

Recommended Technical Standards for Existing Roads

UNH Technology Transfer Center

Purposes and Acknowledgements

These model standards provide New Hampshire cities and towns with a set of recommendations for inclusion in their policies governing existing roads. Nearly all are technical, quantitative standards that will ensure long lasting roads. That is, if a city or town repairs roads constructed according to these standards, it will provide its residents with safe, properly designed and constructed roads for a long time.

Similar to the Recommended Technical Standards for New Roads, municipal officials should regard these as minimum technical standards for existing roads in their city/town. They should exceed them whenever considerations of safety or cost effectiveness warrant. Also similar to the new road standards; specific situations, such as topography and other physical factors, might require a one-time exception to these standards. Another reason for some exceptions is if the situation meets recommendations of AASHTO's *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT<400)*. It is derived from a formal risk assessment of such roads, provides design criteria for such roads, and describes how and when to make exceptions to those criteria. Municipal officials should approve an exception only after considering all factors, and based on an engineering study where appropriate.

Two attachments are included in these model standards. Table I, "Roadway Geometric Design Standards," provides minimum standards by classification as defined in section 2 below. Figure 1 and its accompanying table, entitled "Geometric Cross Section Design Elements," provides minimum standards for various ranges of average daily traffic (ADT). Both should be included in documents that make these standards official policy.

In the text below, "roads" means Class IV and V roads, streets, and highways. A separate "Definitions" handout suggests usage and terms definitions for subdivision regulations. Consistent with those definitions, "Board" is used below to mean the city/town Planning Board. "Road Manager" refers to the city/town official -- for example, public works director, road agent, highway superintendent -- specifically responsible for maintenance and repair of city/town roads. "Plan" refers to the Road Repair Plan described in standard No. 2 below.

Numbers in parentheses refer to sources in the **References** section, which should also be included in policy documents. "*State Specification*" refers to the NHDOT's "*Standard Specifications for Road and Bridge Construction*" (5). "*State Plans*" refers to NHDOT's "*Standard Plans for Road and Bridge Construction*" (6).

Text of Recommended Technical Standards

1. **REPAIR TREATMENTS.** The Road Manager shall determine repair treatments based on generally accepted criteria. These criteria require identification of specific conditions, which should be determined for all network roads, and appropriate repairs selected for each road segment. Treatment applications will conform to the minimum requirements described below and to applicable *State Specifications*.

2. **ROAD REPAIR PLAN.** All repair projects shall be included in an approved multiyear Road Repair Plan. Budgets shall be prepared based on a formally proposed Road Repair Plan, with cost estimates based on completed projects meeting the standards described below. The Plan shall be based on a priority system in which repair strategies and categories have the following relative priorities:

Relative <u>Priority</u>	Repair <u>Strategy</u>	Treatment <u>Category</u>
Highest	Routine	Crack sealing and patching
	Preventive	Surface coat -- thin overlays, sand seals, and chip seals
	Rehabilitation	Thick overlays, cold planning and overlay
Lowest	Reconstruction	Reclaiming and reconstruction

The Road Manager shall determine and document in the Plan which work items will be performed by contract, city/town employees, and a combination of contract and city/town employees. The approved budget shall also serve as approval for the final Road Repair Plan. The governing body shall define the process and authorities for Plan preparation, review, and approval.

3. **PERMITS.** For work accomplished by city/town employees, the Road Manager shall ensure compliance with all federal and state construction and environmental permits. In addition, he will also include in all contracts the requirement that contractors and subcontractors comply with all federal and state construction and environmental permits.

4. **STREET LAYOUT.**

- **General.** All repaired roads shall have adequate provision for a safe and suitable access to a Class V or better road. Where the Road Manager determines an existing access street to be substandard, he/she shall ensure that repair and/or modification of said street is included in the Road Repair Plan. Repaired streets shall be of suitable location, width, grade, and improvement to accommodate prospective traffic and afford satisfactory access to police, fire fighting, emergency equipment, snow removal, sanitation, and road maintenance equipment. Their arrangement and character shall conform to the Master Plan, and any and all other City/Town regulations, and shall compose a safe and convenient system in relation to other existing and planned streets, to topographic conditions, and to the proposed uses of land to be served by the street. Existing stone walls shall be retained where possible or relocated and restored as required by the Board.
- **Arrangement.** Streets layout shall be modified to intersect at right angles as nearly as possible. No street shall intersect another at less than 60 degrees. Streets shall be continuous and in alignment with existing streets as much as possible. The city/town shall

provide for a circular terminus at the end of all roads where thru streets are not provided in the near future.

