



# Engineering Design & Construction Standards Procedures Manual

**February 2, 2017**  
**Revised: November 4, 2022**  
**Revised: April 18, 2024**

# Engineering Design Manual Edit Revision Log

November 4, 2022

April 18, 2024

## General

1. Added a Revision Log Sheet to the manual that will document the original date and future revision dates.
2. Replaced all town symbols with the copyrighted symbols.
3. Development Services Department revised to Engineering Department throughout manual.
4. Unified Development Ordinance (UDO) revised to Land Development Code (LDC) throughout manual.
5. Revised Sections I, II and III.
6. Revised Appendixes A, C, D, E, F, G, H, J and K.

## Section I – Administrative Procedures

1. Page 3, Section F - Adding detail to Bonding requirements
2. Page 4, Closeout As-Built requirements.
3. Page 4, “Device” replaced with “Measure”
4. Page 4, Included inverts
5. Page 4, Defined digital

## Section II – Design Criteria

1. Page 6, Set minimum posted speed.
2. Page 6, and at intersections of town roads with speed limits exceeding 25 mph
3. Page 6, Trail cross-sections
4. Page 6, Directional access
5. Page 7, gutter spread reinforced concrete or HDPE (HDPE used for 15-36-inch pipe)
6. Page 8, Sloped criteria revisions
7. Page 8, Maximum bank and slope revisions.
8. Page 8, Street light inspection
9. Page 8, Slopes for access drives to any pond or SCM shall not exceed 5:1.
10. Page 9, Gutter Spread shall not exceed 6 feet for the 10-year 24-hour storm event
11. Page 9, Included swales
10. Page 9, A 5-foot side or 20-foot rear setback shall be provided from the foundation of the principal structure for any commercial wall proposed in a residential subdivision. The required setback includes separation from geogrid.
  - a. Retaining wall plans shall include proposed height or top and bottom of wall elevations at each bend or at 50-foot increments along the full length of the wall, whichever is the lesser.
  - b. A maintenance easement shall be provided for the wall and full length of reinforcement grid. A minimum 10-foot maintenance easement shall be provided for all retaining walls.

- c. Developments with multiple retaining walls shall provide a retaining wall tracking table. The table shall include the wall name/number, approximate length, maximum height, and approximate location i.e adjacent lot number.
- 12. Page 9, Retaining wall height/elevation identifications
- 11. Page 10, Street light inspection.
- 13. Page 10, Addition requirements added for Light Spacing: ... for single family residential development, or 120 feet for townhome and multi-family developments ... at the end of each cul de sac and street stub... A lighting plan shall be developed to identify the envelope of 0.5 foot candles for each light. Alternative spacing and additional lighting may be required to provide adequate lighting in the Right of Way.

### **Section III – Specifications and Special Provisions**

- 1. Page 11, Coal ash added to disallowed backfill material.
- 2. Page 17, Included HDPE

### **Appendix A – Right of Way Encroachment Permit – General Requirements**

- 1. Page 2, Added 48 hours to temporary road closure request.

### **Appendix C – Subdivision Inspection Checklist-Critical Items**

- 1. Page 3, Added 48 hours to temporary road closure request.
- 2. Page 4, Misc. Requirements Added – Street Light Separations

### **Appendix C – Subdivision Inspection Checklist-Critical Items**

- 1. Page 1, Added “A minimum of”
- 2. Page 4 Section D.2 – Work Days added

### **Appendix D – Policy for Street Improvements and Maintenance**

- 1. Page IV, CO minimum standard.
- 2. Page IV, UDO Revised to LDC - missed from 2022 revisions
- 3. Section 3, Street Acceptance Form revised, effective 7/1/2022

### **Appendix E – Street Lighting Policy**

- 1. Page 1, Adequate lighting defined
- 2. Page 1, Section 2.D Revised
- 3. Page 3, Section 4.A.2 Identify Lights and foot-candle radius
- 4. Page 3, Section 4.A.3 Electronic
- 5. Pages 1 & 3, Light spacing reduced.
- 6. Page 4, Section 5.A – Sidewalk Illumination
- 7. Page 4, Section 5.D – Lighting Plan foot candle radius

### **Appendix F – TIA Request Form & Process**

- 1. Page 2, TIA requests must be received by April 30th to ensure traffic counts reflect counts during the school year.

### **Appendix G – TIA Ordinance**

- 1. TIA Ordinance reviewed 9/9/2022

### **Appendix H – Policy for Driveway Design & Construction**

- 1. Page iv, within reasonable period of time revised to 60 days.
- 2. Page iv, Removal of tree permit requirement.
- 3. Page v, Section 2.2 - Driveway Maintenance Clarification Added
- 4. Page v, Section 2.3 – identify curb radii added

5. Page vi, Section 2.3 – Proposed Culvert information added
6. Page vii, Type I Residential Driveway offset added.
7. Page vii, Type II driveway offset added.
8. Page ix, Minimum separations increased to 100’

#### **Appendix J – Traffic Calming Policy**

1. Policy effective 8/17/2021
2. Definition relocated to page 3.
3. Mini round about added.
4. Round about removed.
5. Minimum posted speed is 25 MPH in new developments unless subdivision has a precedent of lower speeds.

#### **Appendix K – Erosion and Sedimentation Control Ordinance**

1. Revised December 2021 per State revisions.

#### **Appendix M – Engineering Construction Document Review Checklist**

1. Page 2, Section C.1 – Provided legend on all plan sheets
2. Page 4, Section C.3 – Added “or greater than 10 feet vertical”
3. Page 4, Section C.3 – Clear zone on streams increased from 10 to 30 feet
4. Page 4, Section C.4 – Added Retaining wall table
5. Page 4, Section C.4 – Identify intersection Radii on site plan
6. Page 5, Section C.5 – Handrail requirement
7. Page 8, Section C.6 – Scale not to exceed 1” = 60”
8. Page 8, Section C.6 – Structure Labels to match in modeling/calculations to construction documents.

