

A photograph of a tree-lined residential street. The road is paved and runs down the center, flanked by green lawns and mature trees with dense green foliage. Sunlight filters through the leaves, creating dappled shadows on the road. In the background, a white house with a dark roof is visible on the left, and another house is partially visible on the right.

# City of Cornelius Public Works Standards

Terry W. Keyes  
City Engineer  
3-13-20

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## Public Works Standards

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**Appendix A - Standard Details, Notes, and Guides**

**Appendix B – Revision History**

# Chapter 1 General

## 1.01 Philosophy

Few people realize developers construct most public infrastructure. Due to this fact, a city needs Public Works Standards to ensure infrastructure is consistent within a jurisdiction. Furthermore, standards are needed to ensure infrastructure is constructed in a way that does not impose excessive long-term maintenance costs on city residents and businesses.

The Cornelius Public Works Standards have the reduction of long-term maintenance costs as their primary objective. Secondary objectives are creating an attractive community and, in terms of streets, creating a safe environment for pedestrians and bikes, as well as motorized vehicles.

Finally, the standards are not intended to be onerous. Every effort is made to keep the standards simple and not overly regulatory. Creativity in designing infrastructure is encouraged, as long as the goal of minimizing long-term maintenance costs is preserved. If an engineer has a better way to approach a design issue than that allowed in these standards, Section 2.04 provides a relatively painless way to propose alternate designs.

## 1.02 Work Covered by these Standards

The standards cover the following types of work:

- a. Construction or reconstruction of City-owned infrastructure within the public right-of-way (ROW) or public easements
- b. Construction or modification of non-public infrastructure within public right-of-way or City-owned property
- c. Construction of stormwater quality treatment and stormwater quantity storage facilities
- d. Erosion control on all projects requiring an erosion control permit as defined by the Clean Water Services (CWS) Design and Construction Standards

## 1.03 Organization of Standards

The chapters of these standards correspond to the various facets of the public infrastructure, specifically, streets, water, sanitary sewer, drainage and erosion control, and parks. Appendix A contains Standard Details.

The reader will occasionally come across information in shaded boxes like this one in these Standards. This information is included to provide an explanation of the reasoning behind portions of the Standards.

#### 1.04 Using Standard Details

Designers are encouraged to use the standard details in Appendix A and those from Clean Water Services (CWS) in their construction plans. The City details are available on either the City's website or from the City Engineer. The Clean Water Services details are available on the CWS website.

City and CWS standard details that are used in construction plans should not be altered.

If the designer desires to alter a detail to better fit their situation, they should strip the City or CWS title block from the detail. Alternatively, the designer can use the standard detail with its City or CWS title block and cloud the changes they make to the detail. This allows the City to easily review the plans and proposed changes to the standard detail used.

#### 1.05 Definitions

<i>ANSI</i>	American National Standard Institute
<i>APWA</i>	American Public Works Association
<i>ASTM</i>	American Society of Testing and Materials
<i>AWWA</i>	American Water Works Association
<i>City</i>	City of Cornelius
<i>CWS</i>	Clean Water Services
<i>HMAC</i>	Hot mix asphalt concrete
<i>Lateral</i>	A sanitary sewer or storm sewer pipe serving a single property or business. Sanitary sewer and storm sewer laterals are private from the main line to the building.
<i>LIDA</i>	Low Impact Development Approach for handling stormwater runoff
<i>ODOT</i>	Oregon Department of Transportation
<i>ORS</i>	Oregon Revised Statutes
<i>Parkway Strip</i>	Parkway strips are the landscaped areas along streets, typically between the back of curb and the sidewalk.
<i>Pathway</i>	An off-street paved corridor for use by pedestrians and bicycles, which is 10 or more feet wide

<i>Services</i>	Services are water lines from the public water main thru the water meter. From just past the meter to the building, water service lines are private.
<i>Sidewalk</i>	An off-street paved corridor for use by pedestrians only, which is less than 10 feet wide
<i>TSP</i>	Transportation System Plan



## Chapter 2 Administrative Procedures

### 2.01 Adoption and Changes to Standards

These standards were reviewed and endorsed by the City's Public Works Advisory Board and the Cornelius Planning Commission. On July 18, 2016 the Cornelius City Council adopted these standards.

Major changes to these standards require City Council adoption. The City Engineer can implement minor technical changes and corrections.

### 2.02 Other Standards

For issues not addressed by these standards, the latest version of the *Oregon Standard Specifications for Construction* published by ODOT and APWA-Oregon shall govern.

### 2.03 Permitting

These standards are implemented through various types of approvals and permits, which are summarized below. A more detailed description of each permit and approval follows the summary.

Permit or Approval	When Needed	Examples
Erosion Control Permit	Projects disturbing a significant amount of ground and not covered by another permit or approval.	<ul style="list-style-type: none"> <li>• Single-family home construction</li> <li>• Subdivision grading prior to engineering plan approval</li> </ul>
Right-of-Way Permit	Work in the right-of-way that does not directly involve City-owned infrastructure.	<ul style="list-style-type: none"> <li>• Telecommunications work along roadways</li> <li>• Road and lane closures for various purposes</li> </ul>
Public Works Permit	Small projects involving only connections to public infrastructure or planting trees in the right-of-way.	<ul style="list-style-type: none"> <li>• Driveway construction</li> <li>• Water services</li> <li>• Sanitary and storm laterals</li> <li>• Street tree planting</li> </ul>
Engineering Plan Approval	Projects involving construction of new public infrastructure and required stormwater quality/quantity facilities.	<ul style="list-style-type: none"> <li>• Subdivisions</li> <li>• Commercial projects with stormwater quality facilities</li> </ul>

a. *Erosion Control Permit*

Erosion control is important because erosion can result in sediment entering the City's stormwater system and eventually the Tualatin River or Council Creek. Sediment in the storm system increases the City's maintenance costs and sediment in the Tualatin River or Council Creek impacts fisheries and other beneficial uses of these waterways.

If a project disturbs soil, it likely requires an erosion control permit. If a Right-of-Way Permit, Public Works Permit, or Engineering Plan Review approval is required for the work, erosion control requirements are typically written into those approvals and permits. However, if the work does not fall into one of those other permits or approvals, a separate Erosion Control Permit is required. The City Engineer or his designee issues Erosion Control Permits.

Projects exempt from an Erosion Control Permit and erosion control requirements are:

1. Work of a minor nature, providing all the following criteria are met:
  - The activity does not require a development permit or approval from the City; and
  - No land disturbance occurs within 100 feet of a stream, wetland, or other water body; and
  - The work involves the disturbance of less than 500 square feet of area where the slope is less than 20 percent or less than 50 square feet where the slope is 20 percent or greater; and
  - The combination of excavation and fill is less than 20 cubic yards.
2. Permits and approvals for which there is no physical disturbance to the surface of the land.
3. Activities that constitute accepted farming practices as defined in ORS 30.930 and 215.203.
4. Pavement maintenance including overlays where the pavement area is not expanded beyond the existing pavement boundaries and minor pavement patch work involving less than 500 square feet of area.

Projects disturbing more than one acre require a special type of erosion control permit called 1200-C or CN. These types of projects are well beyond the scope of a simple Erosion Control Permit and always require Engineering Plan Review approval.

b. *Right-of-Way Permit*

Construction projects in public right-of-way that do not involve improvements to the public infrastructure require a Right-of-Way Permit. These types of permits are typically required for private utility work in the public right-of-way. They are also needed when a person or organization wishes to close a portion of a street or restrict travel lanes.

The City Engineer or his designee approves Right-of-Way Permits. They are intended to ensure the public infrastructure is not harmed and the public is not seriously inconvenienced by the proposed work.

A Right-of-Way Permit may include approval conditions and erosion control requirements that must be met as part of the permit.

*c. Public Works Permit*

For small projects that involve merely connecting to the public infrastructure, e.g., a new driveway, sidewalk, water service, sanitary lateral, or storm lateral; or planting tree(s) in the public right-of-way, engineered plans are not required. Instead a Public Works Permit issued by the City Engineer or his designee shall be obtained. The Public Works Permit may include conditions of approval and standard drawings from these Standards defining how the work shall be performed.

*d. Engineering Plan Approval*

1. Large projects involving construction of public infrastructure, stormwater treatment, or extensive erosion control facilities require construction plans designed by a Professional Engineer (PE).
2. The City Engineer must approve these plans before construction of the facilities can commence. In many cases bonding for public infrastructure, stormwater treatment, and erosion control facilities is required before City approval of plans.
3. At the end of construction all projects that gain Engineering Plan Approval shall submit as-built drawings to the City Engineer of the public infrastructure constructed or modified by the project. As-built drawings shall be in PDF and AutoCAD digital form. In addition, maintenance bonding for public infrastructure will likely be required.

## **2.04 Deviations from the Standards**

Standards are great for the majority of situations. However, sometimes circumstances make use of these standards difficult or even bizarre. Also, a designer may have ideas of how the City's objectives can be better met using methods not covered by the standards. In these cases, a *Deviation from the Standards* is appropriate.

Deviations from the Standards are granted by the City Engineer after consultation with the Public Works Director, and when appropriate, the Community Development Director.

Requests for Deviations should include a description of the proposal, location where it will occur, and why it is appropriate. The Request for Deviation can be made in email form and will typically be approved or denied in email form.

Approved Deviations do not set precedent. If the Deviation makes sense and provides a better or alternative way to meet the objectives of these Standards, the Deviation eventually will be incorporated into the Standards.

## **2.05 Easements**

Easements for public water mains, sanitary sewers, storm drains, and maintenance roads to public facilities such as stormwater ponds, shall be dedicated to the City of Cornelius. These easements shall be a minimum of 20 feet wide.

On all new streets, an 8-foot wide Public Utility Easement (PUE) shall be dedicated along all public street right-of-ways, excluding alleys. This is for use by private utilities such as Portland General Electric (PGE) and telecommunications companies such as Frontier and Comcast.

## **2.06 Excavation near Public Infrastructure**

A licensed and bonded contractor experienced in excavation and public utilities is required for any excavation near existing public infrastructure in the public right-of-way or public easements.

## **Chapter 3 Water**

### **3.01 Materials**

- a. All new and replacement public water mains shall be class DR18 C900, except Class 52 Ductile Iron pipe may be used on short runs (18 feet or less) between valves, tees, crosses, and reducers.
- b. Hydrant assemblies shall use Class 52 Ductile Iron pipe to connect the gate valve to the hydrant and shall be installed as shown in Standard Detail W-1.

### **3.02 Valves & Fittings**

- a. Valves shall be resilient seated gate valves.
- b. Values are required on all pipes leaving a junction.
- c. All valves shall be Mueller brand.
- d. Valves shall be set as shown in Standard Detail W-2.

### **3.03 Alignment**

- a. Pipes should generally be laid in straight lines. However, the City Engineer may allow water lines to be angled at fittings as long as the angle does not exceed the manufacturer's recommendation.
- b. Water mains shall intersect at 90-degree angles.
- c. To the extent possible, water mains shall be located to avoid valve boxes being placed in the wheel path on streets.

### **3.04 Restraints**

- a. A minimum of three lengths of pipe shall be restrained at all water system dead-ends.
- b. Mechanical restraints shall be used on all tees, crosses, valves, and changes in pipe direction of more than 10 degrees. Field lock gaskets alone are insufficient to meet this requirement for mechanical restraints.
- c. Concrete thrust blocks shall only be used in special cases and when directed by the City Engineer or City's engineering inspector. When required, thrust blocks shall be installed in accordance with Standard Details W-3 and W-4.

### **3.05 Dead End Lines**

Dead end lines shall end at a hydrant or a 2" blow-off assembly as shown in Standard Details W-5 and W-6.

### **3.06 Installation and Services**

#### *a. General*

Installation of pipe shall follow pipe manufacture's recommendations and AWWA guidelines.

#### *b. New Water Main – Small Service Lines*

Water services 2-inch and smaller shall be installed in accordance with Standard Detail W-7.

The party constructing a new water main shall be responsible for constructing all 2-inch and smaller service connections. These connections include the connection to the main line, service, meter box, and curb stop. The City will set the meter.

Where service lines will be constructed for adjoining lots, the service lines shall be laid in the same trench, whenever possible, to minimize street cuts. The taps into the main line and the centerline of the meter boxes shall be a minimum of 24" apart. Service lines shall be a minimum of 12" apart.

#### *c. Existing Water Main – Small Service Lines*

The City will construct the connection to existing water mains for 2-inch and smaller services. These connections include the connection to the main line, service, meter box, and curb stop. The City will also set the meter.

#### *d. Large Service Lines and Fire Service Lines*

Construction of new service lines, greater than 2-inches in size, and fire service lines are the responsibility of the developer or property owner.

### **3.07 Tracer Wire**

#### *a. Services*

12-gauge copper tracer wire is required on all service lines between the water main and the meter.

#### *b. Main Lines*

12-gauge copper tracer wire is required on main lines where the run between valve boxes is not linear.

### **3.08 Trenching and Pavement Restoration**

- a. Trenching backfill shall be accomplished in accordance with Standard Detail S-3.
- b. Pavement shall be restored to pre-existing conditions or better. Pavement restoration shall follow the requirements of Standard Details S-4 and S-5.

## Chapter 4 Sanitary Sewer, Storm Drainage, and Erosion Control

### 4.01 CWS Standards

In general, the latest version of the *CWS Design and Construction Standards for Sanitary Sewer and Surface Water Management* standards shall govern construction and design of sanitary sewer and storm and erosion control facilities. Where conflicts exist between the City's Public Works Standards and the CWS Standards, the City standards shall prevail.

