

# Construction Specifications for Non-Residential Roadways

**SECTION 1 - Required Improvements:** Non-Residential Roads shall be designed and constructed to include, but not limited to the following;

- pavement
- curbs & gutters
- storm drainage facilities
- sanitary sewer facilities
- power and communication conduits and manholes/handholes
- lighting and signage
- traffic lights and controls
- water mains and fire hydrants
- pavement markings
- landscaping
- local gas
- guardrail and fences
- wetland impact mitigation
- permitting

The above elements shall be designed and constructed as outlined in this specification and/or the to meet the requirements of the Agencies listed in Section 3 of this specification, unless waived by the Planning Board.

## **SECTION 2 - General Requirements**

**A)** All Plans and Specifications shall be prepared by a Professional Engineer currently registered in the State of New Hampshire and shall be appropriately signed and stamped. The design shall be done using “customary and standard” engineering methodology and should include, but is not limited to, a topographic survey, wetland delineation, and soils investigation.

**B)** Any change in or variation from the *Construction Specifications for Non-Residential Roadways* shall be submitted for review and approval by the Planning Board.

**C)** Construction plans for the roadway shall contain all horizontal and vertical data necessary for the construction of the roadway, drainage facilities and utilities. Plans shall be in New Hampshire State Plane Coordinates and USGS 1983 North American Datum.

- D) Plan sheet size shall be 36 inches by 24 inches.
- E) Plan scale shall be either 1" = 20' or 1" = 40'.
- F) The horizontal scale of profiles shall correspond to the plan scale. For twenty scale plans, the vertical scale shall be 1" = 4'. For forty scale plans, the vertical scale shall be 1" = 8'.
- G) The design vehicle shall be a WB-50.
- H) All structures within the right-of-way shall be designed to meet AASHTO HS-25 loading requirements.
- I) The Planning Board may require that an independent consultant be hired by the Town to perform a special study, or to review all or part of the design and construction. The costs for the independent consultant shall be borne by the applicant.

**SECTION 3 - Conformance:** The standards and specifications from the following Agencies (latest revision) shall be used in the design and construction of all improvements unless stated otherwise in these regulations;

- A) Town of Newington - Zoning Ordinance
- B) State of New Hampshire
  - Highway Design Manual
  - Standard Specifications for Road and Bridge Construction
  - Manual on Drainage Design for Highways
  - Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire
  - Best Management Practices for Urban Stormwater Runoff
  - Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities
- C) American Association of State Highway and Transportation Officials (AASHTO) - A Policy on Geometric Design of Highways and Streets
- D) U.S. Department of Transportation - Manual on Uniform Traffic Control Devices (MUTCD)

**E)** City of Portsmouth, NH - Water Division Handbook

**F)** Non-municipal utility companies with jurisdiction, including but not limited to:

- Gas
- Communications (telephone, cable)
- Electric

**G)** National Fire Protection Association (NFPA)

**H)** National Electrical Code (NEC)

## **SECTION 4 - Roadway Design Requirements**

**A)** Horizontal Alignment

**1)** Industrial Roads shall provide for the continuation to adjoining streets in order to facilitate fire protection, movement of traffic and the construction or extension of needed utilities and public services. In the case of dead-end streets, the Planning Board may require the reservation of a twenty-foot-wide easement to provide for continuation of pedestrian traffic, bicycle traffic, and utilities to nearby streets or to public water bodies.

**2)** The alignment design shall be consistent with acceptable engineering practices and should be such that the safety of the facility is not compromised. Every effort should be made to meet the requirements for a minimum design speed of 30 m.p.h. Layout of the roadway shall meet the requirements of the typical roadway section ( Figure 1).

**3)** Maximum rate of superelevation for horizontal curves shall be  $e_{\max} = 0.04$ .

**4)** Roadway curves shall be designed with as large a radius as feasible, the minimum radius being 200 feet.

**5)** Streets shall join the industrial road so that for a distance of at least 100 feet the street from the intersection is approximately at right angles to the industrial road. No street shall intersect the industrial road at an angle of less than 60 degrees. Street right-of-way lines at intersections shall be rounded by curves of at least 30 feet radius.

**6)** No more than two proposed streets or driveways shall intersect at any one location. Closely spaced offset intersections shall also be avoided. Where alignment is not possible, a 125 foot separation between intersecting center lines shall be established.