#### **Standard Drawings – Miscellaneous Concrete Infrastructure**

1. 100.1 Standard Curb and Gutter – Compacted stone extended to 1’
2. 101.1 Curb and Gutter – Compacted stone extended to 1’
3. 102.1 Transverse Expansion Joint – Joint spacing revisions.
4. 103.1 18-inch Vertical Curb – Expansion joint revision.
5. 113.1 Residential Drop Curb Type I – Add property line minimum offset.
6. 122.1 Catch Basin Placement At Intersections – Note 2: Radius requirements updated
7. 136.1 Directional Accessible Ramp with Small/Curb Radii – NCDOT Note Removed
8. 137.1 Directional Accessible Ramp with Large Curb Radius – Detectable warning truncated domes set perpendicular to walk. Placement maximum offset.
9. 137.1 Directional Accessible Ramp with Large Curb Radius – NCDOT Note Removed

#### **Standard Drawings – Street Section**

1. TYPICAL PAVEMENT SECTION has been revised for all roadway sections.
2. 200.0 Residential Subdivision Utility Layout – 20’ off street tree spacing from streetlights and at stop signs.
3. 200.1 Residential Local Street & Parking Both Sides – 2:1 cut max revised to 3:1.
4. 200.2 Residential Local Street Parking One Side – 2:1 cut max revised to 3:1.
5. 200.3 Residential Local Street No On-Street Parking - 2:1 cut max revised to 3:1.
6. 200.3A Residential Local Street No On-Street Parking MUP Section – New Detail
7. 210.1-210.4 – MUP notation added
8. 210.1 Residential Collector Street with Bike Lanes - 2:1 cut max revised to 3:1.
9. 210.1A Residential Collector Street MUP Section – New Detail

10. 210.2 Residential Divided Collector Street - 2:1 cut max revised to 3:1.
11. 210.4 Residential Collector Street Ditch - 2:1 cut max revised to 3:1.
12. 220.1-220.4 – MUP notation added
13. 220.3 Retail/Mixed Use Street With Medium and Parking – Base course to extend 12”.
14. 220.4 Retail/Mixed Use Local Street With Parking and Green Zone Both Sides – Cut max revised to 3:1. Base course extended.
15. 230.1-230.2 – MUP notation added
16. 230.1 Retail/Mixed Use Collector Street with Bike Lanes - Cut max revised to 3:1. Base course extended.
17. 230.2 Retail/Mixed Use Local Street With Median and Bike Lanes - Cut max revised to 3:1. Base course extended.
18. 240.1-240.3 – MUP notation added
19. 240.1 Industrial Local Street Parking on Both Sides - Cut max revised to 3:1. Base course extended.
20. 240.2 Industrial Local Street Parking On One Side of Street Typical Section - Cut max revised to 3:1. Base course extended.
21. 240.3 Industrial Local Street No Parking - Cut max revised to 3:1. Base course extended.
22. 250.1-250.2 – MUP notation added
23. 250.1 Industrial Collector Street No On-Street Parking - Cut max revised to 3:1. Base course extended.
24. 250.2 Industrial Collector Street With Median and No Parking Typical Section- Cut max revised to 3:1. Base course extended.
25. 280.1 Residential Local Street Cul-de-sac – Dimension labels provided, 2:1 cut revised to 3:1.

#### **Standard Drawings – Storm Drain**

1. 306.1 Rip Rap Aprons at Pipe Outfalls Other Than SWIM – Rip rap approx. max slope revised 3:1.
2. 306.1 Rip Rap Aprons at Pipe Outfalls Other Than SWIM – Velocity (V) and Flow rate (Q) added to Outlet structure table

#### **Standard Drawings – Stormwater BMP Details**

1. 406.1 Wetpond Profile – Shelf slope revised to 6:1
2. 408.1 Wetpond Littoral Shelf and Berm Detail – Shelf slope revised to 6:1

#### **Standard Drawings – Erosion Control**

1. 509.1 Standard Stilt Fence Outlet – Add max drainage area per outlet.
2. 520.1 Slope Stability – Revised to 3:1 slopes for residential.
3. 522.1 Temporary Asphalt Diversion Berm

#### **Standard Drawings – Tree Standards**

1. 600.1 Tree Planting – Backfill specifications Added
2. 610.1 Shrub Planting Bed – Backfill specification Added
3. 614.1 Root Flare Depths Added

#### **Standard Drawings – Miscellaneous Standards**

1. 701.1 Safety Rail (Handrail) Warrants – Drop off definition revised to 3:1.
2. 710.1 Parking Standards – Minimum Operational Widths Added

3. 726.1 Typical Sight Triangles – Internal sight triangle revised to match document text (15'x15')
4. 728.1 Asphalt Trail – Typical Section – Detail Added
5. 729.1 Puncheon Boardwalk - Detail Added
6. 730.1 Speed Cushion Detail Added
7. 731.1 Speed Cushion – Narrow Roadway Detail Added
8. 732.1 Equestrian Trail Detail Added.

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# Town of Waxhaw Engineering Standards and Procedures Manual

## OVERVIEW

The Town of Waxhaw's Engineering Design & Construction Standards Procedures Manual (ED&CSPM) is provided as a resource that will assist in ensuring compliance with all Town requirements related to proposed land development activities inside the Town limits.

It is the Town's goal that the ED&CSPM present clear and concise technical requirements, policies, and procedures while providing the guidance and details necessary for an effective and efficient process.

The ED&CSPM is intended as a supplement to the Town *Land Development Code (LDC)*, and *Storm Water Design Manual*. Where discrepancies exist between this manual and any adopted Town Ordinance, the Ordinance shall govern. The latest revision of the *NCDOT Standard Specifications for Roads and Structures* and the *NCDOT Design Manual* shall apply to all roadway and storm drainage construction unless otherwise specified herein this manual.

