



CITY OF BISMARCK ENGINEERING DEPARTMENT

DESIGN GUIDELINES

Effective January 2024

This document was compiled to provide a guide to designing new developments for grading, water, sanitary sewer, storm sewer, and paving. It includes information from the City of Bismarck Ordinances, the latest version of Construction Specifications for Municipal Public Works Improvements (Specifications), and additional resources and best practices. It is not intended to be all inclusive, but a reference.

- **DATUM**

- Based on the City of Bismarck monuments and adjusted to ground distance.
- Horizontal Datum shall be NAD 83 (2011), North Dakota South Zone.
- Vertical Datum shall be NAVD 88 Geoid 18.
 - To better align with recent flood plain mapping that will become effective in 2024 and into the foreseeable future, City-wide all plans will now be in NAVD 88 datum.
- Drawing units shall be in international feet.
- See the City of Bismarck Survey Control Monuments Book posted on the City Engineering Department website.

- **CONSTRUCTION SPECIFICATIONS AND STANDARD DETAILS**

- See the latest edition of the City of Bismarck Construction Specifications for Municipal Public Works Improvements, posted on the City Engineering Department website.

- **STANDARDS, PROCEDURES, & REQUIREMENTS FOR CAD DRAWINGS**

- See City of Bismarck CAD Standards, posted on the City Engineering Department website.

- **GRADING**

- Street widths, grades, and intersections shall be designed per the information provided below.
- Grading in the right of ways shall follow the pertinent Sections and Detail Drawings from the Specifications.
- Any grading that includes current or future public right of way is subject to a grading permit from the Engineering Department.
- All grading requires a Large Site Construction Stormwater Management Permit from Public Works – Stormwater Division.

- **STATIONING ALIGNMENTS**

- For each street or utility alignment, the overall stationing shall follow a standard of increasing in stationing from the south to the north or from the west to the east.
- If an alignment changes direction, the stationing can continue if following an eastbound to northbound or northbound to eastbound direction.
 - If the alignment changes from an eastbound to southbound or from a northbound to westbound direction, a station equation and two separate alignments will be required, following the requirements above, with a labeled station equation at the alignment intersection.
- Within a plan set, the station range values of any two separate alignments may not overlap.
- Choose beginning stationing such that negative stations are avoided.
- Continuation of an alignment stationing from a previous plan set is allowable, if it adheres to the criteria above.

- **PLAN SHEET ORIENTATION**

- Following the stationing requirements above, orientate plan views such that stationing increases from left to right on the sheet, with generally either a north up or north right direction to the sheet.

- **WATERMAINS**

- Watermain location:
 - Generally, west or north side of street, with some exceptions.
 - 11.5' from property line in 26'/54' R/W = 2.5' behind face of curb.
 - 11.5' from property line in 32'/60' R/W = 2.5' behind face of curb.
 - 11.5' from property line in 38'/66' R/W = 2.5' behind face of curb.
 - 12' from property line in 44'/80' R/W = 6' behind face of curb.
 - 12' from property line in 48'/80' R/W = 4' behind face of curb.
- Watermain size:
 - Min. 8" in R5/R10 zoning districts.
 - Min. 12" in all other zoning districts.
 - Master plan or fire flow needs may dictate larger sizes.

- Min. 7.5' of cover to top of pipe.
- Hydrant size:
 - 6" leads and hydrants in R5/R10 zoning districts.
 - 8" leads and hydrants in all other zoning districts.
- Hydrant spacing:
 - Max. 400' in R5/R10 zoning districts.
 - Max. 300' in in all other zoning districts.
- Hydrant location:
 - At each intersection along streets.
 - If spacing limits require a hydrant between intersections, place at a lot line when possible to minimize impacts to parking spaces and driveways.
 - Within the boulevard to allow clearance from future sidewalk.
Typically:
 - Minimum of 6.5' from property line in R5/R10 zoning.
 - Minimum of 7.5' from property line in all other zoning districts.
 - Provide temporary end-line hydrants for flushing at any ends of mains.
- Hydrant extensions
 - Avoid if possible.
 - Extensions shall be furnished and installed by project contractor.
 - Extensions should be min. 12" and max. 24" in length.
- Newer hydrants may be reset.
 - Hydrants older than 15 years should be replaced.
 - Any hydrant permanently removed from service shall be salvaged to the Public Works department.
- Valve spacing:
 - 800' max. in R5/R10 zoning districts, or so that no more than 20 service connections are affected by a shut down.
 - 500' max. in all other zoning districts.
 - 1300' max. on transmission mains.
- Valve locations:
 - At start of each new connection to an existing main.
 - On at least 2 branches of a tee or 3 branches of a cross.
 - As close as practical to adjacent tee, crosses, etc.
 - On all hydrant leads
 - Placed a min. 2' from hydrant.
 - Closed valve or pressure reducing valve at any pressure zone change.