### 4.02 Conveyance System

- a. To the extent possible, manholes shall be located in streets to avoid wheel paths.
- b. Generally, catch basins along curbs shall be CG-30 (CWS Drawing 330). Catch basins in valley gutters shall be Type II Area Drains (CWS Drawing 380).
- c. All non-metallic pipe, including main lines and laterals, shall have 12-gauge, green-coated tracer wire installed directly on top of the pipe. The tracer wire shall climb the outside of the manhole to the top pick hole and go behind steps and tie to the top step with a 30" tail.
- d. Tracer wire is not required on straight sections of pipe between structures (manholes and catch basins).
- e. Permanent cleanouts are not allowed on public sanitary sewers in the City.
- f. Inserta-tees only are allowed on storm and sanitary pipes larger than 12 inches.

### 4.03 Stormwater Treatment

- a. Stormwater treatment systems to be maintained by the City shall be biofiltration swales.
- b. For single-family residential projects involving multiple parcels, individual lot LIDA systems cannot be used to meet the stormwater treatment or detention requirements for the project.

This requirement does not prohibit individual lot LIDA systems, it just prevents these systems from being part of the system intended to meet a project's stormwater requirements.

The reason for the prohibition on LIDA systems is that the City must periodically inspect these types of systems. When a system is found to be in less than good condition, the City must work with the property owner to bring the system up to standards. The City simply does not have sufficient staff or funding to assist a large number of individual homeowners with their LIDA systems.

- c. For improvements to an existing individual lot, the City's preferred approach to meeting stormwater treatment requirements is payment of fee in lieu of providing



treatment. LIDA systems in these situations will only be approved if other alternatives are not feasible and the LIDA can realistically be assumed to function long-term without City intervention.

#### **4.04 Trenching and Pavement Restoration**

- a. Trenching backfill shall be accomplished in accordance with Standard Detail S-3.
- b. Restore pavement to pre-existing conditions or better and shall follow the requirements of Standard Details S-4 and S-5.

## Chapter 5 Streets

### 5.01 General

#### a. *Philosophy*

These standards for streets are intended to meet the following objectives:

- Reduce future maintenance costs
- Reduce speeds in residential neighborhoods
- Make streets pedestrian-friendly

#### b. *ODOT Roads*

Highway 8 through Cornelius is a road administered by the Oregon Department of Transportation (ODOT). ODOT can overrule any of the standards listed in this section for their road.

#### c. *Policy on Geometric Design of Highways and Streets*

*The Policy on Geometric Design of Highways and Streets, 6<sup>th</sup> Edition* by the American Association of State Highway and Transportation Officials (AASHTO) formed the foundation of the policies in this section. Specifically, policies are based on those for urban streets with speeds in the 25 to 35 mph range.

For areas that are not addressed in these city standards, the AASHTO manual should be looked to for guidance on design questions.

### 5.02 Street Types

For the purpose of design standards, transportation routes are categorized in the following types.

#### a. *Downtown Arterials*

These are defined in the TSP and generally handle the highest traffic volumes in the city. Arterials in the downtown area have different design standards than elsewhere in the City. Downtown arterials include:

- Adair Street (10<sup>th</sup> Avenue to 20<sup>th</sup> Avenue)
- Baseline Street (10<sup>th</sup> Avenue to 20<sup>th</sup> Avenue)
- 10<sup>th</sup> Avenue (railroad south of Baseline Street to railroad north of Davis Street)
- 19<sup>th</sup>/20<sup>th</sup> Avenue (railroad south of Baseline St. to railroad north of Davis St.)

#### b. *Other Arterials*

Arterials outside of the downtown area include:

- Adair Street (west of 10<sup>th</sup> Avenue)
- Baseline Street (west of 10<sup>th</sup> Avenue)
- Baseline Street (east of 20<sup>th</sup> Avenue)
- 10<sup>th</sup> Avenue (south of railroad between Alpine Street and Baseline Street)
- 10<sup>th</sup> Avenue (north of railroad between Davis Street and Holladay Street)
- 19<sup>th</sup>/20<sup>th</sup> Avenue (north of railroad between Davis Street and Holladay Street)

*c. Industrial Streets*

These are streets in industrial zoned areas and collector streets leading into these areas that serve as a primary access route for trucks accessing the industrial zoned land. Industrial streets can also be arterials, collectors, or local streets. Industrial streets include:

- 4<sup>th</sup> Avenue (Baseline to North City Limits)
- Holladay Street (4<sup>th</sup> Avenue to 10<sup>th</sup> Avenue)
- 7<sup>th</sup> Court (south of Holladay Street)
- 26<sup>th</sup> Avenue (Baseline to railroad tracks south of Holladay Street)
- Flax Plant Road
- 12<sup>th</sup> Avenue (south of Ivy Street)
- Kodiak Circle

*d. Collectors*

Collectors are intended to connect neighborhoods with arterials and other neighborhoods. They typically carry a higher volume of traffic than local streets. Collectors include:

- 4<sup>th</sup> Avenue (North City Limits to Heather Street)
- 12<sup>th</sup> Avenue (Dogwood Street to Flax Plant Road)
- 14<sup>th</sup> Avenue (Gray Street to Dogwood Street)
- 20<sup>th</sup> Avenue (south of Baseline Street)
- 26<sup>th</sup> Avenue (Holladay Street to Jasper Drive)
- N. 29<sup>th</sup> Avenue (north of Baseline Street)
- S. 29<sup>th</sup> Boulevard (south of Baseline Street)
- Heather Street (west of 10<sup>th</sup> Avenue)
- Dogwood Street (4<sup>th</sup> Avenue to S. 29<sup>th</sup> Blvd.)
- Davis Street (4<sup>th</sup> Avenue to 19<sup>th</sup> Avenue)
- Gray Street (14<sup>th</sup> Avenue to 16<sup>th</sup> Avenue)
- Holladay Street and Drive (4<sup>th</sup> Avenue to 29<sup>th</sup> Avenue)
- Alpine Street (S. 29<sup>th</sup> Blvd. to 345<sup>th</sup> Avenue)
- Jasper Drive (20<sup>th</sup> Avenue to 26<sup>th</sup> Avenue)
- Kodiak Street (26<sup>th</sup> Avenue to 345<sup>th</sup> Avenue)

*e. Local Streets*

Any street intended to carry a vehicle that is not an arterial, collector, woonerf, alley, or maintenance road is a local street.

f. *Woonerfs*

These are streets where vehicles, bikes, and pedestrians share the same paved surface. Homes or businesses typically front on a woonerf.

These standards create a new type of public street called a woonerf or shared street. The woonerf typically serves 2-6 lots that lack local street frontage.

g. *Alleys*

These are special purpose vehicle routes typically located at the rear side of lots and providing access to garages. Alleys normally do not have houses or businesses fronting on them.

h. *Maintenance and Emergency Access Routes*

These are narrow vehicle routes designed to access special purpose infrastructure such as stormwater facilities or provide secondary access for emergency vehicles.

The City generally follows the standards set by Clean Water Services for these types of facilities. These standards are spelled out in the *CWS Design and Construction Standards for Sanitary Sewer and Surface Water Management*, Section 4.02.4.

i. *Off-Street Pathways*

Off-street pathways can be recreational trails or access corridors between streets. Only pedestrians and bicycles may use off-street pathways. Other than maintenance and emergency vehicles, vehicles are prohibited on off-street pathways.

### 5.03 **Layout Considerations**

a. *Street Spacing*

1. Local streets in residential neighborhoods should generally be spaced no further than 400 feet apart. In other words, intersections should occur no farther than 400 feet apart.
2. Collector streets generally shall be spaced at least 600 feet apart and no more than 900 feet apart.
3. Where the street design in a neighborhood prevents easy pedestrian connectivity between streets, the City Engineer may require 10-foot wide off-street pedestrian connections between streets.

Two examples of where this type of pedestrian connection might be required are at the end of a cul-de-sac and between long adjacent parallel streets where no connecting streets exist to allow pedestrian movement between streets.

*b. Cul-de-Sacs and Dead End Streets*

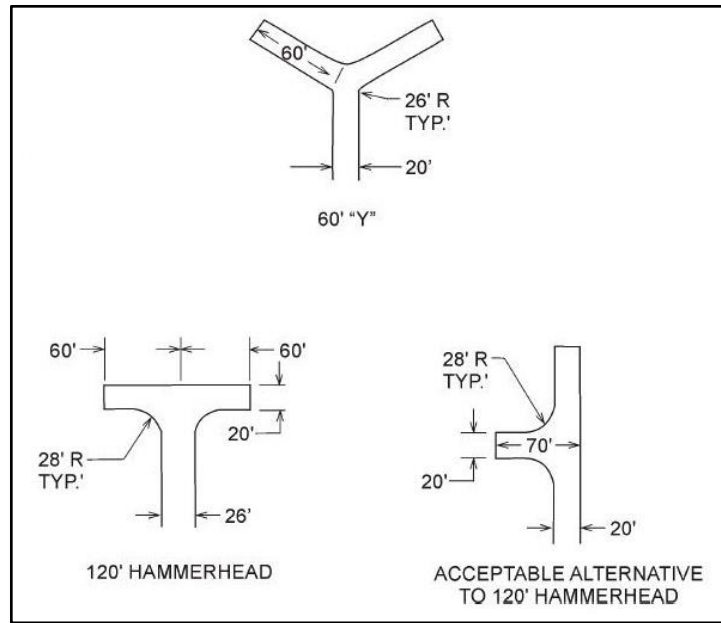
Cul-de-sacs are required at the end of dead-end streets for a couple reasons. First, they allow vehicles to turn around without backing up. Second, they allow a street sweeper to work efficiently.

However, the standard cul-de-sac required by the Oregon Fire Code is a 96' diameter monster that requires over 7,200 square feet of pavement. This amount of asphalt is equivalent to over 360 feet of a 20' wide linear street. This is extremely costly to maintain.

For this reason, the City's preferred configuration at the end of a dead end street is a combination small cul-de-sac and hammerhead. The small cul-de-sac allows most vehicles (cars and pickups) to turn around without backing up. The hammerhead provides the larger vehicles the ability to turn around.

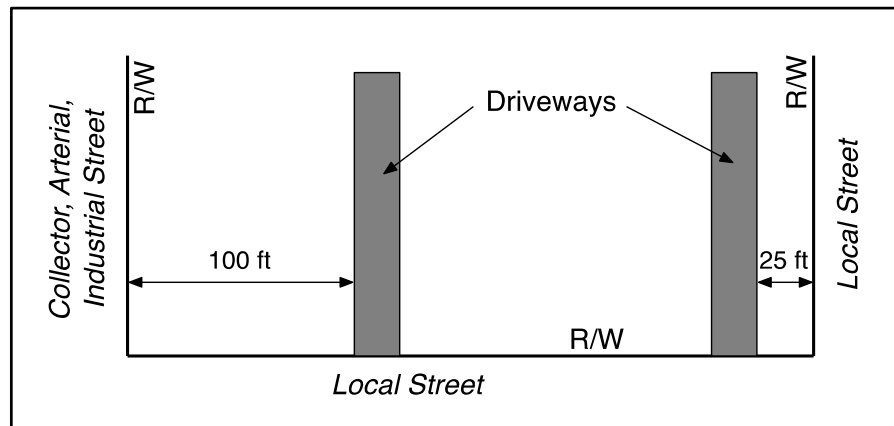
The City is also open to other design possibilities that meet the Oregon Fire Code while minimizing pavement area.

1. Cul-de-sacs are required on all dead-end streets, except where the street will be extended with future development or the street is a woonerf.
2. Cul-de-sacs shall have a diameter of 50 feet from curb face to curb face.
3. No parking is allowed inside the cul-de-sac. Cul-de-sacs shall be posted for no parking, unless the configuration of driveways on the cul-de-sac makes legal parking impossible.
4. Dead end streets over 150 feet in length require a hammerhead turnaround meeting the criteria in the diagrams below. A hammerhead can be combined with a 50-foot radius cul-de-sac.
5. Hammerheads shall be posted as no parking and shall be in a public easement if outside the right-of-way.
6. Allowable hammerhead designs are:



*c. Driveway Locations and Spacing*

1. Driveways on local streets shall be a minimum 100-feet back from the right-of-way of an arterial, collector, or industrial street and 25-feet back from the right-of-way of a local street. This is shown in the drawing below.



2. Driveways on arterials, collectors, and industrial streets shall maintain a 100-foot separation between driveways and from the right-of-way of arterials, collectors, industrials streets, and local streets.
3. Driveway access to public streets requires City Engineer approval. The approval can be in the form of a Public Works Permit or Engineering Plan Approval. The City Engineer may require a traffic study if a proposed driveway may cause safety issues. The City Engineer may also impose conditions on the approval to avoid potential traffic and pedestrian safety issues.

d. *Woonerfs*

1. Woonerfs shall be used where two or more adjoining parcels require driveways in excess of 50 feet to reach a street.
2. Woonerfs shall be less than 150 feet long to avoid a hammerhead at the end.
3. Woonerfs shall serve no more than six parcels.

e. *Existing Streets*

When public improvements are implemented on existing streets, the City Engineer may modify the requirements in this section so that any new infrastructure constructed harmonizes with the existing infrastructure.

## 5.04 Right-of-Way Components and Widths

These standards approach street and right-of-way design in an unconventional way compared to street standards in other communities. In Cornelius, a street is simply the combination of narrow travel lanes, parkway strips, and sidewalks or multi-use pathways. The base right-of-way width is not inherently wide enough for on-street parking or turn lanes. When these are provided they add to the width of the right-of-way.