County, State, and Federal agencies may also have additional requirements not provided for or referenced within this manual. In situations of conflicting or overlapping requirements, the more restrictive regulation applies. This manual does not relieve the design professional of the responsibility to correctly incorporate the provided information. It is the Design Engineer's responsibility to provide technical adequacy of the design using engineering judgment, experience, and sufficient knowledge in providing all related design elements.

The Town of Waxhaw's Engineer shall be responsible for incorporating revisions as deemed appropriate based on a continual review of the ED&CSPM. The Manual can be found at the Town website from the following link:

[Engineering Design & Construction Standards Procedures Manual](#)

This manual was created to capture most, but not all, scenarios related to development within the Town of Waxhaw. Town of Waxhaw Engineering Department reserves the right to enforce standards not included within this manual, which uphold the Town's initiative to maintain a safe environment for its citizens.

# I. Administrative Procedures

## A. Introduction

Processes and procedures for various plan review and development standards are discussed in this section. Each section provides information on the process, standard, or the plan review agency to contact regarding that process.

## B. Engineering Plan Review Checklist

The *Engineering Plan Review Checklist* is a detailed list of the items to be reviewed by the Town Engineering Department or designee. The preliminary plan must include, at a minimum, the information described in the Town's Subdivision Ordinance and/or other applicable ordinances. A copy of the *Engineering Plan Review Checklist* will be included in the Appendix.

Note: The Town Planning Division maintains their own plan review checklists. Additionally, the duration of the plan review varies by review agency. Plan calculations and details are reviewed at this stage.

## C. Fees

Fees for plan review are set and collected by the Town of Waxhaw Engineering Department. Fees vary by the type and size of development and are updated on an as needed basis. Plan review fees can be found at the below web address:

[FEE SCHEDULE](#)

## D. Driveway Permits

### Town Driveway Permit

A Town of Waxhaw Driveway Permit is required for all new or proposed modifications to connections to Town streets in accordance with the *Policy For Driveway Design & Construction*. A copy of the *Town Driveway Permit Application* is in the Appendix. If a property owner is proposing to do work in addition to driveway construction within Town maintained right-of-way, a Town Encroachment Permit may be required. Contact the Town Engineering Department at 704-843-2195 to confirm if a permit is needed.

Note: Two signed original copies of the driveway permit application along with two sets of plans are required for submission to the Town Engineering Department. A separate encroachment permit is not needed if a driveway permit has been obtained.

### NCDOT Driveway Permit

When accesses and/or driveways to North Carolina Department of Transportation (NCDOT) maintained facilities are proposed or are proposed to be modified, contact the NCDOT Division 10 District 3 office at (704) 218-5100. Forms are available on the web at <http://www.ncdot.gov/>. The Town will review the NCDOT driveway permit applications for accesses proposed within the Town of Waxhaw.

### E. Encroachment Permits

1. The Town of Waxhaw requires that an encroachment permit be obtained when construction activity, including installation of temporary or permanent structures, is proposed under, on, or over property in which the Town has property rights. Property rights include but are not limited to street rights of way, utility easements, or other owned property. An Encroachment Permit is required regardless of any other approvals (excluding a driveway permit), such as building permits or Planning Department entitlements. Encroachments for structures that also require a Building Permit will need to be reviewed concurrently and approval of a Building Permit will not be granted if Encroachment is not permitted.
2. Encroachment Permit applications are processed through the Town of Waxhaw Engineering Department. A copy of the *Town of Waxhaw Right of Way Encroachment Agreement* is included in the Appendix.
3. No advertising shall be permitted within Town of Waxhaw public right of ways.

### F. Bonding

1. Bonding is addressed in Chapter 5 Section 5.16 - Improvement Guarantees/Partial Releases of the Waxhaw Land Development Code.
2. Engineering will review bond estimates to confirm consistency with recent Town and NCDOT bids.
3. The following items must be submitted to close out bonding for a development:
  - Signed and sealed as-builts provided for the complete storm system, all catch basin location, grate and pipe inverts and pipe sizes and materials. (note Section H)
  - GIS Layer (ERSI shape file or geodatabase) to upload information into the town database
  - Stamped engineers estimate brought down to \$0 (or reduction number)
  - Erosion Control close out certification

### G. Final Inspection

The procedures for preparing new subdivision construction for final inspection are outlined in the *Subdivision Inspection Checklist-Critical Items*, located in Appendix-C. A final inspection of all



streets to be turned over to the Town for Maintenance must be inspected by the Town or Town designated inspector. Contact the Town Engineer to schedule final inspections.

## H. As-Built Documents

1. Submit actual field surveyed "as-built" plans for all stormwater management SCM facilities or practices after final construction is completed.
  - As-built plans shall be submitted depicting all public facilities and all private facilities.
2. Plans shall be prepared by a Professional Land Surveyor (PLS) or Professional Engineer (PE) registered to practice in North Carolina.
3. **Digital** copies (pdf and AutoCAD) shall be submitted and consistent with all As-Built Submittal Requirements. Field Survey/As-Built to be tied to NC Grid System.
4. Plans shall show:
  - Final design specifications for all stormwater management facilities and practices;
  - Field surveyed contours;
  - Pipe information including: diameter, length, type, slope, **inverts** and location;
  - Size, type and location of the following, as they apply to the project:
    - Storm Drain Box & Box Number;
    - Riser Structure;
    - Inlet; and/or
    - Level Spreader.
  - Invert elevations and planted vegetation (if applicable) of all measures, controls, and devices as installed; and
  - Detailed drawings for each stormwater control **measure** shall be submitted.
5. Plans shall show all recorded drainage and access easements for each SCM (Stormwater Control Measure), referencing book map and page number.