- 7) Local or secondary street openings onto the same side of the industrial road shall be at least 400 feet apart.
- 8) Design vehicle for determining radii at intersections and turning roadways is a WB-50. Minimum curb or edge of roadway radii at intersections shall be 25 feet.
- 9) Right-of-way width is 60 feet. Minimum right-of-way radii at intersections is 30 feet.
- 10) Sight distance calculations are required for intersections and changes in alignment. Sight distance analysis shall be conducted using accepted design practice.

#### **B) Vertical Alignment**

- 1) Desirable grades shall be a maximum of 6% and minimum of 0.5%, nor greater than 3% within 100 feet of its point of intersection with another street. Approach platforms for intersecting streets and driveways shall extend back from the industrial roadway a minimum of 100 feet. The platforms shall be graded at a maximum of 3% wherever possible. Grades of roads shall conform as closely as possible to the original topography.
- 2) Except for stopped conditions at intersections, the minimum K values for vertical curves shall be 40 for sags and 30 for crests. The minimum length of vertical curve is 100 feet. The length of vertical curve and corresponding K value shall be shown on profiles.
- 3) Existing ground elevations and proposed finished centerline grades, shall be shown on profiles.

#### **C) Cross Sections**

- 1) Cross sections shall be required for all new construction and improvements to existing roadways greater than 250 linear feet in length. The necessity for cross sections for projects less than 250 linear feet in length shall be at the discretion of the Planning Board.
- 2) Cross sections shall be required at intervals no greater than 50 feet. Cross sections shall also be required at intersections with existing streets and driveways.

3) The roadway template shall conform to the Town of Newington, Non-Residential Road, typical roadway section (Figure 1). Any change in or variation from the typical roadway section shall be submitted for review and approval by the Planning Board.

4) Sufficient cross section data shall be obtained and gutter line or edge of pavement grades shown in those areas where the normal cross slope of the roadway changes.

#### **D) Curbing**

Vertical granite curbs shall be installed at each intersection for a distance of 50 feet from the PC or PT in each direction. Granite curbing shall also be installed in areas where there is a requirement to protect property from runoff (i.e. the low side of a superelevated curve where a drainage ditch is not feasible).

#### **E) Railroad Grade Crossing**

1) Design in accordance with the NHDOT Highway Design Manual.

2) Requires coordination and approval from the Owner/Operator.

#### **F) Storm Sewers, Drains & Appurtenances**

1) Design Storm: The drainage system shall be designed to handle a 25-year/24-hour storm event. Storm runoff calculations shall include areas tributary to the proposed public improvements as well as the specific area of the improvement.

2) Above ground drainage is preferable to underground systems. Above-ground drainage infrastructure shall be installed wherever such installation is practical.

3) Drainage swales shall be situated at least one foot below the grade of the finished roadway, and their design shall be subject to the approval of the Town Engineer.

4) There shall be a minimum cover of four feet over all roadway pipes and culverts. Where the minimum cover requirement cannot be met, the strength of the pipe shall be checked.

5) All drainage pipe shall be reinforced concrete pipe. Class IV pipe shall be used under roadways and Class III pipe shall be allowed for all other locations.

6) Minimum size for drain pipes and culverts shall be 15 inches.

- 7) Culvert headwalls shall be of either concrete or mortar rubble masonry.
- 8) All storm drain lines shall be designed such that a minimum velocity of 2.5 feet per second will be maintained when flowing one third full. For open ditches, a minimum desirable grade of 0.5 percent shall be employed where possible to keep the ditch self cleaning.
- 9) Erosion protection for ditches shall be provided where warranted by soil conditions or water velocity. Erosion protection shall be provided for all pipe outlets.
- 10) Permanent drainage and maintenance easements shall be secured for all elements of the storm drain system not within the limits of the right-of-way.
- 11) Drainage structures shall be placed at all pipe intersections and at all changes in alignment, grade and pipe size but, in any case, a storm drain shall not have a manhole or catch basin more than 300 feet apart. The maximum desirable length for open ditches outletting at culverts or catch basins shall be 400 feet.

#### **G) Sanitary Sewer**

- 1) Design of sanitary sewers shall meet the requirements of the New Hampshire Department of Environmental Service's *Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities*.
- 2) Sanitary sewer service shall be extended to each future lot at a maximum spacing of 500 feet, unless waived by the Planning Board. If possible, the service shall be extended no less than 10' past the edge of right-of-way. At a minimum, the service shall be extended to the edge of right-of-way. Service terminations shall be clearly marked at the site and on as-built/ record drawings.