Also of note is that bike lanes are not included on collectors and local streets. Instead of bike lanes, multi-use pathways are provided on one side of collectors. The reason for eliminating bike lanes on collectors is that in residential neighborhoods, on-street bike lanes are too dangerous for children and many adults. To create safer places for families to bike, these standards replace on-street bike lanes with 12-foot multi-use paths on all collectors. These multi-use paths offer much safer passage for children on bikes. More serious and experienced bike riders will likely bike in the vehicular travel lanes. Since speeds in residential area are typically less than 25 mph due to speed limits and design of the streets, these bike riders should be able to keep up with traffic and not pose a hazard.

The effect of this approach is to significantly narrow streets, thereby reducing future maintenance costs and slowing traffic.

a. *Base Width*

A base right-of-way contains travel lanes, curb and gutter, parkway strips, and sidewalks or multi-use paths. Parking and center-turn lanes are not provided for in the base width.

The table below shows the components of the base right-of-way, the width of each component, and the total minimum right-of-way width for each type of street.

Street Type	Minimum Travel Lanes <sup>1</sup>	Bike Lanes	Parkway Strips <sup>2</sup>	Sidewalks	Total Min. ROW Width
Downtown arterial	Two 11 ft.	Two 6 ft.	None	Two 8 ft.	50 ft.
Other Arterial	Two 11 ft.	Two 6 ft.	Two 6 ft.	Two 6 ft.	58 ft.
Industrial Street	Two 11 ft.	None	Two 6 ft.	Two 6 ft.	46 ft.
Collector	Two 10 ft.	None	Two 6 ft.	One 6 ft. and one 12 ft. multi-use path	50 ft.
Local Street	Two 10 ft.	None	Two 6 ft.	Two 5 ft.	42 ft.
Woonerf	Two 10 ft.	None	Two 5 ft.	None	30 ft.
Alley	Two 10 ft.	None	None	None	20 ft.
Maint. & Emerg. Access Route	One 12 ft. plus 3 feet <sup>3</sup>	None	None	None	15 ft.
Off-Street Pathway	One 10 ft.	None	None	None	10 ft.

1. Travel lane width is measured from the face of curb, edge of pavement where no curb exists, or the edge of the parking bay.
2. Parkway Strips are measured from the face of curb to the edge of sidewalk, multi-use path, or right-of-way where no sidewalk exists.
3. The extra 3 feet of width along a maintenance and emergency access route shall be distributed equally on both sides of the route.

*b. Parking Bays*

Parking along public rights-of-way is provided in parking bays. Parking bays are areas paved in concrete that can be designed for parallel or head-in parking. Parking bays always end in bulb-outs and never end to an intersection.

The base width right-of-way has insufficient size for parking bays. Therefore, where parking bays are planned, the right-of-way must be expanded by the size of the parking bay.

1. Where parking bays are provided, the width of the right-of-way shall be increased by the width of the parking bays.
2. Parking bays for parallel parking shall be 8-feet wide. This distance shall be measured from the face of curb to the edge of the travel lane.
3. Parking bays for head-in parking, perpendicular to the travel lane, shall be 20-feet deep. This distance shall be measured from the face of the curb to the edge of the travel lane.
4. The City Engineer shall determine the depth of parking bays for angled head-in parking.



- On-street parking bays are not required on streets. The Community Development parking standards, developer preferences, and land use conditions of approval shall determine the need for parking spaces provided by parking bays.

c. *Turn Lanes*

- Where turn lanes are provided, the width of the right-of-way shall be increased by the width of the turn lane(s).
- Turn lanes shall be 11 feet wide.
- Turn lanes are prohibited unless their need is identified in a traffic study and the City Engineer concurs with the findings of the traffic study.
- The turn lane length shall be limited to that recommended in the traffic study.
- Continuous center-turn lanes are prohibited in Cornelius, except on Hwy. 8 east of 20<sup>th</sup> Avenue.

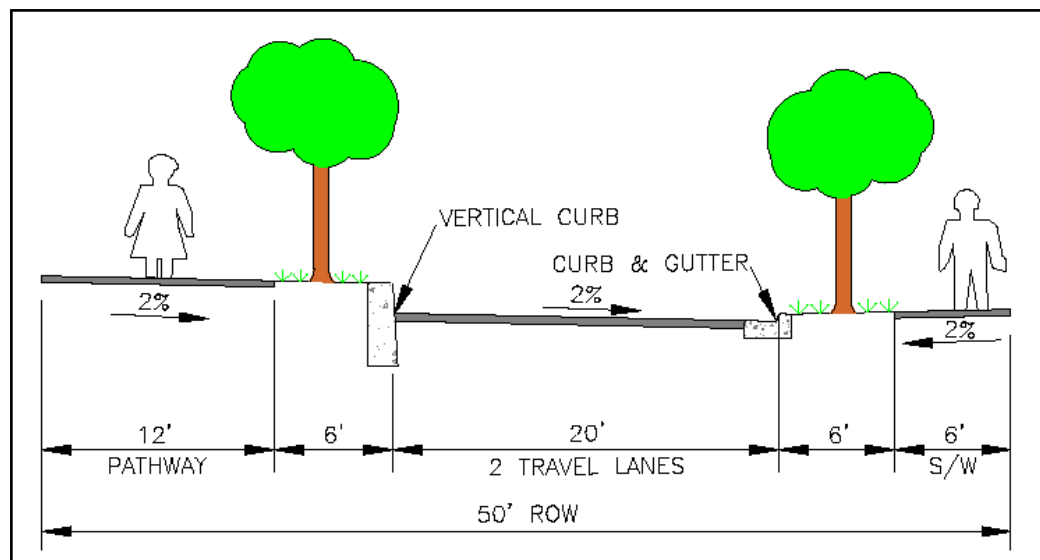
d. *Other Components of the Right-of-Way*

- Where the edge of the right-of-way requires a retaining wall or fence that is to be maintained by the City, the right-of-way width shall be increased to include this feature.
- Where an uphill bike lane is required per section 5.05(b), the right-of-way shall be increased by the width of the uphill bike lane.

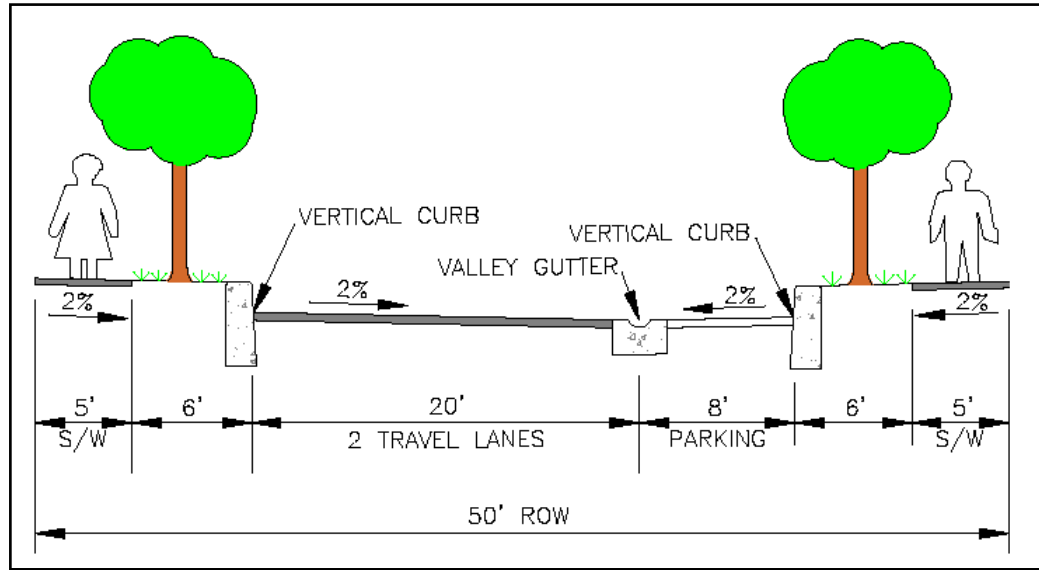
e. *Examples*

Following are a few examples of the results of applying the widths defined in this section. The cross slopes shown on the streets are for illustrative purposes only.

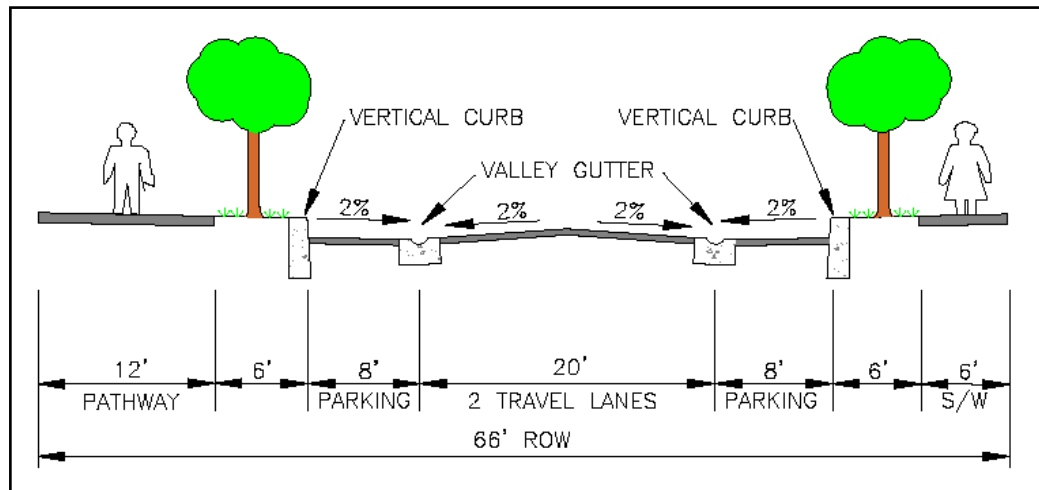
- Non-Industrial collector street without parking:



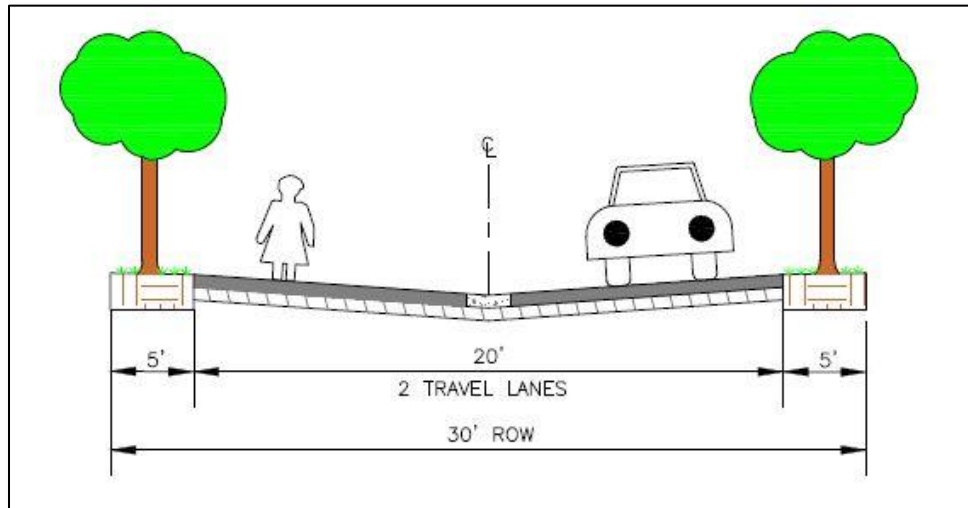
2. Non-Industrial local street with a parking bay on one side:



3. Non-Industrial collector street with parking bays on both sides:



4. Woonerf with no parking



**5.05 Other Design Elements**

*a. Cross Slopes*

1. Streets with two lanes or less can be constructed in a shed section.
2. Streets with more than two lanes shall be constructed with a crown section.
3. Alleys and woonerfs shall be constructed in an inverted crown section, unless a shed section is more appropriate for the underlying topography.
4. Sidewalks and parkway strips shall generally be constructed to drain toward the paved street area. However, the slope can be reversed if the underlying topography makes the reverse slope more appropriate. When the slope for the sidewalk and parkway strip drains away from the paved area, drainage from the sidewalk and parkway strip must be adequately addressed so as not to infringe on the rights of the neighboring property.
5. Streets and parking bays shall have a minimum cross slope of 2%.
6. Parkway strips generally shall have a minimum cross slope of 2%. However, this slope can be increased to 10% if the underlying topography makes a steeper slope more appropriate.

*b. Uphill Bike Lanes*

While these standards envision experienced bike riders riding in travel lanes on collectors, a problem can arise in uphill street sections, where even experienced bike riders will have difficulty keeping up with traffic. In these situations, an uphill bike lane or a connection to the adjacent 12-foot pathway is required.

1. Where a collector street has no bike lanes, an uphill bike lane shall be included in the street cross section when the uphill grade of the street exceeds 3%.
2. Uphill bike lanes shall begin at the point where the grade exceeds 3% and end 100 feet past the point where the grade flattens to less than 3%.
3. Where a 12-foot pathway exists on the uphill side of the street, the bike lane can be avoided if a paved 6-foot wide connection is made between the street and the 12-foot pathway to allow bike riders to easily leave the street at the beginning of the uphill area and then smoothly re-enter the street where the grade flattens. The connections shall be angled so bike riders do not need to slow to switch from the street to the pathway and then back to the street. The connections shall also be paved in concrete.

*c. Parking Bays*

These standards require parking bays to occasionally switch sides of the street to create a chicane effect so that traffic is slowed. Also, bulb-outs must be installed at the end of the parking bays to prevent the parking bay from being used as part of an extra wide travel lane.