## I. Street Maintenance Acceptance

The Town of Waxhaw may consider the acceptance of privately owned streets upon the written request of the owning entity. Streets will only be accepted in their entirety, or by block, and street construction, including required repairs and final inspection, must be completed at time of petition.

The procedures for preparing new subdivision streets for acceptance by the Town are outlined in the *Policy for Street Improvements and Maintenance*, located in [Appendix-D](#).

## II. Design Criteria

### A. Introduction

The following sections present minimum design criteria for the design of public streets, storm drainage, street lighting, street and roadway signage for traffic regulation and street identification, and landscaping.

### B. Local Street Design

For use in designing Residential and Retail/Mixed-Use Public Streets

Posted Speed Limit (miles per hour)	25	30	35	40	45
Stopping Sight Distance* (feet)	155	225	285	***	***
Intersection Sight Distance - Left-Turn Movement From Stop*and** (feet)	280	365	425	***	***
Intersection Sight Distance - Right-Turn From Stop*and** (feet)	240	315	370	***	***
Minimum Horizontal Radius (Normal Crown) (feet)	200	430	675	***	***
Minimum K value for Crest Vertical Curves	11	24	37	***	
Minimum K value for Sag Vertical Curves	20	43	58	***	
Maximum Longitudinal Grade	10 percent				
Maximum Longitudinal Grade within 125 feet of intersection (measured from intersecting street nearest edge of pavement of travel way)	5 percent				
Intersection Angle Range	75 to 105 degrees				

\* Values will need to be adjusted for grades of more than +/- 3 percent

\*\* Values to be adjusted for streets with more than two total lanes; measurements to be taken 14.5' from travel lane

\*\*\* Refer to latest edition of American Association of State Highway and Transportation Officials *A Policy on Geometric Design of Highways and Streets*

The minimum posted speed in any subdivision without written authorization from the Planning or Engineering director shall be 25 mph.

Provisions of adequate stopping sight distance may require use of larger K values than the minimums listed above. The Town of Waxhaw reserves the right to prescribe more stringent sight distance standards and/or means to achieve adequate sight distance than those listed above. Recordation of sight distance easements may be required on plats prior to approval.

The minimum tangent distance between two horizontal curves is 50 feet. Longer distances may be needed based on the specifics of the roadway design.

Minimum curb and right-of-way radius measured from face of curb/edge of pavement (when intersecting streets have different classification, use the more restrictive):

- Residential Local Street – 20 feet
- Residential Local Street to Residential Alley – 10 feet
- Residential Collector – 25 feet
- Retail/Mixed-Use Local – 25 feet
- Retail/Mixed-Use Collector – 25 feet
- Industrial Local and Collector – 35 feet

For minimum intersection separation, use the following criteria:

- Along local streets – 125 feet
- Along collector streets – 250 feet
- Along thoroughfares – to be determined by Town and/or NCDOT on a case-by-case basis

Intersection offsets/separation from a thoroughfare, at signalized intersections, or at intersections that may become signalized in the future may need to be greater than these minimums and will be determined by the Town and/or NCDOT on a case-by-case basis.

Design criteria for arterial streets shall be established jointly by the Town Engineer and the NCDOT on a case-by-case basis using the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highway and Streets* and/or NCDOT *Roadway Design Manual*.

Intersection corner easements – A minimum thirty-five (35) foot x thirty-five (35) foot sight triangular easement (measured along right-of-way lines) shall be provided at each intersection corner where any street type intersects a collector or thoroughfare. A minimum fifteen (15) foot x fifteen (15) foot triangular sight easement (measured along right-of-way lines) shall be provided at each intersection corner where two local streets intersect. An additional ten (10) foot x seventy (70) foot triangular sight easement shall be provided at intersections connecting to NCDOT maintained roadways (measured along right-of-way lines) **and at intersections of town roads with speed limits exceeding 25 mph**. Driveways (no formal right-of-way) to serve a single project may be required to provide triangular sight easements as determined on a case by case basis. Other triangular sight easements or sight distance requirements may be required by the NCDOT or the Town at all intersections.

#### Sidewalks/Trails

1. Planting strip adjacent to sidewalk shall be graded to one quarter inch per foot (min.) up to one and one quarter inch per foot (max.), except where excessive natural grades make this requirement impractical. In such cases, the Town Engineer may authorize a suitable grade.
2. Sidewalk widths shall be a minimum of five (5) feet unless otherwise specified.
3. **Directional access ramps are required where sidewalks intersect curbing at any street intersection and curbed driveway connections.**

4. Greenway and trail cross-sections that differ from the standards shall be reviewed by the Zoning administrator or Town Engineer on a case-by-case basis.

#### Guardrail/Handrail

1. A guardrail or handrail shall be installed near commercial driveways, parking stalls, pedestrian paths or sidewalks parallel to and within 20 feet of a slope steeper than 3:1 or an elevation change greater than 8 feet.
2. This requirement is not intended for recreational walking trails which shall be considered on a case by case basis.

#### Driveways

Refer to Appendix – H, the Policy for Driveway Design & Construction.

#### Roundabouts

Refer to the *Manual on Uniform Traffic Control Devices* (MUTCD) for roundabout signage and pavement markings.