- Bends
 - Minimize use of horizontal and vertical bends when possible.
 - To maintain standard watermain location from property line, include horizontal bends where R/W geometry exceeds manufacturer's allowable pipe deflection radii.
- Air release valve and manholes:
 - Air releases are required at any high points in a proposed new line.
 - Avoid high points when possible, without significantly increasing depth of watermain.
- Service lines:
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 - Min. (1) 1" service line per lot in in R5/R10 zoning districts.
 - Reviewed on case-by-case basis for number and sizing in all other zoning districts.
 - Curb stop invert 7.5' below top of curb elevation.
 - Curb stop to be placed inside the R/W, approximately 2.5' from property line.
 - Service lines over 2" shall place valves in either the boulevard or street adjacent to the watermain.
- Provide easements for any mains extending beyond plat boundaries.
- **SANITARY SEWER**
 - See City of Bismarck specifications Section 900 for wall thickness by depth.
 - Sanitary size:
 - Minimum main size of 8" in R5/R10 zoning.
 - Minimum size of 10" in all other zoning districts.
 - Account for future upstream minimum size needs.
 - Master plan or sewershed needs may dictate larger sizes.
 - All runs shall end at a manhole.
 - Cleanouts may not be substituted for manholes.
 - End-line manholes should have a booted and plugged invert to allow for future extensions. No pipe should be stubbed out.
 - Manholes max. spacing should be approx. 400'.
 - Sanitary sewer shall be min. 10' horizontally from a watermain.
 - Invert at highest point of gravity system shall be a min. of 5' below top of curb.
 - Service lines:
 - Max. of 1 service line per lot.
 - Min. service size of 4" in R5/R10 zoning.
 - Min. service size of 6" in all other zoning districts.

- Service lines shall connect via a wye to the main.
 - No service line connections into City manholes.
- Service line invert at the property line generally should not be deeper than 11'.
- Provide easements for any mains extending beyond plat boundaries.
- **STORM SEWER**
 - See additional requirements in the Stormwater Design Standards Manual (SWDSM), posted on the Engineering Department website.
 - Storm sewer mains shall not run under or behind curb & gutter due to potential conflicts with watermains, future streetlights, and other utilities.
 - Main line storm sewer shall run from MH to MH, with inlets connected to MH's.
 - Do not run storm sewer mains from inlet to inlet.
 - Top of storm pipe shall be a minimum of 2' below top of subgrade.
 - Ensure manholes have adequate depth to install standard castings.
 - Inlet location:
 - Do not place inlets in intersection radii or where they will interfere with pedestrian curb ramps.
 - Inlets that are between intersections should be placed at a property line to reduce interference with future driveway locations.
 - Provide easements for any mains extending beyond plat boundaries.
- **PAVEMENT, CURB & GUTTER**
 - All new pavements shall have a min. of 6" of gravel/blended base.
 - Use of cement stabilization under asphalt requires soil classification & a mix design.
 - Low volume streets (residential, local commercial, etc.) typically receive FAA 41 mix.
 - Larger traffic volume streets typically receive FAA 43 mix.
 - Min. asphalt thicknesses:
 - Alleys – 4"
 - Residential – 4.5"
 - Collector – 5" (shall include design)
 - Commercial – shall be designed as a minor arterial.
 - Principal & minor arterial – by design only.
 - Preference for arterials to be PCCP.
 - Streets in industrial zoned areas will be PCCP.
 - If no design provided, minimum of 8" PCCP on 12" of gravel/blended base.