1. General
  - Each parking bay shall have a bulb-out at each end.
2. Parallel Parking Bays shall be designed so that:
  - They are not continuous across multiple driveways.
  - Parking spaces shall be 20 to 22 feet long.
  - The parking bay shall not be longer than 300 feet without a bulb-out.
  - Parking shall shift sides of the street every 300 feet or less.
  - Parking bays containing one or two parallel spaces do not require a parkway strip between the curb and sidewalk. However, street trees are still required in these situations and shall be placed on the opposite side of the sidewalk from the parking bay or in tree grates if the sidewalk is of sufficient width.
3. Head-In Parking Bays shall be designed so that:
  - They are not located on an arterial or collector street.
  - Where the travel lanes are 20-feet wide, the parking spaces shall be angled at a 60-degree angle to allow sufficient space for drivers to back up.
  - Parking spaces shall be 9-feet wide.
  - A landscape island at least 6-feet wide shall be provided at a minimum of every 10 continuous spaces.

- Sidewalks may be curb-tight along head-in parking bays. However, sidewalks shall be wider than the required width in Section 5.04(a) to compensate for vehicle overhang in this type of parking bay. Also, street trees are still required in these situations, either on the opposite side of the sidewalk from the parking bay or in tree grates in the sidewalk. Note that trees in tree grates may require a wider sidewalk.

*d. Half Streets*

1. Half streets may be created when a right-of-way is adjacent to a property line and the other property is expected to develop in the future. The future development is assumed to complete the remaining portion of the street.
2. Half streets shall be minimum 20-foot wide with two travel lanes and curbs on each side of the street.
3. Sidewalks and landscaping of the parkway strip are only required on one side of a half street.
4. The right-of-way shall encompass all the features required above for a half street.

*e. Alleys*

1. The 20-foot required width of an alley shall be clear space.
2. If the alley contains aboveground obstacles such as power poles or utility pedestals, these shall be located outside the 20-foot wide clear space and within an easement.
3. If trash will be collected in the alley, a location outside the 20-foot clear zone shall be provided for trashcans.

*f. Public Utility Easement (PUE)*

The PUE is for use by utility companies including but not limited to electric, natural gas, telecommunications, and cable TV. An 8-foot wide PUE shall be dedicated adjacent to and outside the right-of-way for streets, including woonerfs. A PUE is not required along the right-of-way of an alley, unless a parcel on an alley does not also front on a street or woonerf directly.

## **5.06 Pavement**

The concrete pavement requirement for parking bays in this section is designed to seriously reduce long-term maintenance costs associated with periodic repaving of streets. Also, the differences in pavement materials, concrete for parking bays and asphalt for travel lanes, make the travel lanes appear smaller than in a typical 28 or 36-foot wide street paved entirely in asphalt. When travel areas appear narrower, traffic slows.

*a. Pavement Material Type*

1. Asphalt shall be used as pavement for the following features in the right-of-way:
  - Travel lanes on arterials, industrial streets, collectors, and local streets
  - Turn lanes
  - Maintenance and emergency access routes
2. Concrete shall be used as pavement for the following features in the right-of-way:
  - Woonerfs
  - Alleys
  - Parking bays
  - Sidewalks
  - Multi-use pathways
  - Driveways
  - Curbs and gutters
3. Concrete shall be used as pavement for the following public ways, outside a street right-of-way:
  - Sidewalks
  - Multi-use pathways
4. Driveways shall be paved in concrete or asphalt at least 20 feet back from the right-of-way line to help prevent dirt and gravel from being dragged onto public streets.

*b. Pavement Design - Asphalt*

Standard Detail S-1 shows the standard pavement asphalt pavement cross section for various types of streets.

*c. Pavement Design - Concrete*

Standard Detail S-2 shows the standard pavement concrete pavement cross section for various types of surfaces.

*d. Trench Backfill*

Standard Detail S-3 shows the City's requirement for trench backfill. This detail supersedes the trench backfill detail included in the CWS Design and Construction Standards.

*e. Pavement Restoration*

Pavement restoration shall be performed in accordance with Standard Detail S-4 for asphalt pavement and S-5 for concrete pavement.

## 5.07 Curbs

- a. Vertical curbs shall be used where runoff drains away from the curb due to the cross-slope in the paved area.
- b. A curb and gutter section shall be used where runoff drains into the curb from the paved area.
- c. A valley gutter shall be used where runoff drains from opposite directions on a paved surface.
- d. Woonerfs, alleys, maintenance and emergency access routes, and off-street pathways typically do not require curbs.
- e. Mountable curbs are appropriate in cul-de-sacs and other areas where a number of individual driveways are located close together.
- f. Drainage block-outs require City Engineer approval and are typically only appropriate where lateral connections to the storm sewer are not feasible.
- g. Where storm and sanitary laterals traverse under a curb, the curb shall be stamped to identify the lateral type.
- h. Drawings for each of these types of curbs are shown in Standard Detail S-11 through S-14.
- i. Restoration of an existing curb and gutter is shown in Standard Detail S-15.

## 5.08 Driveways, Sidewalks, and ADA Ramps

### a. *Driveways*

1. Driveway locations and spacing requirements are described in Section 5.03(c)
2. Curb radii are only appropriate at the intersection of arterials, collectors, industrial streets, and local streets.
3. All private access to a public street shall use driveways.
4. Residential driveways shall only be used for single-family and duplex dwellings.
5. Residential driveways are limited to 30-feet wide.
6. Commercial driveways shall be used for the following types of access to a public street:
  - Commercial parcel
  - Industrial parcel
  - Government facilities including park parcels
  - Multi-family parcel
  - Maintenance and emergency access road

- Alley
  - Woonerf
7. Commercial driveways are limited to 30-feet wide, unless they are designed with more than two lanes, such as an entrance lane and a right and left turn exit lane.
  8. Where a sidewalk crosses a driveway, the sidewalk path must meet the ADA requirements in terms of grades.
  9. The typical commercial driveway is shown in Standard Detail S-21 and S-22.
  10. The typical residential driveway is shown in Standard Detail S-23 and S-24.

*b. Sidewalks*

1. Sidewalks shall meet ADA requirements unless steep terrain makes this impossible.
2. The pedestrian zone, which includes sidewalks, pathways, and bulb-outs, must remain free of obstacles. Obstacles include above ground obstructions including but not limited to: fire hydrants, mailboxes, utility pedestals, utility poles, above ground utility vaults, trees, sign posts and signs, street light poles, signal poles, and signal control equipment. The only exception to this rule is where the sidewalk is more than 6 feet wide. In the cases of these wide sidewalks, the above ground obstructions should be placed as close as possible to the curb so that a clear corridor for pedestrians at least 5-feet wide is maintained.
3. Signs projecting over sidewalks shall be mounted such that they are at least 7 feet above a sidewalk or pathway.
4. Sidewalk finishing requirements are shown in Standard Detail S-25.

*c. ADA Ramps*

Because of the nearly infinite combination of various widths of sidewalks at intersections, these standards contain no standard details for ADA ramps. Design engineers should feel free to include standard ADA ramp details from other jurisdictions if those details meet these standards and are appropriate for the given situation.

Please note, the minimum slopes shown for ADA ramps on standard details are ABSOLUTE minimums. Jurisdictions have been subject to lawsuits when one of the required slopes on ADA ramps exceeds the minimums by even a seemingly insignificant amount.

The rules for ADA ramps in Cornelius are:

1. Ramps meeting ADA requirements shall be placed at all intersections of sidewalks and pathways with streets. The ADA ramps shall include yellow truncated domes.



2. The width of the bottom of the ADA ramp shall be at least as wide as the sidewalk or pathway it serves.
3. Generally, diagonal ADA ramps are not allowed.
4. The *Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way* dated July 26, 2011 by the United States Access Board shall serve at the design guide for public ADA facilities in the Cornelius.

## 5.09 Intersections and Curb Radii

### a. Street Width

The street width at intersections specified in this section may seem abnormally narrow. That is by design. Narrowing the street at intersections forces vehicles to slow, thus making the intersections safer for pedestrians.

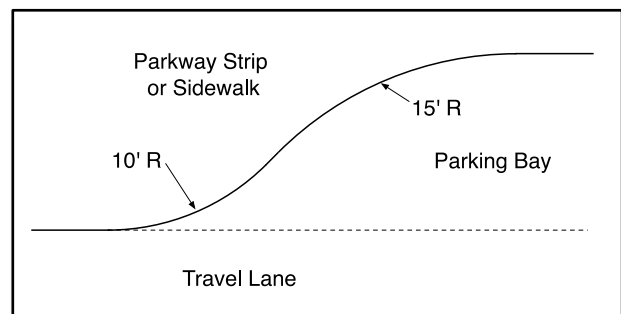
1. The width of a street entering an intersection shall be equal to the total width of the travel lanes, plus turn lanes and bike lane(s), if included in the street cross section. For example, a collector street in a residential neighborhood with no turn lanes or bike lanes will be 20-feet wide (curb face to curb face) at an intersection.
2. If the street includes a parking bay, the parking bay will end in a bulb-out prior to the intersection.

### b. Curb Radii

1. The curb radius at intersections shall be 28 feet.

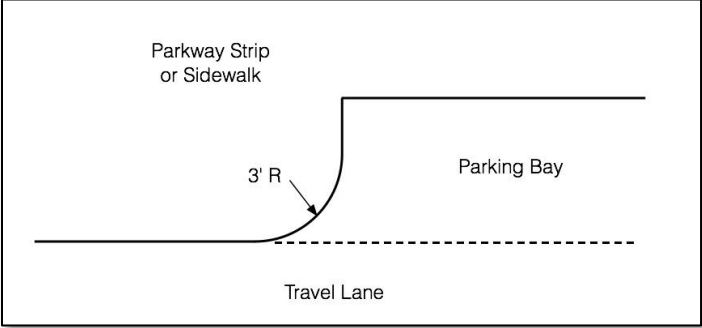
The two curb radii requirements below typically apply to bulb-outs. The reason for these requirements is to allow street sweepers to successfully maneuver around bulb-outs without needing to backup.

2. Except as noted below in subsection 4, the inside radius of all curbs shall not be less than 15 feet, as shown on the right.
3. Except as noted below in subsection 4, the outside radius of all curbs shall not be less than 10 feet as shown in the drawing.



The transitions shown in the drawing above require 18 feet of distance to complete the transition. In a residential neighborhood with small lots and many driveways, creating parking bays between the driveways is nearly impossible with this 18-foot transition. Therefore, Section 4 below provides an exception where the designer is attempting to shoehorn one or two parking bays between driveways.

- 4. Parallel parking bays for one or two cars and head-in parking bays can have an inside curb radius of 0 feet and an outside curb radius of 3 feet as shown in the drawing below. However, when this configuration is used, the parking bay must drain toward the street with no catch basins located along the sidewalk or parkway strip side of the parking bay.



c. *Major Intersections and Roundabouts*

Roundabouts are the city’s preference for traffic control at major intersections. Traffic signals, while effective, are very expensive in terms of operations and maintenance. Therefore, the city seeks to avoid traffic signals whenever possible.

At intersections of collectors or arterials, roundabouts shall be the preferred traffic control employed. Roundabouts include mini-roundabouts.

**5.10 Signing and Striping**

a. *General*

Signing and striping shall follow the latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* by the Federal Highway Administration except as noted below.

b. *Permanent Striping*

- 1. Arterials shall be striped with the appropriate lane markings.
- 2. Bike lanes shall be striped.
- 3. Parking spaces in parallel parking bays can be marked with a simple “T” at the corner of the spaces adjacent to the travel lanes.

4. Parking spaces in head-in parking bays must be striped between the spaces.
5. Striping is not required on other streets.
6. All striping shall be thermoplastic.

c. *Permanent Signs*

1. Permanent signs shall be installed in accordance with Standard Detail S-31.
2. Streets intersecting a collector or arterial shall have a 36" x 36" stop sign, unless the intersection is controlled by a roundabout or traffic signal.
3. Intersections of local streets, alleys, woonerfs, and maintenance access roads shall not have stop signs unless required by the City Engineer. When required, these stops signs shall be 30" x 30".
4. The entrance to a woonerf shall be marked by a Woonerf Sign as shown in Detail S-34.
5. Type 3 barricades (Standard Detail S-32) shall be installed at the temporary end of streets.
6. Object markers (OM 4-2 in the *Manual of Uniform Traffic Control Devices*) shall be installed at the end of woonerfs and sidewalks. Object markers shall also be installed at the permanent end of local streets.

## 5.11 Landscaping

a. *General*

Street trees provide a number of important functions besides making a neighborhood more attractive. Some of these functions include: reducing stormwater runoff and erosion, keeping urban areas cooler, providing food and shelter for wildlife, capturing airborne pollutants, and slowing traffic in corridors lined with trees. These functions are maximized when street trees form a canopy over the street. Therefore, street trees should be selected with an eye toward their ability to form a canopy over the streets in Cornelius.

These standards provide much flexibility in selecting street trees. The flexibility is intended to promote diversity in the tree canopy and avoid a disease wiping out all trees in parts of the City where single species of trees are planted along parkway strips.

b. *Approval*

Planting trees in the public right-of-way requires City approval. Unless the activity is part of a larger project requiring engineering plan approval, the Public Works Permit is the vehicle to use for approving tree plantings in the right-of-way.

The primary information required for City approval is identification of the type of tree(s) to be planted and their locations. City staff then evaluates the information to ensure the proposed plantings meet the standards in this section.

c. *Street Tree Types*

1. The required characteristics of street trees include:
  - Relatively disease free and tolerates urban pollutants
  - Medium to tall tree, except under overhead utility lines
  - Non-fruit bearing
  - Deep rooted
  - Long-lived
  - Ability to thrive in our climate
  - Likelihood that tree can form a canopy over the street
2. Examples of acceptable trees are:
  - Red oak
  - Ginkgo (male only)
  - Douglas Fir
  - Incense cedar
  - Zelkova
  - Marshall Ash
3. Evergreen trees are acceptable as street trees in locations where they do not block vision or access.
4. Acceptable trees are those on the appropriate City of Portland Approved Street Tree Planting Lists (<http://www.portlandoregon.gov/trees/66682>). The Portland lists are broken into groups based on width of parkway strips and whether overhead utility lines exist above the planting area.

d. *Density and Diversity*

In the mid-20<sup>th</sup> century Dutch elm disease decimated urban forests throughout much of North America. This devastation occurred because of the lack of street tree diversity in many cities. With the additional stresses to urban trees due to climate change, maintaining and creating a diverse urban forest is critical.