### C. Storm Drainage and Grading

1. In addition to this manual, all storm drainage design shall conform to the standards and specifications as provided in the *Town of Waxhaw Storm Water Design Manual*, and *NCDOT Standards Specifications for Roads and Structures*. If conflicts occur, the more restrictive standard shall govern.
2. Highway rated reinforced concrete or HDPE (HDPE used for 15-36-inch pipe) shall be used in all storm drain applications. Standard minimum pipe diameter shall be fifteen (15) inches and eighteen (18) inches for cross drain culvert. Culverts sixty (60) inches in diameter or greater may be Corrugated Aluminized Metal Pipe (CAMP) or aluminum with a minimum fourteen (14) gauge metal subject to approval of the Town Engineer.
3. The minimum cover for all pipes is two (2) feet measured from the final surface. Special applications for less than two (2) feet of cover will be reviewed and approved by the Town Engineer individually. The maximum cover for storm drainage pipes shall at a minimum comply with the requirements of the *NCDOT Roadway Design Manual*, Part I, Section 5, and *Drainage Design*. Storm pipe design that exceeds these criteria may be approved at the discretion of the Town Engineer.
4. All storm drain structures over three (3) feet six (6) inches in height must have steps in accordance with standard details set forth in this manual.
5. All graded banks and slopes on residential development shall be at a maximum of three (3) feet horizontal to one (1) foot vertical (3:1) and not to exceed ten (10) feet vertically without terracing. No exceptions to be granted to residential properties without written authorization from

the Town Engineer. Non-residential development may be graded with a maximum of two (2) feet horizontal to one (1) vertical (2:1) and not exceed ten (10) feet vertically without terracing. Non-residential slopes exceeding 3:1 shall be designed by a Professional Geotechnical Engineer. Slopes exceeding 2:1 must be reviewed by the Town Engineer and approved on a case by case basis. Any pond or Stormwater Control Measure (SCM) with a side slope bank greater than 3:1 vertical shall be provided with fencing. Slopes for access drives to any pond or SCM shall not exceed 5:1.

6. Adequate storm drainage shall be provided throughout the development by means of storm drainage pipes or properly graded channels. All pipes shall be of adequate size and capacity, as approved by the Town Engineer, to carry all storm water in its drainage area. **Gutter Spread shall not exceed 6 feet for the 10-year 24-hour storm event.** A 24-inch vertical separation shall be provided between storm sewer and sanitary sewer lines or ferrous pipe specified.
7. In accordance with the Town Zoning Ordinance, the Town Engineer or duly authorized designee shall review the drainage plan for compliance with the standards contained in the current edition of the *Town of Waxhaw Engineering Design & Construction Standards Procedures Manual* and the *Town of Waxhaw Storm Water Design Manual* and all other relevant and appropriate standards established by the Town Engineering Department.
8. Extended roof drains shall extend to a vegetated surface not less than 3 feet from sidewalk, driveway or other impervious surface.
9. Sub-surface drainage shall be provided where the ground water level is likely to be near the surface. In capillary soils, the water level should be four (4) to six (6) feet below the surface to prevent the rise of moisture into the subgrade. Subdrains shall be used to lower ground water in low areas in the street.
10. All Storm Drainage Easements must extend down stream of flared end sections to an appropriate property line or buffer. Overlapping of storm drainage easements shall be approved by the Town Engineer on a case-by-case basis.
11. Storm Drainage Easements shall be provided for all storm drainage pipes and **swales** and shown on site plans, construction plans and plats with widths specified per detail 314.1. The following note shall be placed on all grading plans and plats; "*The purpose of the storm drainage easement (SDE) is to provide storm water conveyance. Buildings are not permitted in the easement area. Any other objects which impede storm water flow or system maintenance are also prohibited.*"
12. In areas where the Floodway Regulations are applicable, the Future Conditions Floodplain 1% Annual Chance Fringe Line, Existing FEMA Floodplain 1% Annual Chance Fringe Line, FEMA Floodway Boundary, and FEMA 0.2% Annual Chance Floodplain Boundary shall be shown on the preliminary plan and the final plat. An application for a Floodplain Development/Zoning Permit shall be submitted in accordance with the requirements set forth in the Town/County Floodway Regulations.

### 13. Retaining Walls

- a. A retaining of any height is considered an accessory structure and shall meet the provisions of the building code. **All retaining walls require permitting** review by the Town of Waxhaw.
- b. **A 5-foot side or 20-foot rear setback shall be provided from the foundation of the principal structure for any commercial wall proposed in a residential subdivision. The required setback includes separation from geogrid.**
- c. Engineering review and professional design is required for all Residential walls retaining greater than 48 inches of unbalances fill.
- d. Residential retaining walls shall meet the requirement of 2018 North Carolina Residential Code R404.4.
- e. For residential retaining walls unbalanced fill height may be measured up to **4 feet above or below** the wall.
- f. Any retaining wall on a residential site that crosses over an adjacent property line regardless of height requires professional engineering design.
- g. Retaining walls that support buildings and their accessory structures shall be designed by a professional engineer.
- h. Engineering review is required for all commercial/non-residential walls retaining greater than 5 feet of fill.
- i. **Retaining wall plans shall include proposed height or top and bottom of wall elevations at each bend or at 50-foot increments along the full length of the wall, whichever is the lesser.**
- j. Non-residential Retaining walls shall be designed and constructed to meet 2018 North Carolina Building Code Section 1807.
- k. For Non-residential walls unbalanced fill height is measured up to 50 feet horizontally behind the proposed wall.
- l. All engineered walls shall be designed with a minimum safety factor or 1.5 against lateral sliding or overturning.
- m. **A maintenance easement shall be provided for the wall and full length of reinforcement grid. A minimum 10-foot maintenance easement shall be provided for all retaining walls.**
- n. **Developments with multiple retaining walls shall provide a retaining wall tracking table. The table shall include the wall name/number, approximate length, maximum height, and approximate location i.e adjacent lot number.**

## D. Utilities

Refer to Standard *200.0-Utility Layout Typical Section* for placement of utility in new subdivisions.

Avoid placement of sewer manholes in gutter pans, wheel paths, wheelchair ramps, and over stormwater lines.

Avoid placement of water lines under roadway pavement.

Water valves shall not be placed in curbing.