- **Classification.**

- a. Arterial Streets are intended to carry traffic from collector streets to the system of highways; that is, to move through traffic to and from major attracters.
 - b. Collector Streets carry traffic from local streets to the major system of arterial streets and highways. They are intended to collect and distribute traffic in minor traffic generating areas.
 - c. Local Streets provide primarily for access to abutting properties, They are designed and intended to carry through traffic.
 - d. Cul-de-sacs and Loop Streets have only one point of access from an approved street that has multiple points of access.
 - e. Private Streets are on property held under private ownership and are not maintained by the Town.
5. **DEAD-END STREETS.** Streets designed to be permanent, dead-end streets shall be shorter than 1,000 feet, and shall be provided with a turn around having an inside road surface diameter of at least 100 feet.
 6. **STREET NAMES.** All streets shall be named to comply with the provisions of the “Enhanced 911 System” (RSA 106-H:2 and RSA 106-H:10), and shall be subject to the approval of the Board.
 7. **TRAFFIC AND STREET SIGNS.** The location and type of sign to be installed shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).
 8. **STREET LIGHT.** Street lights shall be provided if the Road Manager determines they are necessary.
 9. **GUARDRAIL.** Guardrail shall be used in locations where the New Hampshire Department of Transportation’s typical warrant for guardrail is met and/or as required by the Road Manager. Guardrail shall be metal beam on wood posts, meeting *State Specification* 606 and, as applicable, *State Plans* GR-1 through GR-8. All guardrail installation must end safely using a MELT-type terminal unit. FLEAT or ELT-type units may be permitted by the Road Department.
 10. **RIGHT-OF-WAY.** Nearly all existing local roads have an established right of way width. In some instances, the right of way width might preclude travel way and/or shoulder widths. In such instances the Road Manager must ensure that motorists are informed of potentially unsafe situations with proper signage. In addition, if right of way width is insufficient to construct ditches as described in Figure 1. The Road Manager shall provide underdrains and/or other means to enable water to flow away from the road.
 11. **HIGHWAY RIGHT-OF-WAY BOUNDS.** Highway bounds, of a type approved by the Board, shall be installed at each point of curvature (PC), point of tangent (PT), and changes in property at all intersection of streets, at all points of change in direction and at any other points the Board may deem necessary to designate the street lines.

- **Type**
 - a. Stone or Concrete Bounds shall be of concrete or stone, not less than thirty-six (36) inches in length, not less than four (4) inches square or five (5) inches in diameter, and marked on top with a cross, brass plug, iron rod, or other durable material securely imbedded.
 - b. Iron Pipes shall be at least thirty-six (36) inches long and seven-eighths (7/8) inch in diameter or square.
- **Location**
 - a. Bound Locations. The external boundaries, rights-of-way lines, block corners, etc. of a subdivision shall be monumented on the field by bounds. These bounds shall be placed not more than 1,400 feet apart in any straight line and at all corners, at each end of all curves, at the point a curve changes its radius, at all angle points in any line, said points to be not less than twenty (20) feet from the bank of any river or stream.
 - b. Iron Pipe Locations. The lines of all lots and any other points not monumented by bounds shall be monumented by iron pipes. Those iron pipes located along rivers and streams shall be located along the meander line.
- **Placement**. Bounds shall be set flush with finished grade. No permanent bounds shall be set until all construction which would disturb or destroy the monuments is completed. All bounds shall be set under the direction of a registered professional engineer or a registered land surveyor.

12. **ALIGNMENT AND GRADES**. Table 1 provides minimums for curves, grades, and other geometry.

- **Exceptions**. Where, in the opinion of the Road Manager, adherence to the maximum grade specified in Table 1 will cause local streets to be repaired with excessive cuts or fills, he/she may waive the above specified maximum grade. The Road Manager may also waive grade and other geometric criteria if risk assessment in accordance with Reference (3) determines the existing geometry is adequate. However, the Road Manager must ensure, by signage or other means, that motorists are warned of potential hazards.

13. **CONSTRUCTION SUPERVISION**. The Road Manager shall ensure that roadways, drainage facilities, sidewalks, curbs and all other elements of the highway are constructed under the supervision of competent individuals. The Road Manager shall also determine any necessary contractors, consultants, construction testing, and inspection, and shall include costs for these services in project budget proposals.

14. **CLEARING AND GRUBBING**. The entire area of each roadway shall be cleared and grubbed of all stumps, brush, roots, boulders, like materials and all trees not intended for preservation, and shall not be used for fill or buried on site. Clearing and grubbing shall conform to Section 201 of the *State Specifications*.