#### **H) Water**

- 1) Design of water mains, fire services and domestic services, and hydrants shall meet the requirements of the Portsmouth Water Division Handbook.
- 2) Water service shall be extended to each future lot at a maximum spacing of 500 feet, unless waived by the Planning Board. The service shall be 12 inch minimum and, if possible, shall be extended onto each lot no less than 10 feet past the edge of right-of-way. At a minimum, the service shall be extended to the edge of right-of-way. Service terminations shall be clearly marked at the site and on as-built/ record drawings.
- 3) Hydrants shall be installed at a maximum spacing of 500 feet.

**D) Electrical/ Telecommunications**

**1)** All utility lines shall be placed underground in the industrial road right-of-way or in dedicated easements.

**2)** Wherever possible, underground services will be placed under grassed areas rather than paved areas.

**3)** The primary electrical and communication duct system shall be made up of eight (8), 4-inch, schedule 40, PVC conduit, buried to a depth of not less than 3'.

**a)** Conduit shall be encased in concrete, (Figure 2).

**b)** Pull rope shall be installed in all conduit for future pulls. Pull rope shall be nylon rope having a minimum tensile strength of 300 lbs. A minimum of 24" of rope slack shall remain at the end of each duct.

**c)** All conduit terminations shall be capped to prevent debris from entering conduit.

**d)** Conduit shall be extended to each future lot at a maximum spacing of 500 feet, unless waived by the Planning Board. If possible, the service shall be extended no less than 10 feet past the edge of right-of-way with conduit terminations ending in a concrete pull box (Type B - NHDOT Item 614.512). At a minimum, the service shall be extended to the edge of right-of-way. Stub outs for the secondary electrical and communication duct system shall be made up of four, 4-inch, schedule 40, PVC conduit, buried to a depth of not less than 3 feet.

**e)** Reinforced concrete handholes of appropriate size (typically 4 feet X 4 feet X 4 feet) with labeled manhole covers shall be used where deemed appropriate by the local power, telephone, and cable companies, subject to final approval by the Planning Board. Separate handholes shall be required for each utility

**f)** Conduit spacing: Power conduit shall be spaced a minimum of six inches from other conduit or as the National Electric Safety Code permits, whichever is greater. Conduit shall be supported in place using pipe support stanchions spaced every five feet. Conduit termination locations shall be clearly marked at the site and on as-built/record drawings.

**g)** An electrical and communication duct system plan shall be approved by the local power, cable, and telephone companies prior to submission to the Planning Board.



**J) Street Lighting**

1) Street lights are required at all intersections unless waived by the Planning Board. Lighting design should meet the requirements of the *American National Standard for Roadway Lighting* of the American National Standards Institute under the sponsorship of the Illuminating Engineering Society.

2) At locations where the requirements for street light installation is waived by the Planning Board, service enclosures shall be installed along the underground electric system in order to facilitate the installation of street lights in the future.

**K) Gas**

1) Design of the gas main shall meet the requirements of the utility company.

2) Gas shall be extended to each future lot at a maximum spacing of 500 feet, unless waived by the Planning Board. If possible, the service shall be extended no less than 10 feet past the edge of right-of-way. At a minimum, the service shall be extended to the edge of right-of-way. Service terminations shall be clearly marked at the site and on as-built/record drawings.

L) Summary of Dimensional Standards for Non-Residential Roadways.

<b>Feature</b>	<b>Minimum</b>	<b>Maximum</b>
Openings onto Major Roads	400 feet apart	
Intersections on Opposite Side	125 feet apart	
Curve of ROW at Intersections	30 foot radius	
Obstructions at Corners		3 feet high
ROW Width	60 feet	
Design Storm	25 year - 24 hour	
Cover Over Pipes & Culverts	3 feet	
Removal of Ledge	18" below lowest work installed	
Removal of Unstable Material	36" below finished grade	
Base Course (sand - item 304.1)	8 inches	
Base Course (gravel - item 304.2)	8 inches	
Base Course (crushed gravel - item 304.3)	8 inches	
Compaction	95% maximum density	
Roadway Pavement Width	36 feet	
Base Pavement (Type A - Item 403)	2.5 inches	
Binder Pavement (Type B - Item 403)	1.5 inches	
Finish Pavement (Type E - Item 403)	1 inch	
Temperature (in shade) During Paving	40 degrees F.	
Delay Between Binder & Finish Course	one year	
Cross Slope Grade	2%	
Finished Lineal Grade	.5%	6%
Grade within 75' of an Intersection	.5%	3%

(Item No. Refers to Item No. in NHDOT's *Standard Specifications for Road and Bridge Construction*)

## **SECTION 5 - Roadway Construction Requirements**

**A)** All public improvements shall be constructed in accordance with the State of New Hampshire, Department of Transportation's *Standard Specifications for Road and Bridge Construction* unless otherwise noted.

