc.)

<u>Roadway Classification</u> ¹	<u>Min. Design Return Frequency (years)</u>	<u>Allowable Spread into adjacent travel lane</u>
Interstate Highways ²	25	0
Principal Arterials & Other Freeways and Expressways ²	25	0
Other Principal Arterial	25	2 lane
Minor Arterial	10	2 lane
Rural Major Collector	10	2 lane
Urban or Rural Minor Collector	10	2 lane
Frontage Roads (if not classified)	10	2 lane

¹ Please contact the Department District Permit Coordinator for the latest classification of roadways affected by the proposed encroachment.

² Including ramps

It is not necessary to include a clogging factor for inlets on grades, unless debris is known to be a problem. In sag locations, a 50% clogging factor shall be applied by providing double the required inlet capacity (assume 50% of the inlet is clogged).

For sag locations with no available overflow area, i.e. the storm drain is the only system available to drain the sag, design the sag inlet as described above, and provide two additional flanker inlets. Each flanker inlet shall have the same effective perimeter as required for the sag inlet prior to application of the 50% clogging factor. The flanker inlets should be placed at an elevation of 0.37 times the allowable ponding depth (as determined by the allowable spread) above the sag inlet. Flow interception capacities of the flanker inlets will not be considered in design of the sag inlet. This design approach will provide the required inlet capacity at the allowable ponding depth if the sag inlet should become fully clogged and assume that the sag and flanker inlets operate as weirs. The same general design philosophy shall be used for the rare cases in which the sag inlet operates as an orifice at the allowable ponding depth. Orifice situations shall be designed on a case-by-case basis.

If the hydraulic conditions at an existing Department drainage facility will be altered, or if a new drainage facility is proposed by the encroachment/development, analyses for the pre- and post-development flow conditions shall be included in the drainage report. It must be demonstrated that any altered flow conditions will in no way be a detriment to the Department or the traveling public. Any adverse effects to the existing drainage conditions resulting from the encroachment/development must be mitigated to the satisfaction of the Department.

Pre- and post-development condition analyses for drainage facilities within Department right-of-way shall be included in the drainage report. These analyses shall address, but not necessarily be limited to, the following issues:

Culverts

- ! Headwater conditions (depth, extent)
- ! Roadway overtopping (amount, depth, extent)
- ! Outlet conditions (tailwater, velocity, erosion protection)
- ! Rating curve

Channels/Dikes

- ! Flow velocity

- ! Flow depth
- ! Erosion protection

Roadway Surface Drainage Facilities

- ! Spread limits
- ! Inlet capacities
- ! Hydraulic grade line

4. Drainage Report

Drainage Information Form (see attached) shall be submitted with all Department right-of-way encroachment permit applications. This form must be signed and sealed by a Licensed Civil Engineer. This form serves as a conceptual drainage study and will guide the PERMITTEE to determine if a comprehensive drainage study is needed for the encroachment.

A report including stamped final plans and drainage calculations shall be submitted for any development or construction that impacts flows to or within Department right-of-way.

The drainage report shall include the following:

- 1) Department Drainage Information Form.
- 2) A general statement explaining the nature of the encroachment, its impacts to Department right-of-way, and the reason for the proposed encroachment.
- 3) Analysis of pre- and post-development drainage conditions within the development and Department right-of-way supported by any necessary calculations and figures.
- 4) Hydrologic analysis for the drainage basin(s) that impacts the proposed development/encroachment and Department right-of-way. Include a table comparing pre- and post-development flow conditions in Department right-of-way.
- 5) Hydraulic analysis for all hydraulic appurtenances within the development that will impact Department right-of-way.
- 6) Hydraulic analysis for all existing hydraulic appurtenances within Department right-of-way impacted by the development/encroachment. Include a table comparing the performance of these facilities for pre- and post-development flow conditions.
- 7) Impacts of development/encroachment on properties upstream and downstream of Department right-of-way.
- 8) Impacts of development/encroachment on existing and planned regional drainage facilities (if any).
- 9) Design procedures and criteria.
- 10) Existing Department contract plan sheet(s) highlighted showing location of encroachment with Department right-of-way clearly identified.
- 11) Final plans including grading (existing and proposed topography extending a minimum 30 meters (100 feet) past the project limits) and drainage plans and special details for any nonstandard facilities.

The submitted report shall include assumptions, discussions, calculations, plans, special details, and other pertinent information leading to the design of proposed channels, culverts, detention basins, bridges, and other drainage structures within or affecting Department right-of-way. The consultant is responsible for verification and acceptance of all background information, design calculations, and conclusions included in the drainage report.

The report must be signed and sealed by a Licensed Engineer.

5. Acceptable Design References

FHWA Publications:

- 1) Highway Hydrology, HDS #2
- 2) Introduction to Highway Hydraulics, HDS #4
- 3) Hydraulic Design of Highway Culverts, HDS #5
- 4) Design of Riprap Revetment, HEC #11
- 5) Drainage of Highway Pavements, HEC #12
- 6) Hydraulic Design Energy Dissipators for Culverts & Channels, HEC #14
- 7) Design of Roadside Channels with Flexible Linings, HEC #15
- 8) Evaluating Scour at Bridges, HEC #18
- 9) Stream Stability at Highway Structures, HEC #20
- 10) Design of Bridge Deck Drainage, HEC #21
- 11) Urban Drainage Design Manual, HEC #22
- 12) Bridge Scour and Stream Instability Countermeasures, HEC #23

AASHTO Publications:

- 1) Highway Drainage Guidelines
- 2) A Policy on Geometric Design of Highways and Streets
- 3) Model Drainage Manual
- 4) Standard Specifications for Highway Bridges

DEPARTMENT Publications:

- 1) Standard Specifications for Road and Bridge Construction
- 2) Standard Plans for Road and Bridge Construction
- 3) Road Design Division Design Manual
- 4) Bridge Design Manual
- 5) Drainage Manual

Computer Programs:

- 1) COE Flood Hydrograph Package, HEC-1
- 2) COE Water Surface Profiles, HEC-2, or HEC-RAS
- 3) Water Surface Profile Computations, WSPRO
- 4) SCS (NRCS) Urban Hydrology for Small Watersheds, TR-55
- 5) Integrated Drainage Design Computer System, HYDRAIN
- 6) Other computer applied programs of equal or greater sophistication as approved by the Department Hydraulic Engineer.

Other appropriate references may be accepted with prior approval of the Department Hydraulic Engineer. The above listed references may be revised, updated, or superseded by future references. In this event, the most current publication shall be used.