## E. Street Lighting

### 1. Light Spacing

Streetlights shall be spaced not to exceed two-hundred (200) feet **for single family residential development, or 120 feet for townhome and multi-family developments** as measured down the centerline of road, to be eligible for transfer to the Town street lighting account. Streetlights shall also be located at all intersections, **at the end of each cul de sac and street stub**, and mid-block locations. **A lighting plan shall be developed to identify the envelope of 0.5 foot candles for each light. Alternative spacing and additional lighting may be required to provide adequate lighting in the Right of Way.**

### 2. Major Pedestrian Areas within Public Rights-of-Way

If an engineering evaluation indicates major pedestrian activities exist within public right-of-way, the Engineering Department may determine that special lighting should be specified. A lighting plan and cost estimate for the special lighting would be developed, and if funds are available to implement the plan, then the Engineering Department would coordinate the authorization and installation of the special lighting plan.

## F. Signage

All regulatory, warning, and guide roadway signage shall be consistent with the *Manual on Uniform Traffic Control Devices (MUTCD)*, the *North Carolina Supplement to the MUTCD* or as specified in this manual. All street name markers are also to be designed in accordance with 700 series standard drawings. All street name markers shall be nine (9) inch tall extruded aluminum blades and utilize high intensity white prismatic reflective sheeting.

## G. Landscaping

Refer to Section 8.3 of the Town of Waxhaw Land Development Code regarding landscaping requirements.

While landscaping can be installed at street intersections, it shall not block the sight distance of vehicles at the intersection. Sight distance for an intersection shall be calculated in accordance with Section II. B. of this manual. Trees should not be planted within forty (40) feet of an intersection radius return measured along the street along the main or side street of intersections or commercial development driveways.

Trees shall not be planted in permanent drainage easements or within ten (10) feet of a masonry drainage structure. (This does not apply to Stormwater BMP's.)

#### H. Cluster Box Units (CBU's)

Mail cluster box units shall be placed outside of the line of sight (determined by intersection sight distance measurements), sight distance triangles and intersection corner easements. They shall not be placed between the subdivision entrance and its first street intersection. It is best to avoid placing CBU's on the main entrance road to a subdivision, however, special cases may apply.

When locating CBU's near on-street parking, do not place units directly adjacent to the on-street parking. CBU's shall be behind the sidewalk in such cases.

When placing CBU's within the green zone, face of units shall be oriented perpendicular to the street.

Access easements shall be required for all CBU's located outside of the right-of-way and/or common open space. See Standard Detail 719.1 for CURB RAMP FOR CLUSTER BOX UNITS.

The ultimate goal in determining locations for mail cluster box units is to avoid placing the CBU in any way which encourages driving on the wrong side of the street and/or hinders handicap accessibility. The above standards are included to supplement the requirements of the United States Postal Service and shall be followed in addition to USPS standards.

#### I. Traffic Calming

The Town of Waxhaw's goal is to provide safe and pedestrian friendly streets for all of the residents of the town while balancing the need for an efficient transportation network. As part of that goal we understand that traffic must be able to flow freely and to do so as safely as possible. The Traffic Calming Policy (Appendix J) provides avenues for citizens to report and for staff to review concerns on existing roads. The policy shall also be implemented during development review to identify locations of potential traffic concerns and provide strategic measures to design new roads before they are accepted as part of the existing network.

Designers should incorporate traffic calming features into proposed plans to promote driver behaviors that are complementary to street classification and design speed. The Town Engineer may require the implementation of these measures as a condition of plan approval.



### III. Specifications and Special Provisions

#### A. General Notes

The following specifications and special provisions are intended to be used in conjunction with *Town of Waxhaw Standard Drawings, NCDOT Roadway Standard Drawings, and NCDOT Standard Specifications for Roads and Structures* for all development within the Town of Waxhaw unless otherwise directed by the Town Engineer.

1. Unless otherwise specified in this manual, **all work and materials shall conform to the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.**
2. All backfill material shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material, coal, or other objectionable material. Said material shall be capable of being compacted by mechanical means and the material shall have no tendency to flow or behave in a plastic manner under tamping blows or while proof rolling.
3. Materials deemed by the inspector as unsuitable for backfill purposes shall be removed and replaced with select backfill material.
4. Compaction requirements shall be attained by the use of mechanical compaction methods, in eight (8) inch lifts, and shall be placed loose and thoroughly compacted into place to 95% of Standard Proctor, unless specified otherwise.
5. ALL concrete used in the public right-of-way for streets, curb and gutter, sidewalks and drainage structures, etc. shall have a minimum compressive strength of 3600 PSI at twenty-eight (28) days. This requirement shall be provided regardless of any lesser compressive strength specified in the *North Carolina Department of Transportation Standard Specifications for Roads and Structures*. The contractor shall prepare concrete test cylinders in accordance with Section 1000 of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures* at the direction of the project inspector. All equipment and cylinder molds shall be furnished by the contractor. It shall be the responsibility of the contractor to protect the cylinders until such time as they are transported for testing. Testing for projects shall be performed by an independent testing lab, at no cost to the Town. The contractor shall provide equipment and perform tests on concrete for a maximum slump and air content as defined in Section 1000 of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures*. These tests shall be performed at a frequency established by the inspector. Materials failing to meet specifications shall be removed by the contractor.
6. Concrete or asphalt shall not be placed until the air temperature measured at the location of the paving operation is at thirty-five (35) degrees Fahrenheit and rising by 10:00 a.m. Concrete or paving operations should be suspended when the air temperature is forty (40) degrees Fahrenheit and descending. The contractor shall protect freshly placed concrete or asphalt in accordance with Sections 420 (Concrete Structures), 600 (Asphalt Bases and Pavements), 700 (Concrete Pavements And Shoulders), and Division 08 (Incidentals) of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures* when the air temperature is at or below thirty-five (35) degrees Fahrenheit and the concrete has not obtained an age of seventy-two (72) hours.