**B)** The Planning Board may require that an independent consultant ( herein known as the Engineer) be hired to provide for inspection of construction and testing of materials required for construction and insure their satisfactory completion. The additional costs for the independent consultant shall be borne by the applicant.

**C)** Authority of the Engineer

**1)** The Engineer will decide all questions regarding the quality and acceptability of materials furnished, work performed and the rate of progress of the Work.

**2)** The Engineer may appoint representatives as desired and approved by the Planning Board. All representatives have authority to approve or reject materials, to make measurement of quantities, to keep records of cost and otherwise represent the Engineer. The representatives are not authorized to revoke, alter, enlarge, relax, or release any requirements of the standards governing the construction of the improvements.

**D)** Inspection of Work

**1)** All materials and each part or detail of the work shall be subject to inspection by the Engineer. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

**2)** Work done or materials used without the supervision or inspection by the Engineer or authorized representative may be ordered removed and replaced at the Contractor's expense, unless the Engineer or authorized representative failed to inspect the Work after been given reasonable notice in writing that the Work was to be performed.

**3)** When any unit of government or political subdivision, utility, or any corporation is to accept or pay for a portion of the Contract cost or has an interest in the Work for other reasons, its representatives shall have the right to inspect the Work. The inspection by these agencies does not make them a party to the Contract nor will it change the rights of the Contract parties.

**E) Control of Material**

- 1) All material used to construct the roadway shall meet the requirements of the standards set forth by this specification.
- 2) Certificates of compliance shall be submitted for all material to be permanently incorporated into the Work.

**F) Testing of Materials (Supplemental to NHDOT's *Standard Specifications for Road and Bridge Construction*)**

1) Sanitary Sewer - Testing shall be done in accordance with the State of New Hampshire, Department of Environmental Services' *Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities*.

2) Concrete Testing:

a) All concrete to be used in the work shall be subject to testing to determine if it conforms to the requirements of the specifications. The methods of testing shall conform to the appropriate specification but the place, time frequency and methods of sampling, will be determined by the Engineer in accordance with the particular conditions of this project.

b) Concrete consistency shall be measured by the ASTM Standard Method of Test for Slump of Portland Cement Concrete Designation C143. The consistency of concrete shall conform to the following slump requirements:

Pavements and slabs on grade	Normal 1-2	3 Max.
Massive reinforced sections	Normal 2-3	4 Max.
Other reinforced walls & footings,	Normal 3-4	5 Max.

c) Field test of concrete for compressive strength shall be taken, cured and tested by an approved testing laboratory as directed by the Engineer. A minimum of four specimens shall be made for each test. One specimen shall be broken at 7 days, one at 14 days, the other at 28 days. Specimens shall be made and tested in accordance with ASTM Specification C39 and C31. Concrete failing to meet the specification requirements shall be removed and replaced at the Contractor's expense.

**d)** Unless otherwise noted in these specifications or the contract plans, all concrete masonry shall contain air-entrainment cement. The average resulting air content in field mixtures shall be five (5) percent when measured by means of an ACME Air Meter or an approved equal in conformity with the ASTM Standard Method of Test for Air Content of freshly mixed concrete by the "Pressure Method, Designation C231". Such tests shall be performed by the approved laboratory as directed by the Engineer. Any concrete for which the individual air content is less than 3.5 or greater than 6.5 percent, will be rejected.

**3) Roadway Bases, Embankment Compaction and Trench Backfill Testing.**

**a)** The testing laboratory shall visit and obtain a sample of each backfill material from the proposed sources of supply. The Contractor shall allow sufficient time for testing and evaluation of results before material is needed. Samples from alternate sources shall be submitted if required. The Engineer will be the sole and final judge of the suitability of all materials.

**b)** Material in question pending test results shall not be used. Any material rejected shall be removed and replaced with new acceptable materials whether in stockpiles or in place.

**c)** The compaction of the material shall be determined by AASHTO T 238 (Nuclear Method). The density shall not be less than 95 percent of the maximum density determined in accordance with AASHTO T 99 (Standard Proctor Test).