- Curb & gutter streets shall have min. running grade of 0.40%.
 - Ideally, running grade is 0.50% or higher.
 - Max. street grades vary by classification.
- Curb type:
 - Standard or mountable allowed in in R5/R10 zoning.
 - Standard only in all other zoning districts and R5/10 collector streets.
- On most low volume and low speed streets, any grade change of less than two percentage points between the in and out grades shall use a vertical inflection point.
 - Changes over 2 percentage points shall use a vertical curve.
 - Use vertical curves when speeds are anticipated to be over 45 MPH.
- Pavement crown shall be a 2.5%, typical.
 - Where curbs grades vary between right and left profiles, the higher curb will maintain a 2.5% cross slope to centerline, with the lower curb becoming a steeper cross slope.
 - Ensure any differences between curb grade elevations doesn't cause more than a 4% cross slope on low side of street.
- Intersection grades:
 - See Intersection Approach Grade Design Criteria below.
 - Typically, pedestrian crossings will be at the intersection. Ensure all grades allow for less than 2% cross slopes at pedestrian crossings.
- Street Width (from face to face of curb) by R/W width:
 - Residential streets:
 - 26' street on a 54' R/W
 - 32' street on a 60' R/W
 - 38' street on a 66' R/W
 - Collector street: 44' street on an 80' R/W.
 - Commercial or industrial streets: 48' street on an 80' R/W.
- Intersection radius sizes. If street widths vary, use the larger radius:
 - 26' street on a 54' R/W, use a 14' radius.
 - 32' street on a 60' R/W, use a 14' radius.
 - 38' street on a 66' R/W, use a 14' radius.
 - 44' street on an 80' R/W, use a 16' radius.
 - 48' street on an 80' R/W, use a 16' radius.
 - Commercial and Industrial areas, use a 30' radius.
- Intersections shall have a minimum of 1% and a max of 2% grade around the radius so as maintain drainage yet not to exceed the max. allowable ADA cross slope. Grade labels and flow direction arrows shall be shown on plans.

- New road closed signs are required on any dead-end street per standard details.
 - Regardless of age, existing road closed signs are to be salvaged to Public Works.
- Temporary turnarounds are required on dead end streets longer than 150', as measured from center of intersection to end of street.
- Cul-de-sac streets may not be longer than 750', as measured from the center of intersection to center of turnaround.
 - Min. cul-de-sac length of 230', as measured from center of intersection to center of turnaround.
 - Min. circular turnaround paved diameter of 96'.
- All new asphalt streets receive chip and fog seals.
- Pavement markings required on all collector and arterial streets.
 - Additional locations as directed by City Engineer.

INTERSECTION APPROACH GRADE DESIGN CRITERIA

INTERSECTION APPROACH CLASSIFICATION ¹	INTERSECTION APPROACH DISTANCE AND GRADES ²	
	MAXIMUM STREET GRADE	MINIMUM DISTANCE ³
Local ⁴	±3.0%	50 FEET
Collector ⁴	±3.0 %	100 FEET
Minor Arterial	±2.0 %	200 FEET
Principal Arterial	±1.5 %	300 FEET

- (1) Roadway classification is to be based on the current City of Bismarck Major Street Plan or the Functional Classification Map prepared by the North Dakota Department of Transportation. Definitions for Roadway Classifications can be found in the City of Bismarck Code of Ordinances Section 14-09-03.
- (2) Alternative Design based on projected traffic volumes from a traffic impact or operations study or another approved source to be approved by City Engineer.
- (3) Minimum distance measured from intersection radius point.
- (4) In commercially zoned areas, the local and collector roadway system shall be designed as a minor arterial unless a city approved traffic impact or operations study indicates otherwise.

• **ADA RAMPS**

- ADA ramps shall be installed with the paving project.
- ADA ramps each direction at intersections.



- Avoid single ramps for multi-directional use.
- ADA ramps that connect to a multi-use path should be 10' wide.
- Only one ADA ramp is required opposite a T-intersection.
 - It should be placed in a platted non-access area where least likely to interfere with a future driveway.
- **SIDEWALKS**
 - 6' wide in commercial, industrial, or multi-family residential areas.
 - Back of sidewalk placed at property line.
 - 4.5' wide in single family residential areas.
 - Back of sidewalk placed 0.5' from property line.
 - Back of sidewalk elevation to be set as 3% grade from top of curb.
 - Cross slope to be designed at 1.5% max, draining into R/W.
 - Install sidewalk along City-owned lots with adjacent paving project.