To create this diversity these standards implement the 10-20-30 guidelines from Frank Santamour. This guideline dictates that no more than 10% of any species, no more than 20% of any genus, and no more than 30% of any family is planted in an area.

For those without a landscape architecture degree or training in biology, an explanation of tree species, genera, and families is in order.

A *family* is a group of genera that closely or uniformly resemble each other in general appearance and technical character. A *genus* is a group of tree species that have fundamental traits in common but that differ in other, lesser characteristics. A *species* is a natural group of trees in the same genus made up of similar individuals.

To better understand these terms, the table below shows where some common trees fall into the various categories.

<b>Family</b>	<b>Genus</b>	<b>Species</b>
Maple (Aceraceae)	Maples (Acer)	Vine maple (Acer circinatum)
Maple (Aceraceae)	Maples (Acer)	Norway maple (Acer platanoides)
Pine (Pinaceae)	Spruce (Picea)	Sitka spruce (Picea sitchensis)
Pine (Pinaceae)	Spruce (Picea)	Blue spruce (Picea pungens)
Pine (Pinaceae)	Pines (Pinus)	Ponderosa pine (Pinus ponderosa)
Pine (Pinaceae)	Pines (Pinus)	Lodgepole pine (Pinus contorta latifolia)
Beech (Fagaceae)	Beech (Fagus)	European beech (Fagus sylvatica)
Beech (Fagaceae)	Oaks (Quercus)	Italian oak (Quercus frainetto)
Beech (Fagaceae)	Oaks (Quercus)	Red oak (Quercus rubra)
Elm (Ulmaceae)	Elms (Ulmus)	Frontier elm (Elmus 'Frontier')
Elm (Ulmaceae)	Zelkova (Zelkova)	Japanese zelkova
Birch (Betulaceae)	Birches (Betula)	Chinese red birch (Betula albosinensis)
Birch (Betulaceae)	Hornbeams (Carpinus)	American hornbeam (Carpinus caroliniana)
Birch (Betulaceae)	Hazels (Corylus)	Turkish filbert (Corylus columa)

- For projects required to plant 10 or more street trees, the planting list shall include:
  - A maximum of 10% of any species, or a minimum of 10 different species
  - A maximum of 20% of any genus, or a minimum of trees from 5 different genera
  - A maximum of 30% of any family, or a minimum of trees from 4 different families

2. For projects required to plant 5 to 9 street trees, the planting list shall include:
  - All trees of a different species
  - All trees of a different genus
  - All trees of a different family
3. For projects required to plant less than 5 street trees, the trees shall all be from different genera. In other words, if 3 trees are to be planted, they should represent trees from 3 unique genera.
4. Street trees shall be planted in a diverse pattern. The interval between planting identical street trees shall be equal to half the number of different trees in the planting list.

For example, if the planting list contains 12 different trees including a Red Oak, then Red Oaks can be planted no closer than every 6<sup>th</sup> tree along a street.
5. Trees should be planted approximately 12 to 30 feet apart. The distance depends on the ultimate size of trees.

*e. Size Requirements*

The following size requirements are based on caliper size (diameter 12" above the ground) rather than DBH (diameter at breast height) because nurseries typically measure trees in caliper size.

For young trees, caliper size and DBH will be nearly the same. Only as trees get older and the bottom of the trunks flare out will caliper size start to differ significantly from DBH.

1. Broadleaf trees planted in single-family and duplex neighborhoods, shall be a minimum caliper size of 1.5".
2. Broadleaf trees planted in other than single-family and duplex neighborhoods shall be a minimum caliper size of 2".
3. Conifers must be a minimum 5 feet in height at time of planting.

*f. Location Restrictions*

1. Street trees shall generally be planted in parkway strips. Where a parkway strip does not exist, such as in locations where a sidewalk is adjacent to a parking bay, then street trees shall be planted on the opposite side of the sidewalk from the street or in tree grates where the sidewalk is sufficiently wide. Trees planted outside the right-of-way shall be protected in an easement.
2. The minimum distance between new street trees and fire hydrants or utility pedestals shall be 5 feet.

3. New street trees shall be planted a minimum of 10 feet from directional traffic signs and utility poles.
4. New deciduous street trees shall be planted a minimum of 15 feet from stop signs and yield signs.
5. New evergreen street trees shall be planted a minimum of 20 feet from stop signs and yield signs.
6. New street trees shall be planted a minimum of 20 feet from street lights, unless the street tree has a narrow profile in which case it can be planted a minimum of 15 feet from street lights.

*g. Root Barriers*

Trees in parkway strips shall be installed with an 18-inch deep root barrier to help prevent cracking and uplifting of adjacent sidewalks and curbs.

*h. Planting Method*

The appropriate planting methods for trees are shown in Standard Detail S-41.

*i. Tree Grates*

The City once required cast iron tree grates and cast-iron grates are the type installed along the downtown arterials. However, the cast iron grates exhibit a high failure rate and are difficult to replace with a similar design. Therefore, the City now prefers tree grates made of plastic and composite material because these have a much longer lifespan.

Trees surrounded by pavement, such as those planted in 8-foot or wider sidewalks require tree grates. Tree grates shall be made of plastic or composite material that is able to withstand the expected traffic load of the sidewalk. Cast iron tree grates are prohibited.

*j. Irrigation*

Newly planted street trees need to be watered, especially in our region's dry summers. Watering shall be accomplished through use of a temporary irrigation system or with individual portable tree watering devices such as "gator bags." For new developments, the developer is responsible for watering the tree during the two-year warranty period.

Where a homeowner is planting a street tree or two on their property, a temporary irrigation system or gator bags are not required. The homeowner can hand water the tree(s).

*k. Groundcover*

1. In areas the City is required to maintain, grass that requires weekly mowing is not appropriate. Instead, bark dust or low maintenance groundcover is strongly preferred.

2. In areas where on-street parking exists, the groundcover or shrubs planted adjacent to the curb shall allow pedestrians to easily cross over the vegetation. For example, thorny bushes are inappropriate adjacent to parking spaces.

## 5.12 Lighting

- a. Street lighting shall be LED with the following features:
  1. Fixtures shall emit no light upward.
  2. Color temperature (CCT) shall not exceed 3000K.
- b. All street lighting shall be Option C, in other words, owned and maintained by the City.
- c. Luminaires are to be cobra-head style with 8' elliptical mast arms mounted on 25-foot high aluminum poles. Mounting new luminaires on utility poles is prohibited. The only exception to this requirement is along arterials in the Main Street District downtown.
- d. All street lighting shall be designed by an Oregon licensed engineer using the provisions in this manual, and where applicable, ANSI/IES RP-8 American National Standard Practice for Roadway Lighting.
- e. All material and workmanship shall conform to PGE Schedule 95, Option C.
- f. Lighting equipment along Highway 8 may need to meet additional ODOT requirements. The City Engineer should be consulted in those situations.

## 5.13 Other Considerations

- a. *Mailboxes*
  1. Group mailboxes shall be installed at a location approved by the Cornelius or Hillsboro USPS Postmaster and be located a minimum of 10 feet from fire hydrants.
  2. For group mailboxes installed in parkway strips, a 4-foot concrete sidewalk shall connect the back of the curb to the street sidewalk or pathway to provide easy access to the mailboxes.
  3. Group mailboxes shall be installed in a parking bay or other location where a mail truck can be out of the travel lanes when accessing the mailboxes. Parking shall be restricted in the vicinity of the group mailbox.



*b. Franchise Utility Pedestals and Associated Facilities*

Pedestals, power meter boxes, power transformers, cable closures, and similar franchise utility facilities shall be located outside the right-of-way in the public utility easement, unless approved by the City Engineer.

*c. Survey Monuments*

Survey monuments shall be installed per Washington County Surveyor standards.

*d. Bollards*

Unless another design is approved by the City Engineer, bollards shall be constructed and installed as shown in Standard Detail S-51.

**Chapter 6**  
**Parks**

*Reserved*

## Chapter 7 Small Wireless Facilities in the Public Right-of-Way

### 7.01 Philosophy

Small Wireless Facilities provide an important telecommunication service to the citizens of Cornelius. This chapter of the standards implements a process to allow these facilities in the rights-of-way in such a manner that impacts to the public are minimized.

### 7.02 Definitions

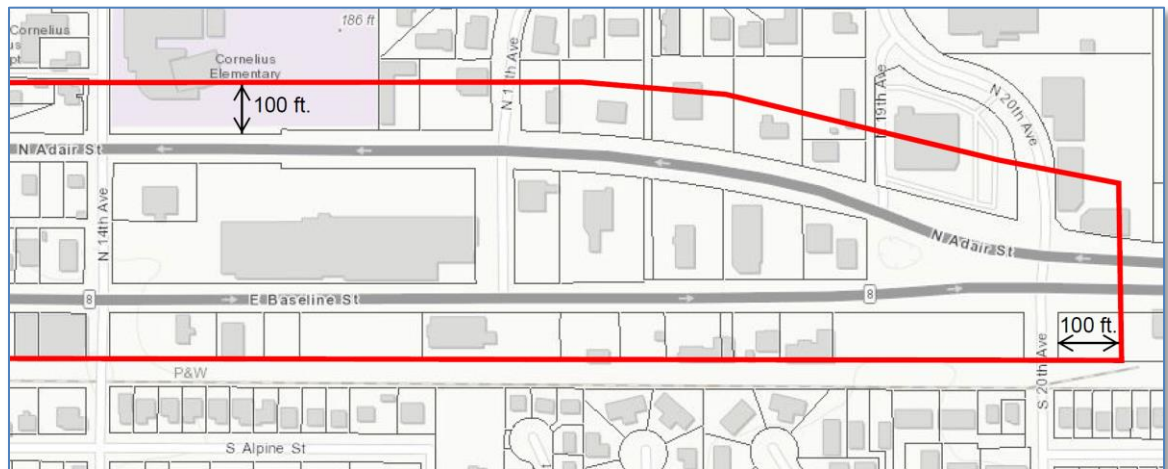
The definitions in this section are in addition to those in Section 1.05.

<i>Accessory equipment</i>	Antenna equipment as defined in 47 C.F.R. § 1.6002(c) means equipment, switches, wiring, cabling, power sources, shelters or cabinets associated with an antenna, located at the same fixed location as the antenna, and, when collocated on a structure, is mounted or installed at the same time as such antenna.
<i>Antenna</i>	As defined in 47 C.F.R. § 1.6002(b), an apparatus designed for the purpose of emitting radiofrequency (RF) emission, to be operated or operating from a fixed location pursuant to Federal Communication Commission authorization, for the provision of personal wireless service and any commingled information services. For purposes of this definition, the term antenna does not include an unintentional radiator, mobile station, or device authorized under 47 C.F.R. Part 15.
<i>Antenna facility</i>	Antenna and associated antenna accessory equipment as defined in 47 C.F.R. § 1.6002(d).
<i>Applicable codes</i>	Building, fire, safety, electrical, plumbing, mechanical, and other codes adopted by a recognized national code organization or state or local amendments to those codes that are of general application and consistent with state and federal law.
<i>Applicant</i>	An entity duly authorized to submit an application as or on behalf of a wireless provider.
<i>Clear Vision Zone</i>	A triangular area beginning at the intersection of projected curb lines of a street and extending 15 feet along the leg of each projection.
<i>Collocate or Collocation</i>	As defined in 47 C.F.R. § 1.6002(g) this means (1) mounting or installing an antenna facility on a preexisting structure, or (2) modifying a structure for the purpose of mounting or installing an antenna facility on that structure.

*Dimensions*

Dimensions in this chapter are often listed in 3 planes. *H* refers to the vertical dimension or height. *W* is the width of an object in a horizontal plane. *D* refers to the depth of an object, also in the horizontal plane. For an object mounted on a support structure, *D* is the distance from the support structure's surface to the farthest edge of the object in a horizontal plane.

*Downtown Business District (DBD)* The pedestrian-oriented central core of Cornelius. The district is bounded by the northern ROW of the rail line between Alpine and Baseline, a line 100 feet north of the northern ROW of Adair St., a line 100 feet west of the western ROW of 10th Avenue, and a line 100 feet east of the eastern ROW of 20th Avenue, as shown below.



*Ground-based Equipment* Equipment supporting the small wireless antennas that is not internal to a support structure and less than 7 feet above the ground. Ground-based equipment does not include underground cables or conduit to the site.