**d)** At least one laboratory compaction test shall be performed for each distinctive type of material to be incorporated. These laboratory tests to be taken at the suggestion of the testing laboratory and/or as directed by the Engineer. A minimum of four (4) in-place moisture density determinations, by AASHTO T238 (Nuclear Methods), shall be taken for each 500 linear feet of roadway base courses and a minimum of 2 test for each 500' of embankment and trench backfilled.

**e)** If the compaction at any point is found to be unacceptable, additional compaction with or without modification to the field moisture content as directed shall be performed and additional moisture-density determinations made. This procedure shall be repeated until satisfactory compaction is obtained.

f) The Contractor will cooperate with the testing laboratory in obtaining field samples of in-place materials after compaction. Also incidental field labor and equipment necessary to dig and backfill test holes shall be furnished by the Contractor.

#### 4) Hot Bituminous Pavement

a) Base Courses shall meet the requirements of NHDOT's *Standard Specifications for Road and Bridge Construction*.

#### b) Wearing Course

**I)** When constructing the wearing surface, a control strip shall be constructed at the beginning of the work for the purpose of establishing the correct rolling pattern that will achieve the required density. Each control strip shall be constructed to acceptable density and surface tolerances and shall remain in place to become a portion of the completed work. Unacceptable control strips shall be corrected or removed and replaced at the Contractor's expense. A control strip shall be at least 100 linear feet in length and span the width of the roadway. The materials and the equipment used to construct the control strip, shall be the same as that to be used in the remainder of the course represented by the control strip.

**II)** Compaction of the control strip shall commence immediately after the course has been placed and continue until no discernable increase in density can be obtained by additional compactive effort. The mean density shall be determined by averaging the results of ten (10) tests, selected randomly within the test strip, in accordance with ASTM D 2590 Standard Test Method for Density of Bituminous Concrete In-Place by Nuclear Methods. If the mean density is found to be less than 95 percent of the maximum density of laboratory specimens prepared in accordance with AASHTO T 245, the Engineer may order the construction of another control strip. A new control strip may also be ordered by the Engineer or requested by the Contractor when a change in the material or job mix formula is made or if the Engineer has reason to believe that the material being placed, is not representative of the control strip.

**III)** A minimum of four (4) random nuclear density tests, in accordance with ASTM D 2590, shall be taken every 500 linear feet during placement of the wearing course to determine if the a minimum density of 95 percent of laboratory specimens, in accordance with AASHTO T 245, has been obtained. If the tests

do not meet the minimum 95 percent compaction requirements, then the Contractor shall correct the deficiencies immediately. The Engineer shall stop construction of the wearing surface if the Contractor is not able to correct the compaction deficiencies. Work will be restarted only when the Contractor proves to the Engineer that the proper compactive effort can be achieved.

5) Water Service shall be constructed and tested in accordance with the City of Portsmouth, Water Division Handbook.

**G) Construction Debris & Sediment:** A stabilized construction entrance, at least 6 inches deep, 75' long, and as wide as the road (comprised of crushed stone) shall be installed prior to the construction of a new roadway. All roads shall be cleaned of debris and sediment on a daily basis.

**H)** The entire right-of-way of each street shall be cleared of all stumps, brush, roots, boulders, and all trees not intended for preservation. None of the preceding shall be used for fill. All loam, soft clay, and other yielding material shall be removed to a depth that is specified by the Engineer. Loam shall be removed and stockpiled for re-use. The Engineer shall inspect and approve the sub-grade prior to placement of roadway construction materials.

**I)** Shade trees shall be planted at intervals of 100 feet along the roadway. The species and planting locations shall be recommended by the Newington Conservation Commission, and are subject to review and approval by the Planning Board.

**J)** The Contractor shall provide permanent reference monuments along the sides of street right-of-ways and reference pins along the sides of other easements and property lines.

**1) Permanent Monuments** shall be of stone or reinforced concrete, at least 6" X 6" X 54", with a drill hole in the center. If they are made of concrete, the mix shall be Class A.

**2) Reference Pins** shall be of ferrous metal, 5/8 inch in diameter or larger and a minimum of 36" in length. The pin shall be driven into the ground and shall not protrude above the ground surface more than 6" inches.

**3) Benchmarks:** A permanent marker, fabricated as described in section A above, shall be placed near a major roadway, and shall indicate the elevation in reference to the U.S.G.S. survey.