15. **SUBGRADE PREPARATION**. All loam, humus, soft clay, and other yielding material shall be removed from within the limits of the roadway area to a depth of no less than twenty-four (24) inches below subgrade grade and/or to a depth that may be required by the

Road Manager. Ledge occurring anywhere in the full cross-section of the roadway must be cleared to a minimum depth of twenty-four (24) inches below the finished surface. Ledge occurring in pipe trenches must be cleared so as to have a gravel cushion of at least one (1) foot below and on both sides of the pipe.

16. **STORM DRAINAGE.** All proposed repair projects shall provide for proper surface drainage so that removal of surface waters will not adversely affect any neighboring properties or the public storm water system and will help reduce flooding, erosion, and sedimentation. Where the Road Manager determines that the existing downstream, offsite drainage system is substandard, he/she may make improvements to the drainage system. Whenever necessary, longitudinal storm drainage systems will be provided. Construction shall be in accordance with *State Specifications* Sections 603, 604 and 605, and *State Plans* Standards DR-1, DR-2, DR-3, DR-4, and DR-5.
- Pipe Size, Velocity and Type. The Road Managers shall determine pipe sizes and materials based on past experience and records with the following minimums and maximum length.
 - a. Minimum allowable pipe diameter in any storm drain system shall be fifteen (15) inches;
 - b. Where there is evidence of erosion in ditches, at culvert inlets, and/or outlets, the Road Manager shall provide adequate erosion prevention measures.
 - c. Where possible, the minimum depth of cover for storm drain lines shall be thirty-six (36) inches from the top of pipe to finished grade. Where not possible, the Road Manager shall provide for concrete or other adequate cover over the pipe.
 - d. Bedding shall be three-quarter (3/4)-inch crushed stone. Bedding shall be a minimum six (6)-inch depth in earth and twelve (12)-inch depth in ledge; and
 - e. Maximum length between drain manholes shall be three hundred (300) feet.
 - Calculated Quantities and Flow Rates. If the Road Manager determines that empirical evidence is insufficient, he/she shall arrange for a drainage study/stormwater management report by a professional engineer. The minimum design velocity in pipes shall be two (2) feet per second and the maximum velocity shall be ten (10) feet per second. The rainfall frequency to be used for calculations shall be as follows:
 - a. Residential Areas: 10 years;
 - b. Commercial Areas: 25 years;
 - c. Industrial Areas: 25 years; and
 - d. Flood Protection Works: 50 years
 - Placement of Drain Lines All off-site drain lines shall be placed within right-of-way dedicated for public streets unless use of easements is specifically approved by the Board.
 - Drainage Structures. Manholes and other drainage structures shall be pre-cast concrete meeting H-20 loading and constructed and installed in accordance with *State Specification* for Road and Bridge Construction. Drainage structures shall not exceed eighteen (18) feet in depth (rim to bottom of structure). Outlet structures at detention basins, when necessary, shall be designed by a professional engineer.
 - Driveway Culverts. The location, length, size, bedding and backfill of all driveway culverts shall be approved by the Road Manager prior to construction. Driveway culverts

shall be located a minimum of eight (8) feet off edge of roadway pavement, or at the bottom of the roadway ditch.