<i>Right-of-way or ROW</i>	Includes, but is not limited to, the space in, upon, above, along, across, over or under the public streets, roads, highways, lanes, courts, ways, alleys, boulevards, bridges, trails, paths, sidewalks, bicycle lanes, and all other public ways or areas reserved for, dedicated to or open to the use by the general public for travel, including the subsurface under and air space over these areas, but does not include parks, parkland, or other City property not generally open to the public for travel.
<i>Small Wireless Facility</i>	<p>A facility that provides cellular and data coverage to supplement a network Provider's cellular network that meets each of the following four conditions per the 47 C.F.R § 1.6002(l):</p> <ol style="list-style-type: none"> <li>1. The proposed facilities meet one of the following height parameters: <ol style="list-style-type: none"> <li>a. are mounted on structures 50 feet or less in height including their antennas as defined in 47 C.F.R. § 1.1320(d), or</li> <li>b. are mounted on structures no more than 10 percent taller than other adjacent structures, or</li> <li>c. do not extend existing structures on which they are located to a height of more than 50 feet or by more than 10 percent, whichever is greater.</li> </ol> </li> <li>2. Each antenna or antenna enclosure shall not exceed three cubic feet in volume.</li> <li>3. The total volume of accessory equipment external to the support structure (including, but not limited to cabinets, vaults, boxes, radios, and panels) shall not exceed twenty-eight (28) cubic feet. This maximum applies to all equipment installed at the time of original application and includes any equipment to be installed at a future date. Antennas and antenna shrouds or enclosures are excluded. Proposals with equipment that exceed this maximum shall not be eligible for siting as Small Wireless Facilities.</li> <li>4. The facilities do not result in human exposure to radio frequency radiation in excess of the applicable safety standards specified in the FCC's Rules and Regulations (47 C.F.R. § 1.1307(b)).</li> </ol>
<i>Structure/Support Structure</i>	As provided in 47 C.F.R. § 1.6002(m), a pole, tower, or base station, or other structure, whether or not it has an existing antenna facility, that is used or to be used to support Small Wireless Facilities (whether on its own or comingled with other types of services).
<i>Technically feasible</i>	A proposed placement, location or design for a Small Wireless Facility can be implemented without a material

reduction in the intended service objective of the Small Wireless Facility.

<i>Utility Pole/Pole</i>	A type of structure in the rights-of-way that is or may be used in whole or in part by or for wireline communications, electric distribution, lighting, traffic control, signage, or similar function, which may be used as a support structure for Small Wireless Facilities consistent with these standards and all other applicable codes; provided such term does not include a tower, building, or electric transmission structures.
<i>Wireless provider</i>	<i>Entity providing personal wireless services, as defined in 47 U.S.C. § 332(c)(7)(C)(i) or an entity authorized to provide communications service in the state, that builds or installs wireless communication transmission equipment, wireless facilities, but does not provide personal wireless services.</i>

### **7.03 Work Covered by this Chapter**

This chapter covers Small Wireless Facilities located in the public right-of-way. Installation of these facilities in the City and outside of the public right-of-way is governed by the City's development and zoning codes.

### **7.04 Installation Types**

#### *a. Existing Utility Poles*

1. Use of existing utility poles requires written approval from the pole owner.
2. All Small Wireless Facility-related equipment shall be removed and relocated, at no cost to the City, if the City or pole owner decides to underground or relocate the utility lines using the pole in the future.
3. Small Wireless Facilities mounted on existing or replacement utility poles may not:
  - A) Exceed 50 feet in height, including all antennas; or
  - B) Be mounted in such a manner so as to be more than 10 percent taller than other adjacent structures, including all antennas; or
  - C) Be mounted in such a way to extend the existing utility poles on which they are located to a height of more than 50 feet or by more than 10 percent, whichever is greater, including all antennas.

#### *b. Existing City-Owned Support Structures*

Small Wireless Facilities are not allowed on existing or replacement support structures owned by the City unless the applicant can first establish the following:

1. No existing non-City owned support structure alternatives exist that can serve as adequate support structures; and

2. It is not feasible for the applicant to install a new support structure for the Small Wireless Facilities.

In such situations, the applicant will have the responsibility of establishing that that the City-owned support structure can adequately support the Small Wireless Facility by providing calculations and drawings prepared and stamped by a Professional Engineer, duly licensed by the State of Oregon, for review and approval by the City Engineer or designee. This does not prohibit new or replacement support structures that contain Small Wireless Facilities and a street light or other infrastructure, if the new support structure meets the other requirements in this chapter.

*c. New or Replacement Support Structures*

1. The total height of any new or replacement support structure, may not:
  - A) Exceed 50 feet in height, including all antennas; or
  - B) Be mounted in such a manner so as to be more than 10 percent taller than other adjacent structures, including all antennas; or
  - C) Be mounted in such a way to extend the existing support structures on which they are located to a height of more than 50 feet or by more than 10 percent, whichever is greater, including all antennas.
2. The design and appearance of new and replacement support structures shall be subject to approval by the City, and shall be consistent with other existing support structures in the City. Proposals for new and replacement support structures shall be required to be accompanied by calculations and drawings prepared and stamped by a Professional Engineer, duly licensed by the State of Oregon, for review and approval by the City Engineer or designee.
3. New support structures shall be made of aluminum or stainless steel.

*d. Strand Mounted*

1. Each strand-mounted Small Wireless Facility shall not exceed 3 cubic feet in volume.
2. Only one (1) strand-mounted wireless facility is permitted between any two existing poles, subject to applicable codes.
3. Strand-mounted devices shall be placed as close as possible to the nearest pole and in no event more than five feet from the pole unless a greater distance is required by the joint use utility pole owner to comply with applicable health and safety standards.
4. No strand-mounted device will be located in or above the portion of the roadway open to vehicular traffic.
5. Strand-mounted devices must be installed with the minimum excess exterior cabling or wires (other than original strand) to meet the technological needs of the facility.

## 7.05 Approval Process

The City's approval process for Small Wireless Facilities varies depending on the degree of potential impacts from each small wireless site. Facilities proposed for existing support structures with no ground-based equipment have minimal submittal requirements and simplified equipment criteria. In contrast, those facilities proposed on new or replacement support structures and/or with ground-based equipment face more rigorous requirements and information submittals.

### a. License

Applicants seeking to construct Small Wireless Facilities must have a valid license franchise agreement or Small Wireless Facility License with the City prior to applying for a permit to construct.

### b. Permit Type

A Public Works Permit Application is required for all Small Wireless Facilities located in the right-of-way.

### c. Submittal Requirements

Applicants are encouraged to package multiple sites into one application to streamline review.

Standard submittal requirements include:

1. Complete Public Works Permit Application with related application fees as established by resolution of the City Council.
2. Drawing or map showing location of site
3. Drawings or plans for installation, including elevations, that allow the City to determine if the facility meets the requirements of this chapter.
4. Traffic control plan, if travel lanes need to be closed during installation.
5. Drawings or maps showing any trenching and underground construction that will occur in conjunction with the installation of the facility.
6. Photos of similar facilities.
7. Structural analysis of the support structure by a Professional Engineer indicating the structure and foundation can handle the proposed equipment load.
8. Detailed site plan showing other nearby infrastructure including but not limited to: sidewalks, driveways, curb/gutter, overhead and underground utilities, street trees, street lights, fire hydrants, utility pedestals, mailboxes, signs, etc.

The City Engineer may waive any of the above submittal requirements.



*d. Approval*

1. When approved, the City Engineer signs the Public Works Permit Application and stamps the submitted plans as approved.
2. Approval shall be based on meeting the requirements of this chapter.
3. Decisions shall be rendered on Small Wireless Facilities proposed on existing or replacement support structures within 60 days of receipt of a complete application.
4. Decisions shall be rendered on Small Wireless Facilities proposed on new support structures within 90 days of receipt of a complete application.

*e. Deviation from Standards*

Section 2.04 of these Standards provides a procedure for deviations from the standards. In the case of Small Wireless Facilities:

1. An applicant may request a deviation from these standards if compliance with the standard:
  - A) Is technically infeasible;
  - B) Impedes the effective operation of the Small Wireless Facility;
  - C) Impairs a desired network performance objective;
  - D) Conflicts with joint use support structure owner requirements related to health and safety; or
  - E) Otherwise materially inhibits or limits the provision of wireless service; and the City finds the applicant's proposed design provides equivalent or superior approach to compliance with these standards.
2. Requests for deviation must be narrowly tailored to minimize deviation from the requirements of these design standards.
3. The Small Wireless Facility design approved under this section must meet the conditions of 47 C.F.R. § 1.6002(l).
4. The City Engineer will review and may approve a request for deviation to the minimum extent required to address the applicant's needs or to facilitate a superior design.

## 7.06 Siting

### a. Preferred ROW Locations and Support Structures

1. Small Wireless Facilities shall be located according to the prioritization of transportation facilities and support structures listed below. The location and siting of Small Wireless Facilities shall be in the following order where more than one location and/or support structure is available, in order from highest priority to least desirable:

Locations:

- Alleys and maintenance and emergency access routes (most desirable)
- Industrial streets
- Collectors
- Arterials
- Woonerfs
- Local streets
- Downtown arterials (least desirable)

Support Structures

- Existing or Replacement Third-Party Support Structures (most desirable)
- New Support Structures
- City-Owned Infrastructure (least desirable)

### b. Downtown Arterials

Downtown arterials include:

- Adair (10<sup>th</sup> to 20<sup>th</sup>), including the intersections at 10<sup>th</sup> and 20<sup>th</sup>
- Baseline (10<sup>th</sup> to 20<sup>th</sup>), including the intersections at 10<sup>th</sup> and 20<sup>th</sup>
- 10<sup>th</sup> (Baseline to Adair)

Over the past few years, the City, Washington County, and Oregon Department of Transportation reconstructed the arterials through downtown Cornelius. This reconstruction included placing all possible utilities underground on these streets. Therefore, the City seeks to avoid new above ground utilities on these streets. If these locations are critical for the facilities, the City will work with applicants to find locations adjacent to the downtown arterials ROW locations. These alternate locations will typically be parallel alleys or cross-streets. If alternate locations are not technically feasible, the City shall allow Small Wireless Facilities on downtown arterials, subject to the other requirements of this chapter.

### c. Locations within the ROW for New Support Structures and Equipment

Small Wireless Facilities cannot obstruct vehicle travel lanes, bike lanes, or sidewalks. The City encourages applicants to construct bulb-outs for new support structures and equipment, where feasible.

1. New locations for support structures and equipment must provide adequate space for existing or future sidewalks, separated from the travel lanes by a

minimum of 6 feet. Required city sidewalk widths are 5 feet on local streets and 6 feet on collectors and arterials, and Small Wireless Facilities may not encroach on or interfere with pedestrian use of sidewalk areas.

2. Support structures and equipment shall not interfere with pedestrian access under the Americans with Disabilities Act (ADA).
3. Applicants can construct bulb-outs to create space for new support structures and equipment. New bulb-outs shall preserve the minimum travel lane widths as specified elsewhere in these standards.

*d. Other Siting Considerations*

Siting of Small Wireless Facilities shall meet the following additional requirements.

1. Support structures and ground-based equipment that can be a visual barrier shall not be in the Clear Vision Zone.
2. Support structures and ground-based equipment shall be a minimum of 18 inches back from the face of curb.
3. Support structures and ground-based equipment shall be a minimum of 5 feet from fire hydrants.
4. Wherever possible, Small Wireless Facility support structures shall be located on the boundary between adjoining properties.
5. Support structures and ground-based equipment on new support structures shall not be located directly in front of a building entrance.
6. Small Wireless Facilities may not obstruct or otherwise interfere with street lights or any other public infrastructure in the public right-of-way.
7. The siting of Small Wireless Facilities shall not displace any street trees, nor negatively affect the health of any street trees.
8. To avoid potential public safety issues, Small Wireless Facilities shall not create a visual barrier to vehicle operators, bike riders, or pedestrians.
9. Hwy. 8, Adair and Baseline Streets, is a state highway managed by the Oregon Department of Transportation (ODOT). Therefore, installations in this right-of-way shall be subject to any separate review, approval and permitting from ODOT, in addition to the City.

## **7.07 Equipment Design – Outside the Downtown Business District**

*a. Antennas*

1. The total volume of any individual antenna on one structure shall not exceed three cubic feet.

2. All other equipment associated with the Small Wireless Facility is no more than 28 cubic feet in volume.
3. Antennas shall be the same color as the support structure they are attached to.

*b. Accessory Equipment– Support-Structure Mounted*

1. Shrouding

Accessory equipment shall be shrouded in opaque cubical or cylindrical enclosures that completely hide the equipment from viewing horizontally or from below.

Only one equipment shroud shall be installed per existing support structure. All wiring and cable connections on new and replacement support structures shall be internal to the structure.

The equipment shroud shall be the same color as the support structure it is mounted on.

2. Size

The shrouded volume of all accessory equipment shall not exceed 28 cubic feet.

3. Clearance

Support structure-mounted equipment shall be mounted to provide a minimum of 10 feet of clearance above ground level. If any part of the accessory equipment is over a street, driveway, or other vehicle way, the support structure-based equipment shall be mounted to provide a minimum of 17 feet of clearance above ground level.

4. Cabling

Wiring and cable connections between the antenna and accessory equipment shall be hidden in a shroud. Wiring and connections between the ground and support structure-based equipment shall be enclosed in conduit or shrouded. The conduit, shrouding, and all visible hardware shall match the color of the support structure. All wiring and cable connections on new and replacement structures shall be internal to the structure.

c. *Accessory Equipment– Ground Based, External to Support Structure*

The City believes well designed, ground-based equipment cabinets are less intrusive than equipment mounted on support structures. The requirement for stainless steel boxes is to help address graffiti problems. Stainless steel is more difficult to tag and easier to clean.

1. General

Accessory equipment shall be housed in cubical enclosures with generally flat surfaces on the sides and top.

Only one equipment cabinet shall be installed per support structure.

Equipment cabinets shall be stainless steel.

All wiring to and from a ground-based equipment cabinet shall be underground.

2. Size

The maximum measurements of any side of an equipment cabinet shall be no more than 3-feet tall, 5-feet long (parallel to street centerline), and 3-feet wide (perpendicular to street centerline), and in no case shall exceed 28 cubic feet in volume.

d. *Accessory Equipment– Ground Based, Internal to Support Structure*

1. The accessory equipment cabinet shall be round and the same material and color as the support structure.
2. The maximum outer diameter of the equipment cabinet shall be 24 inches.
3. The maximum volume of the equipment cabinet shall not exceed 28 cubic feet.
4. All wiring to and from a ground-based equipment cabinet shall be underground or internal to the support structure.