7. Plant all street trees in the middle of the planting strip unless otherwise noted on the standard detail.

#### Grading

1. Proposed street rights-of-way shall be graded to their full width for ditch type streets and a minimum of eight (8) feet behind the curb for curb and gutter sections.
2. Fill embankments shall be constructed in accordance with section 235 of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures* and placed in successive lifts not to exceed more than six (6) inches in depth for the full width of the cross-section, including the width of the slope area. No stumps, trees, brush, rubbish or other unsuitable materials or substances shall be placed in the right-of-way. Each successive six (6) inch layer shall be thoroughly compacted by the sheepsfoot tamping roller, ten (10) ton power roller, pneumatic-tired roller, or other methods approved by the Town Engineer. Embankments over and around all pipe culverts shall be of select material, placed and thoroughly tamped and compacted as directed by the Town Engineer or his representative.

#### Roadway Base

1. All roadways shall be constructed with a base course as detailed on the applicable *Town of Waxhaw Standard Detail Drawing*.
2. The material for the aggregate base course (ABC) shall be in conformance with Section 520 – Aggregate Base Course of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures*.
3. An asphalt concrete base course, as detailed on the *Standard Detail Drawing* may be substituted in lieu of an aggregate base course and shall be in accordance with all applicable articles of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures*.
4. Asphalt concrete base course (ACBC) shall be used for widening strips less than five (5) feet in width.

#### Roadway Intermediate and Surface Course

1. Plant mixed asphalt shall conform in all respects to Section 610 of the *NCDOT Standard Specifications for Roads and Structures*.
2. The final one and one half (1.5) inch lift of asphalt surface course for residential subdivision streets shall be withheld until a minimum of eighty (80) percent of the development is occupied (occupied means a certificate of occupancy has been issued) (All documentation to be provided by the developer and approved by the Town Engineer or designee). All known base failures shall be repaired prior to application of the final one and one half (1.5) inch lift of asphalt surface course.
3. The Town Engineering Department shall be given at least a forty-eight (48) hour notification to inspect the first lift of surface course deficiencies. Prior to application of the final layer of asphalt, all deficiency repairs are to be monitored and accepted by the Town Engineer or designee.

4. The Town Engineering Department shall be notified prior to using recycled plant mixes.
5. Failure to meet any of the requirements of this manual may result in the delay or prevention of street acceptance by the Town of Waxhaw or NCDOT.

### Sidewalks and Driveways

1. Sidewalks shall be constructed with concrete having a minimum compressive strength of not less than 3600 P.S.I. concrete. The sidewalk shall be at least six (6) inches thick where sidewalk crosses a driveway and at least four (4) inches thick in all other locations. The subgrade shall be compacted to ninety-five (95) percent of the maximum density obtainable with the Standard Proctor Test. The surface of the sidewalk shall be steel trowel and light broom finished and cured with an acceptable curing compound. Tooled joints shall be provided at intervals of not less than five (5) feet and expansion joints at intervals of not more than forty-five (45) feet. The sidewalk shall have a lateral or cross slope of one-quarter (1/4) inch per foot.
2. Planting strip adjacent to sidewalk shall be graded to one-quarter (1/4) inch per foot (min.) up to one and one-quarter (1 1/4) inch per foot maximum, except where excessive natural grades make this requirement impractical. In such cases, the Town Engineer may authorize a suitable grade.
3. Sidewalk widths shall be a minimum of five (5) feet unless otherwise specified.
4. Approval of sidewalk construction plans must be obtained as part of the plan review process. A recorded permanent public sidewalk easement is required for all sidewalk located outside public right-of-way; the width of the easement shall be specified by the Town. The sidewalk easement must be recorded with the Union County Register of Deeds prior to issuance of a certificate of occupancy for the corresponding building(s).
5. Accessible ramps are required where sidewalks intersect curbing at all street intersections and curbed driveway connections.

### B. 100 Series Drawings – Miscellaneous Concrete Infrastructure

Drawings in this series include details for curb and gutter, sidewalks, driveways, accessible ramps, culvert crossings, and street tapers. The following list provides information in addition to that included in the standard drawings in this series.

1. All curb and gutter shall be backfilled with soil approved by the Inspector after three (3) days of cure time to prevent erosion. All curb and gutter shall be backfilled no later than forty-eight (48) hours after the three (3) day cure time.
2. All concrete shall be cured with one hundred (100) percent Resin Base, white pigmented curing compound which meets ASTM Specifications C-309, Type 1, applied at a uniform rate at one (1) gallon to four-hundred (400) square feet within twenty-four (24) hours of placement of the concrete.

3. Straight forms shall not be used for forming curb and gutter in curves.
4. All excess concrete on the front edge (lip) of gutter shall be removed when curb and gutter is poured with a machine.

#### C. 200 Series Drawings – Street Sections

Drawings in this series include details for street typical sections including pavement design, cul-de-sacs, parallel parking space location/layout, alleys, and hammerheads.

1. All asphalt cuts shall be made with a saw or milling machine when preparing street surfaces for patching or widening strips.
2. All subgrade shall be compacted to one-hundred (100) percent of the maximum density obtainable with the Standard Proctor Test to a depth of eight (8) inches, and a density of ninety-five (95) percent Standard Proctor for depths greater than eight (8) inches. All tests shall be performed by developer at no cost to the Town.
3. Paper joints shall be used to seal the ends of an asphalt mat so that future extensions can be made without causing rough joints.
4. When placing asphalt against existing surfaces, a straight edge shall be used to prevent “humping” at that location.
5. Stone shall be primed if paving is not complete within seven (7) days following stone base approval.
6. Surfaces shall be tacked when asphalt is being placed over existing asphalt streets or adjoining concrete, storm drain and sanitary sewer structures.
7. Sweeping of the stone base and/or application of a tack coat may be required near intersections. These requirements will be established by the Town/NCDOT Inspector based on field conditions.
8. A canvas cover or other suitable cover shall be required for transporting plant mix asphalt during cool weather when the following conditions are present:
  - a. Air temperature is below sixty (60) degrees Fahrenheit.
  - b. Length of haul from plant to job is greater than five (5) miles.
  - c. Other occasions at the Inspector’s discretion when a combination of factors indicates that material should be covered in order to assure proper placement temperature.
9. Roadside ditches shall conform to NCDOT standards unless otherwise specified by Town along Town maintained roads.