17. **CURBS.** The Road Manager may require roadways be curbed on both sides and drained appropriately. Construction shall be in accordance with *State Specifications* Section 609, and *State Plans* Standards CR-1 and CR-2.
18. **SIDEWALKS.** The city/town may require construction of sidewalks for pedestrian access to schools, parks, shopping areas and transit stops or where population density and/or traffic volume conditions are such that the city/town determines the construction of sidewalks to be prudent. In commercial and industrial districts, sidewalks may be required on both sides of the street. In residential districts, sidewalks may be required on one side of the street. Sidewalks shall be a minimum of 5 feet wide (minimum), no closer than 22 feet to the street centerline, and constructed with granite curb, 6 inches thick gravel (*State Specification* 304.2, except maximum size shall be 2 inches), 3 inches crushed gravel (*State Specification* 304.3), and 3 inches of asphalt pavement (*State Specification* 608). Curb shall be set in Portland Cement Concrete. Curb ramps and sidewalks shall be constructed to comply with reference (2).
19. **DRIVEWAYS.** Driveway width for commercial and industrial subdivisions shall be in accordance with the [city/town] Zoning Ordinance. Maximum driveway width for residential single family and duplex lots shall be twelve (12) feet at the right-of-way with five (5)-foot radius at the edge of pavement of the street.
20. **BASE COURSE.** The road base course shall be of materials, and at least the widths and thicknesses, indicated in Figure 1. Crushed gravel shall conform to Pay Item 304.3 in *State Specification* Section 304. Gravel shall conform to Pay Item 304.2 in *State Specification* Section 304, except that the maximum size stones shall be 3 inches. All other provisions of *State Specification* Section 304 are part of these standards.
21. **ASPHALT SURFACE.** Where designated in Figure 1, "Asph. Surf. Treated" surfaces shall be a two-layer Bituminous Surface Treatment in accordance with *State Specification* Section 410. "Hot Mix" surfaces shall be Hot Bituminous Pavement in accordance with *State Specification* Section 403. Widths and thicknesses shall be at least as indicated in Figure 1. At least a 44 feet wide pavement is required in areas where on-street parking is expected on both sides of the travel way. Angle parking is not allowed.
22. **GRAVEL SURFACE.** In cases of very low traffic volumes, defined herein as up to 50 vehicles per day, where the Board determines an asphalt surface is not required, the total usable roadway width shall be a minimum of 22 feet. Provision for a wider section should be considered to allow for future upgrading to an asphalt surface as recommended above. The gravel wearing course shall conform to *State Specification* 304.2, except that the maximum size stones shall be 1¼ inches. All other provisions of *State Specification* Section 304 are part of these standards.
23. **GRAVEL SHOULDERS.** Gravel shoulders, and their base courses, shall be at least the depths, widths, and thicknesses indicated in Figure 1. Gravel shall conform to *State Specification* 304.33. All other provisions of *State Specification* Section 304 are part of these standards.

24. **BRIDGES.** Bridges, as defined by State Law (RSA 234:2), are structures of 10.0 feet or greater clear span, and shall be designed to MS-18 (HS-20) loading (AASHTO Specifications). The minimum roadway width shall be 24 feet. Bridges shall be designed by a professional engineer, and constructed in accordance with that design.
25. **ENVIRONMENTAL IMPACTS AND PERMITS.** The Road Manager shall be responsible for determining the applicability of any and all environmental regulations that apply to repair projects, for acquiring the necessary permits, for taking whatever action is necessary to comply with applicable regulations and permits, and, if necessary, for terminating the necessary permits. The applicable work could include, but not be limited to,
- Any fill, dredge, excavation, etc that impacts wetlands or other jurisdictional areas;
 - All temporary and permanent measures and treatment devices necessary to prevent erosion and control sediment during and after construction;
 - Any construction activity proposed to disturb one (1) or more acre of land as defined by US EPA NPDES permits
 - Any disturbance of more than 100,000 square feet of terrain (50,000 sq. feet. if within the protected shoreland) as defined by NHDES rules for a “Site Specific” permit.
26. **UTILITIES.** Utility poles should be kept close to the right-of-way line, in no case closer than the ditch back slope and always well back of a curb. Water and sewer mains should be constructed outside the surface area, and preferably outside the ditch line.
27. **SAFETY.** Safety is an important factor on all roadway improvements. On existing roads it may not be possible or practical to obtain obstacle-free roadsides but every effort should be made to provide clear areas within the maintenance limits. The use of flatter slopes, the use of guardrail where necessary, and the use of warnings signs are other safety factors to be considered. These areas are addressed in the publication *Roadside Design Guide* by AASHTO, 2002.