**7.08 Equipment Design – Inside the Downtown Business District**

a. *Antennas*

1. The total volume of any individual antenna on one structure shall not exceed three cubic feet.
2. Antennas shall be the same color as the support structure they are attached to.
3. Antennas shall be mounted to provide a minimum of 10 feet of clearance above ground level. If any part of the antenna is over a street, driveway, or other vehicle way, the antenna shall be mounted to provide a minimum of 17 feet of clearance above ground level.

4. Wiring and cable connections between the antennas and ground shall be internal to the support structure or shrouded so it is not visible. The shrouding and all visible hardware shall match the color of the support structure.

*b. Accessory Equipment*

1. All accessory equipment shall be located underground in a vault.
2. Vaults shall be located and constructed so as not to impede other uses of the right-of-way such as use by pedestrians, bicycles, and vehicles,
3. Wiring and cable connections between the base of the support structure and the vault shall be underground.
4. The size of all accessory equipment shall not exceed 28 cubic feet.

## **7.09 Other Considerations**

*a. Power Supply*

Small Wireless Facilities shall be supplied with power independently. They shall never share power with street lights or traffic signals.

*b. Impacts to ROW During Construction and Maintenance*

Any impacts to the right-of-way during construction, installation, and maintenance of a Small Wireless Facility shall be mitigated and the site returned to its original condition or better. Specifically landscaping, pavement, and other elements inside the right-of-way in the vicinity of the Small Wireless Facility shall be restored to original condition or better within seven days of construction, installation, or maintenance of the Small Wireless Facility.

*c. PUE*

All ground conduit must be located in the public utility easement (PUE), where available.

*d. Structure and Equipment Identification*

Each support structure and ground-based equipment cabinet shall display 5-feet above finished grade, a maximum 4-inch by 6-inch aluminum plate with the Small Wireless Facility owner's name, location identifying information, and emergency telephone number. Other than this identification information and safety information, no signage or advertising of any kind is allowed on the Small Wireless Facilities, except as otherwise required by law.

*e. Visible Static or Flashing Lights*

Equipment shall not have static or flashing lights that are visible when the enclosures are closed.

*f. Noise*

Small Wireless Facilities, including equipment, shall not produce noise in excess of the limits established in Section 9.20 of the Cornelius Municipal Code.

*g. Graffiti Abatement*

No less than 10 calendar days from the date the owner of the Small Wireless Facility receives notice from the City of graffiti on its facilities, the owner shall remove all graffiti. If the graffiti has not been removed after 10 days, the City may cause the graffiti to be removed and the owner of the Small Wireless Facility shall reimburse the City for such removal.

*h. Removal – Due to Abandonment*

When a Small Wireless Facility is abandoned, with no intention of further use, the facility shall be removed within 90 calendar days. If the Small Wireless Facility is mounted on a support structure solely intended to support the Small Wireless Facility, then the support structure supporting the Small Wireless Facility, caisson, foundation and any other supporting infrastructure shall be removed. All utilities providing service to the small wireless installation shall be disconnected. The disturbed area shall be left in a condition acceptable to the City, (and to the pole owner, if applicable). In situations where the support structure supports other telecommunications equipment and/or other vertical infrastructure, such as a street light, the Small Wireless Facility and any other unused telecommunications equipment shall be removed, and the support structure and remaining infrastructure shall be replaced or reconfigured to perform its original purpose and function. If the subject Small Wireless Facilities and support structure is not removed within 90 days, the City may cause the facilities to be removed and disposed of, and the owner of the Small Wireless Facility and support structure shall reimburse the City for such removal and disposal.

*i. Removal – Due to Conflicts*

Within 30 days after written notice from the city, the owner of a Small Wireless Facility shall, at its own expense, temporarily or permanently disconnect, remove, relocate, change, or alter the position of the facility located within the right-of-way whenever the City has determined that doing so is reasonably necessary for the construction, repair, maintenance, or installation of public improvements in the right-of-way. These public improvements may be constructed by the City or another entity.

## **Appendix A**

### **Standard Details, Notes, and Guides**

#### **Water Standard Details**

- W-1 Fire Hydrant Assembly
- W-2 Gate Valve Setting Detail
- W-3 Thrust Block Table
- W-4 Collar Thrust Block
- W-5 Standard Blow-Off (Future Extension)
- W-6 Standard Blow-Off (End of Line)
- W-7 Domestic Water Service
- W-8 2-Inch Water Service

#### **Street Standard Details**

- S-1 Asphalt Pavement Thickness
- S-2 Concrete Pavement Thickness
- S-3 Trench Backfill
- S-4 Asphalt Pavement Cut Restoration
- S-5 Concrete Pavement Cut Restoration
  
- S-11 Curb and Gutter
- S-12 Vertical Curb
- S-13 Mountable Curb
- S-14 Valley Gutter
- S-15 Curb and Gutter Restoration
  
- S-21 Commercial Driveway with Curb-Tight Sidewalk
- S-22 Commercial Driveway with Parkway Strip
- S-23 Residential Driveway with Curb-Tight Sidewalk
- S-24 Residential Driveway with Parkway Strip
- S-25 Sidewalk Finishing
  
- S-31 Permanent Sign Installation
- S-32 Type 3 Barricade
- S-34 Woonerf Sign
  
- S-41 Street Tree Planting
  
- S-51 Bollard

#### **Standard Notes**

#### **Guides**

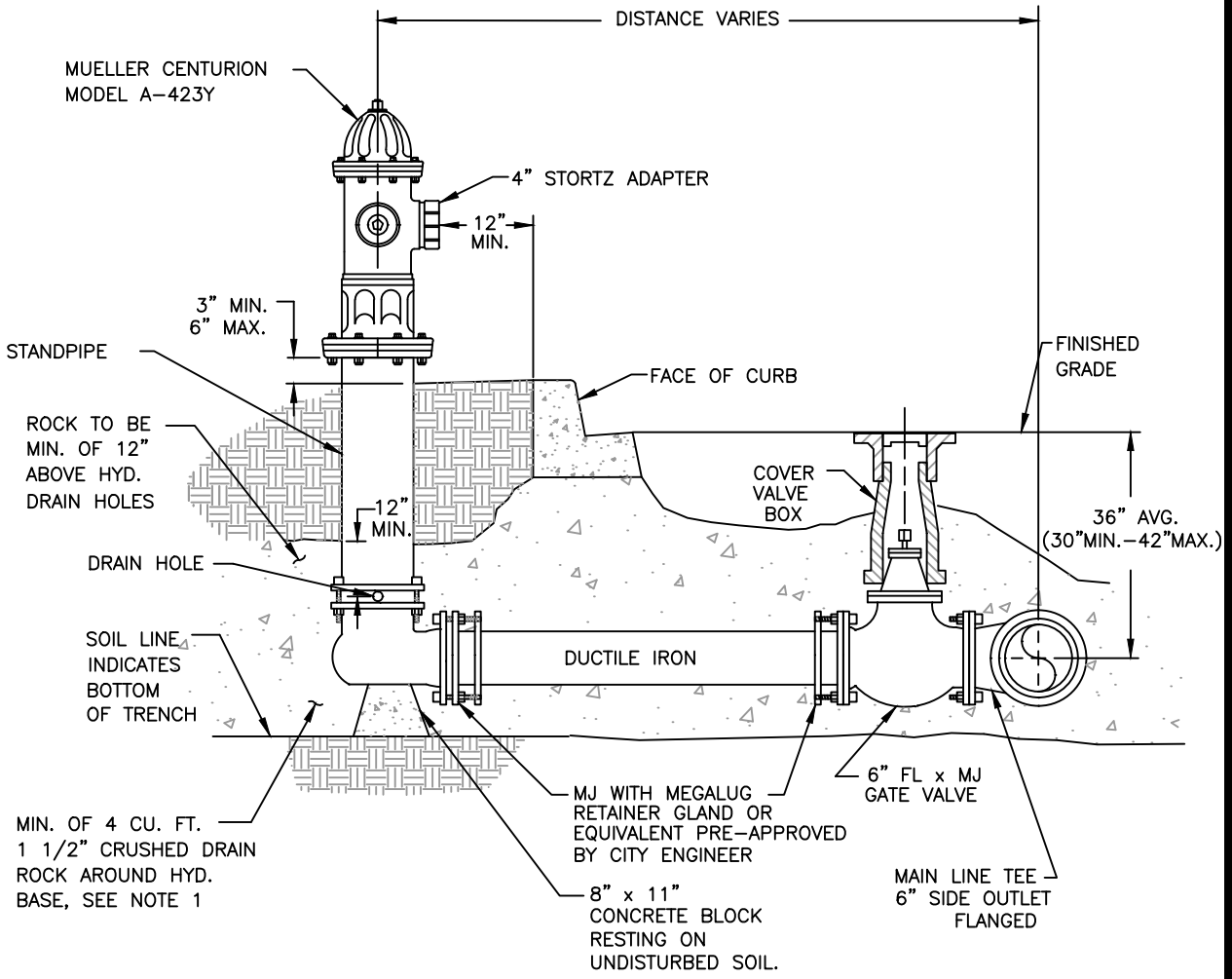
Below are publications from other agencies that contain information that is helpful in meeting these standards.

- *ADA Ramp Inspection Form* – ODOT (11-3-15)



- *Example Single Family Erosion and Sediment Control Site Plan – Clean Water Services (5-5-16)*
- *Using the Cornelius Pavement Details (S-1 and S-2) in a Plan Set*

# Water Standard Details



**NOTES:**

1. IF DISTANCE IS GREATER THAN 10' FROM CENTER OF MAINLINE TO CENTER OF HYDRANT ELBOW THRUST BLOCK OR RODDING IS REQUIRED.
2. ALL FITTINGS TO BE MUELLER UNLESS EQUIVALENT PRE-APPROVED BY CITY ENGINEER.
3. GATE VALVE TO BE DUCTILE IRON BODY, RESILIENT WEDGE ONLY PER AWWA C515.

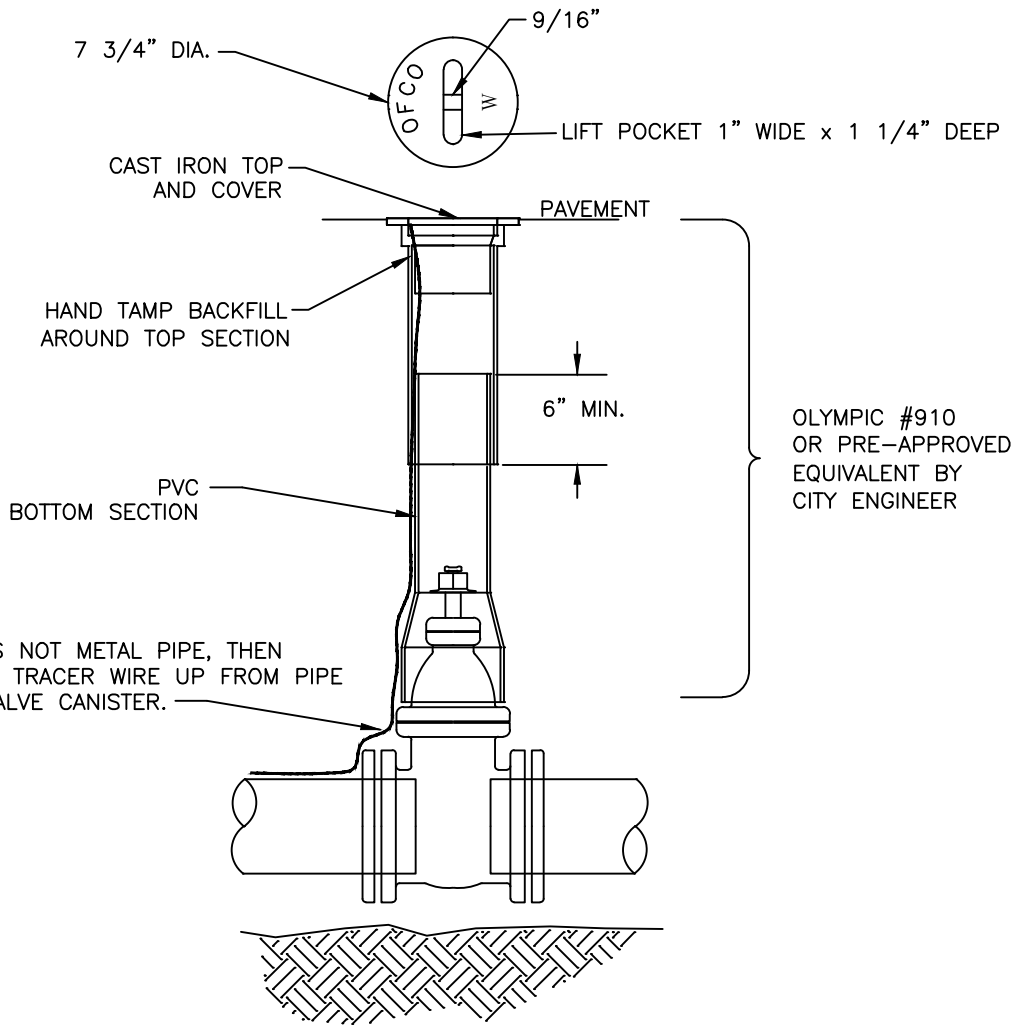
**Cornelius**  
Oregon's Family Town

**FIRE HYDRANT  
ASSEMBLY**

WATER

W - 1

7/18/16



NOTES:

1. VALVE BOX NOT TO REST ON OPERATING ASSEMBLY.
2. CENTER VALVE BOX ON AXIS OF OPERATING NUT.
3. GATE VALVE TO BE DUCTILE IRON BODY, RESILIENT WEDGE ONLY PER AWWA #C515.