#### D. 300 Series Drawings – Storm Drainage

Drawings in this series include NCDOT standards approved for use, catch basins, wingwalls, riprap aprons, flared end section pipe, riprap plunge pools, trench drains, paved ditches, subdrains, overlapping of easements, minimum drainage easements, and grading at drop inlets. The following list provides information in addition to that included in the standard drawings in this series.

1. All concrete shall be at least 3600 PSI. Prior approval from the Town Engineer shall be obtained in order to use pre-cast storm drainage structures in any street right-of-way.
2. Concrete pipe used within the street right-of-way shall be a minimum of Class III Reinforced Concrete Pipe, with a minimum diameter of fifteen (15) inches (eighteen (18) inches minimum on cross drain culverts). See Design Criteria Section C for additional information. Installation of Class IV or higher concrete pipe shall be in Accordance with *NCDOT Standard Specifications* and be identified on the As-Built Plan. The Town Inspector shall be given documentation and notification of this information prior to construction.
3. Concrete mortar joints shall be used for joining all concrete pipes. The pipe shall be clean and moist when mortar is applied. The lower portions of the bell or groove shall be filled with mortar sufficient to bring the inner surface flush and even when the next joint is fitted into place. The remainder of the joint shall then be filled with mortar and a bead or ring of mortar formed around the outside of the joint. The application of mortar may be delayed until fill is completed when the pipe is larger than thirty (30) inches.
4. Preformed joint sealer, which conforms to AASHTO specification M-198 for Type B flexible plastic gaskets, may be used in lieu of the mortar joining method.
5. Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.
6. All new storm drain pipe installations shall be inspected with a video camera and reviewed with the Town Engineer or representative. The video camera and methods must be pre-approved by the Town Engineer or representative.

#### Installation of Reinforced Concrete, HDPE, and Corrugated Metal Pipe

1. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means and shall have no tendency to flow or behave in a plastic manner under tamping blows or while proof rolling.
2. Materials deemed by the Engineer as unsuitable for backfill purposes shall be removed and replaced with select backfill material.
3. Backfilling of trenches shall be accomplished immediately after the pipe is laid. The fill around the pipe shall be placed in layers not to exceed eight (8) inches, each layer shall be thoroughly compacted to ninety-five (95) percent of the maximum density obtainable with the Standard Proctor Test. A density of one-hundred (100) percent Standard Proctor is required for the top eight (8) inches.

4. Compaction requirements shall be attained by the use of mechanical compaction methods. Each layer of backfill shall be placed loose and thoroughly compacted in place.

#### E. 400 Series Drawings – Stormwater BMP

Drawings in this series include bioretention, flow splitters, wetponds, wetlands, grass swales, grass channels, infiltration ditches, observation wells, buffer strips, sand filters, and level spreaders.

#### F. 500 Series Drawings – Erosion Control

Drawings in this series include sediment traps, skimmers, pipe slope drains, silt ditches/fences, inlet protection, check dams, construction entrances, filter berm basins, dewatering, stream crossings, slope stability, seeding schedules, construction within creek banks, baffles, embankments, and brick storm structures.

1. The contractor shall do that which is necessary to control erosion and to prevent sedimentation damage to all adjacent properties and streams in accordance with the appropriate NCDWQ *Regulations for Sedimentation and Erosion Control*, and Town *Erosion and Sedimentation Control Ordinance*. The Town Ordinance, Permit Application forms, and Plan Review Checklist can be found in the Appendix, and on the website by following the link below:

[EROSION CONTROL PROGRAM INFORMATION](#)

#### G. 600 Series Drawings – Trees

Drawings in this series include tree plantings/protection, tree pits, irrigation, valve boxes shrub plantings, medians, root crown depths, planting notes, bridging tree roots, asphalt curb placement at existing trees, and rock chimneys.

#### H. 700 Series Drawings – Miscellaneous

Drawings in this series include concrete control monuments, handrails, street name signs, end of road devices and markers, parking standards, accessible parking signage, roundabout signage, emergency vehicle median crossovers, bicycle racks, bicycle lockers, and Cluster Box Units.

#### I. Traffic Control

The contractor shall maintain two-way traffic at all times when working within existing streets. The contractor shall place and maintain signs, danger lights, and barricades and furnish watchmen or flagmen to direct traffic in accordance with the latest edition of the *Manual on Uniform Traffic Control Devices (MUTCD)*.

Lane restrictions limiting the Contractors work to certain times of the day and days of the week may be imposed at the discretion of the Town Engineer. See section D & E of the *Utility Pavement Cut Policy* in the Appendix.

## References

1. North Carolina Department of Transportation, most recent edition, Standard Specifications for Roads and Structures.
2. North Carolina Department of Transportation, most recent edition, Roadway Standards Drawings.
3. Town of Waxhaw Storm Water Design Manual.
4. American Association of State Highway and Transportation Officials most recent edition, A Policy on Geometric Design of Highways and Streets.
5. North Carolina Department of Transportation, Roadway Design Manual, latest edition.
6. North Carolina Department of Environmental Quality most recent edition, Erosion and Sediment Control Planning and Design Manual.
7. Manual of Uniform Traffic Control Devices for Streets and Highways, Federal Highway Administration, latest edition.