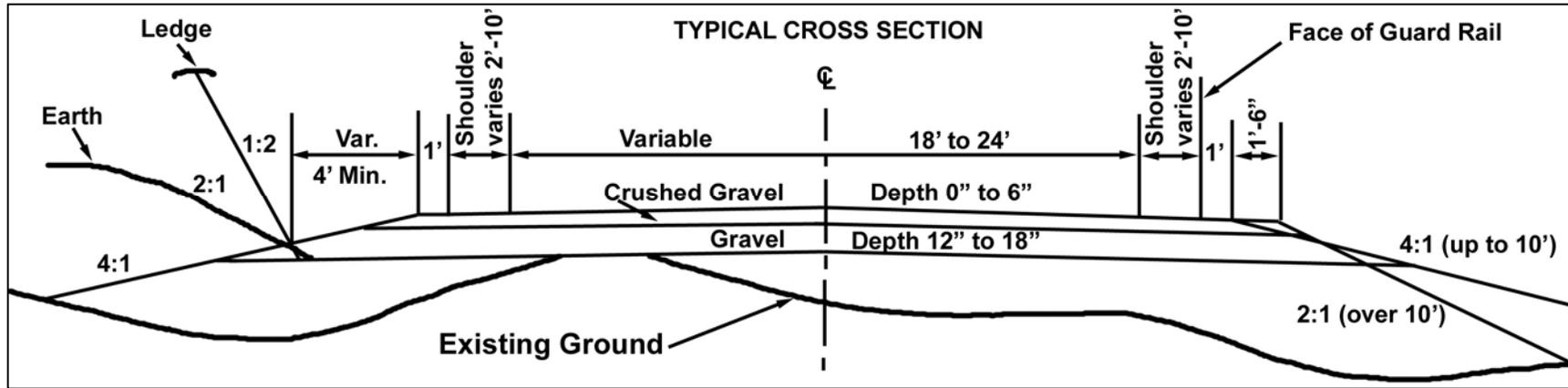
References

- (1) *A Policy on Geometric Design of Highways and Streets.* 2001 or later edition. AASHTO.
- (2) *Designing Sidewalks and Trails for Access, Part II of II: Best Practices Design Guide.*
- (3) *Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT<400).* 2001 or later edition. AASHTO.
- (4) *Roadside Design Guide.* 2002 or later edition. AASHTO.
- (5) *Standard Specifications for Highway Bridges.* 17th Edition (2002) or later. AASHTO.
- (6) *Standard Plans for Road and Bridge Construction.* 2001 or later edition. NHDOT.
- (7) *Standard Specifications for Road and Bridge Construction.* 2002 or later edition. NHDOT.
- (8) *Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire.* 1992 or later edition. Rockingham County Conservation District.

TABLE 1
Roadway Geometric Design Standards

	Arterial	Collector	Local
Right-of-way width	80 feet	60 feet	50 feet
Traveled way width	24 feet	24 feet	22 feet
Shoulder width	10 feet	4 feet	3 feet
Minimum Grade	1%	1%	1%
Maximum Grade	8.0%	8.0%	8.0%
Maximum grade within 100 feet of intersections	2.0%	2.0%	2.0%
Minimum angle of intersection	75	75	75
Minimum centerline radii	600 feet	300 feet	200 feet
Intersection radii: Arterial to Collector to Local to	50 feet 50 feet 30 feet	50 feet 30 feet 30 feet	30 feet 30 feet 30 feet
Rate of super elevation (Use AASHTO Chart)	.08 feet	.08 feet	.04 feet
Rate of super elevation through intersection	.04 feet	.04 feet	.04 feet
Cross slope of pavement (minimum)	2%	2%	2%
Slope of shoulder (minimum)	5%	5%	5%

**Figure 1
Geometric Cross Section Design Elements**



Average Daily Traffic (vehicles/day)	0-50	50-200	200-750	750-1500	1500 & over
Pavement Width (feet)	18 (min.)	20	20	22	24
Shoulder Width (feet) (Note 1)	2	2	4	4	8-10
Center of Road to Ditch Line (feet)	15	16	18	19-21	Varies
Cross Slope of Roadway	4%	3%	2%	2%	2%
Wearing Surface Type (Note 2)	Gravel	Double chip seal or HMA	Hot mix asphalt	Hot mix asphalt	Hot mix asphalt
Wearing Surface Thickness (inches)	3	Varies	1 ½	2	2
Wearing Surface Specification (Note 3)	UNH T ² Handout	UNH T ² Handout or Type C	Type C	Type B	Type A
Pavement Base Thickness (inches)			3	3	4
Pavement Base Specification (Note 3)			Type F	Type E	Type D
Crushed Gravel Thickness (inches)	3	4	4	6	6
Crushed Gravel Specification (Note 4)	NHDOT 304.3	NHDOT 304.3	NHDOT 304.3	NHDOT 304.3	NHDOT 304.3
Gravel Thickness (inches) (Note 5)	12	12	12	12	18
Gravel Specification (Note 4)	NHDOT 304.2	NHDOT 304.2	NHDOT 304.2	NHDOT 304.2	NHDOT 304.2

- Notes:
1. For average daily traffic over 1000 vehicles/day, paved shoulders should be considered.
 2. Gravel surfaces should be paved where steep grades occur.
 3. "Type" is defined in Section 401 of NHDOT *Standard Specifications for Road and Bridge Construction*.
 4. "NHDOT 304.3" is defined in Section 304 of NHDOT *Standard Specifications for Road and Bridge Construction*.
 5. Gravel base course thickness should be increased in areas of poor soils.