(HORIZONTAL) BEARING AREA OF THRUST BLOCKS IN SQUARE FEET								(VERTICAL) VOLUME OF THRUST BLOCK IN CUBIC YARDS				
FITTING SIZE	TEE, WYE, DEAD END AND HYDRANT	STRADDLE BLOCK	90° BEND PLUGGED CROSS	TEE PLUGGED ON RUN		45° BEND	22-1/2° BEND	11-1/4° BEND	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND
				A-1	A-2							
4	1.0	1.6	1.4	1.9	1.4	1.0	---	---	---	---	---	---
6	2.1	3.7	3.0	4.3	3.0	1.6	1.0	---	1.3	---	---	---
8	3.8	6.5	5.3	7.6	5.4	2.9	1.5	1.0	2.3	1.1	---	---
10	5.9	10.2	8.4	11.8	8.4	4.6	2.4	1.2	3.7	1.8	---	---
12	8.5	14.7	12.0	17.0	12.0	8.6	3.4	1.7	5.5	2.8	1.2	---

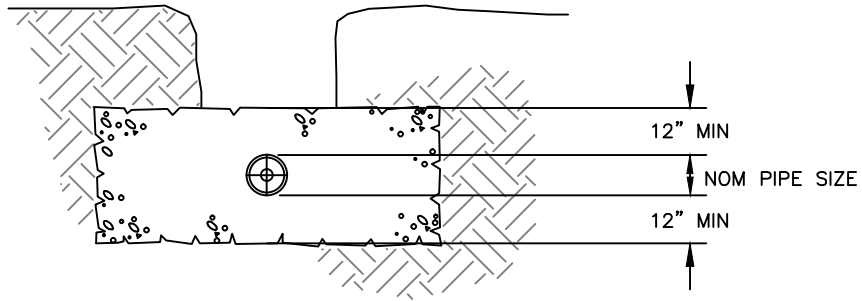
**NOTES:**

1. ABOVE BEARING AREAS BASED ON TEST PRESSURE OF 150 PSI AND AN ALLOWABLE SOIL BEARING STRESS OF 2000 POUNDS PER SQUARE FOOT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES, USE THE FOLLOWING EQUATION:

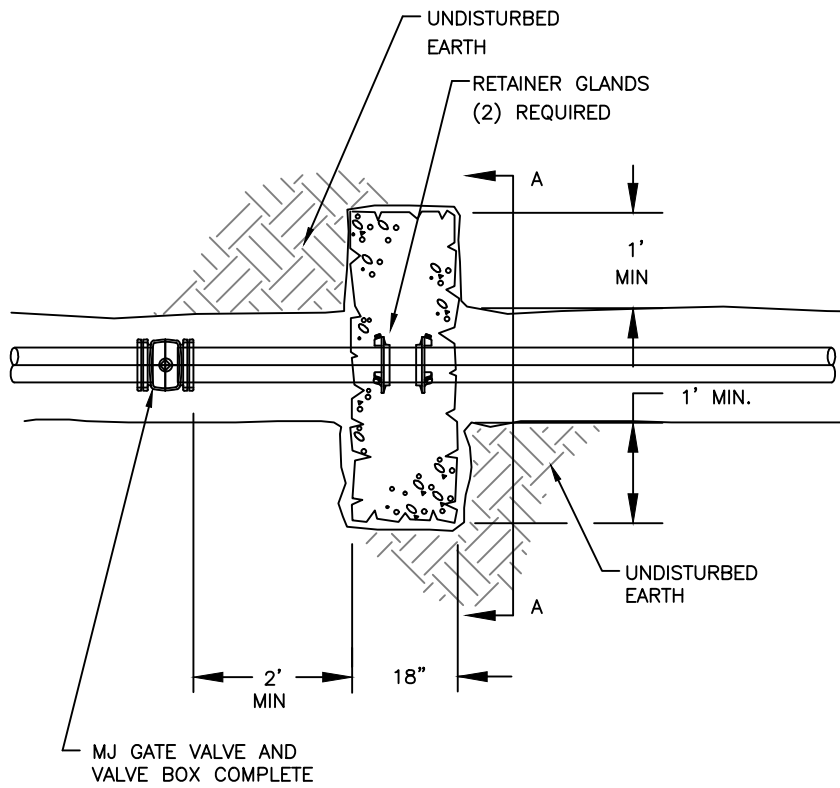
$$\text{BEARING AREA} = (\text{TEST PRESSURE}/150) \times (2000/\text{SOIL BEARING STRESS}) \times (\text{TABLE VALUE})$$

2. ABOVE VOLUMES BASED ON TEST PRESSURE OF 150 PSI AND THE WEIGHT OF CONCRETE = 4050 POUNDS PER CUBIC YARD. TO COMPUTE FOR DIFFERENT TEST PRESSURES, USE THE FOLLOWING EQUATION:

$$\text{VOLUME} = (\text{TEST PRESSURE}/150) \times (\text{TABLE VALUE})$$



SECTION A-A



PLAN

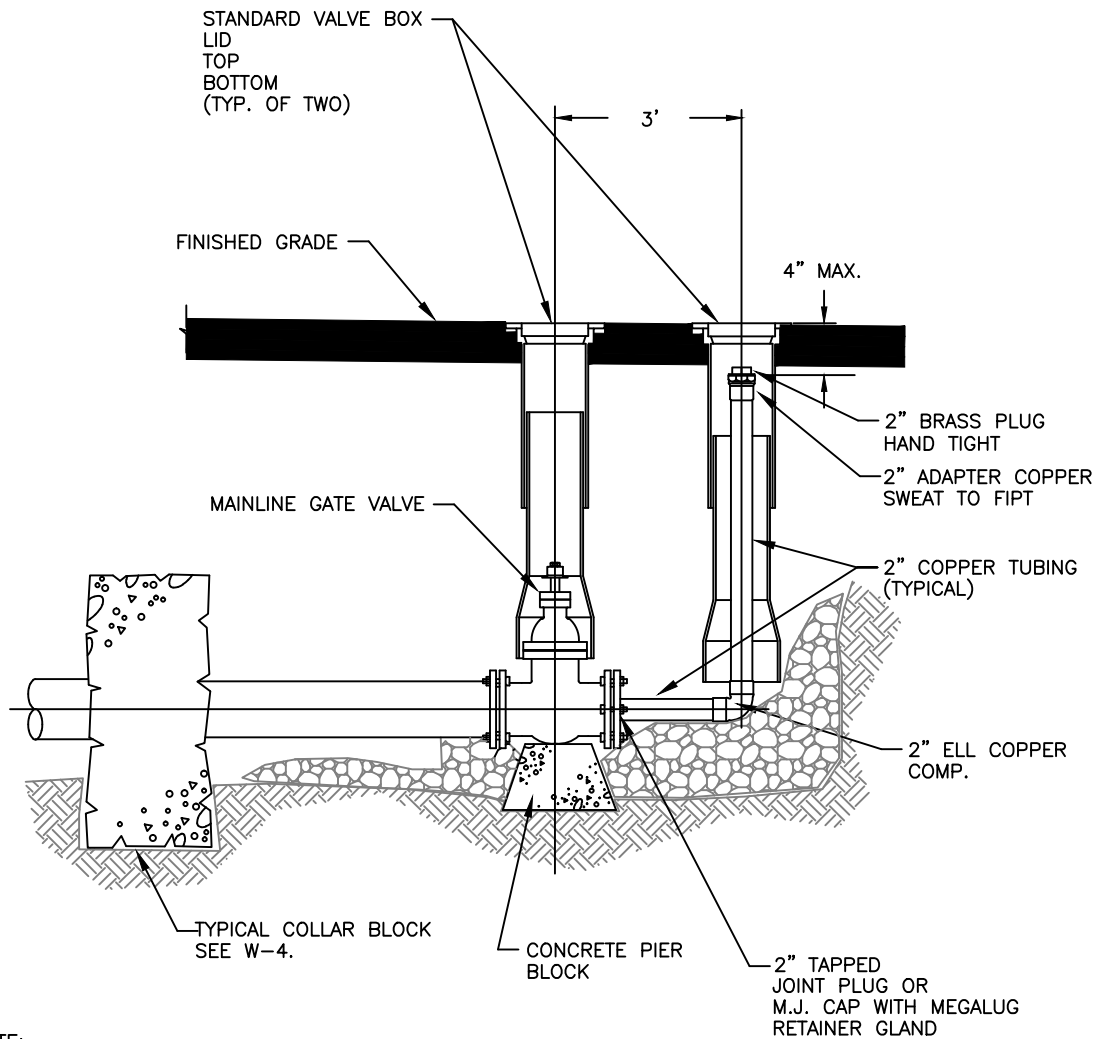
**Cornelius**  
Oregon's Family Town

**COLLAR  
THRUST BLOCK**

WATER

W - 4

7/18/16



**NOTE:**

1. THREADED BRASS PIPING MAY BE USED IN PLACE OF COPPER TUBING
2. 8" MAXIMUM PIPE SIZE ALLOWED FOR 2" BLOW-OFF. 10" AND 12" PIPE SIZE SHALL HAVE 4" AND 6" BLOW-OFFS RESPECTIVELY.
3. BLOW-OFF SHALL BE LOCATED AS NEEDED, AS CLOSE AS POSSIBLE TO EDGE OF PAVEMENT TO MINIMIZE PAVEMENT PATCH WHEN LINE IS EXTENDED.

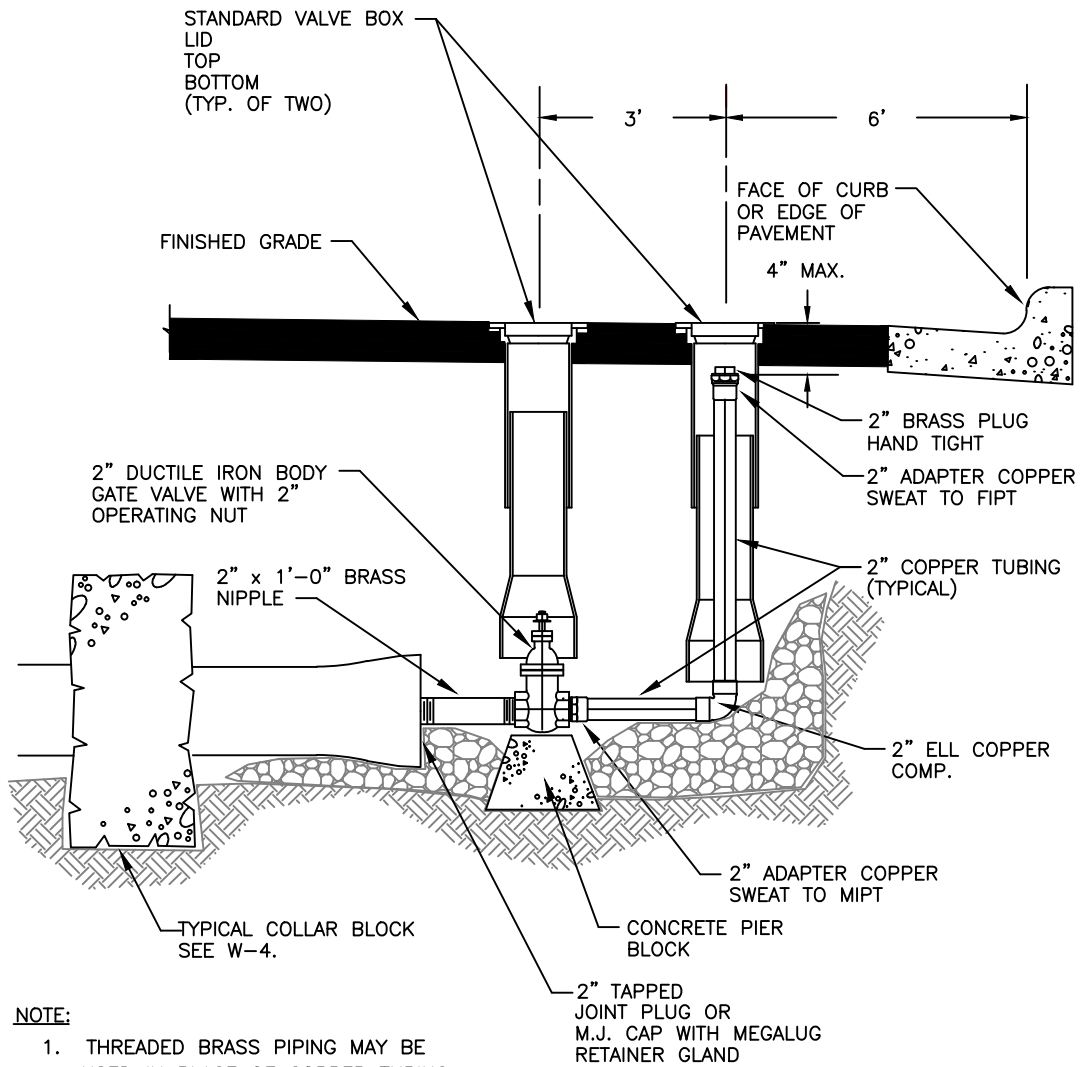
**Cornelius**  
Oregon's Family Town

**STANDARD BLOWOFF  
(FUTURE EXTENSION)**

WATER

W - 5

7/18/16



**NOTE:**

1. THREADED BRASS PIPING MAY BE USED IN PLACE OF COPPER TUBING

**Cornelius**  
Oregon's Family Town

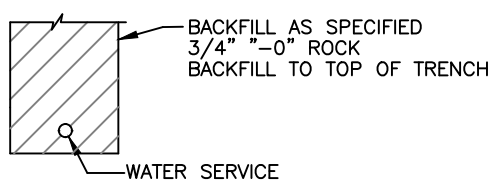
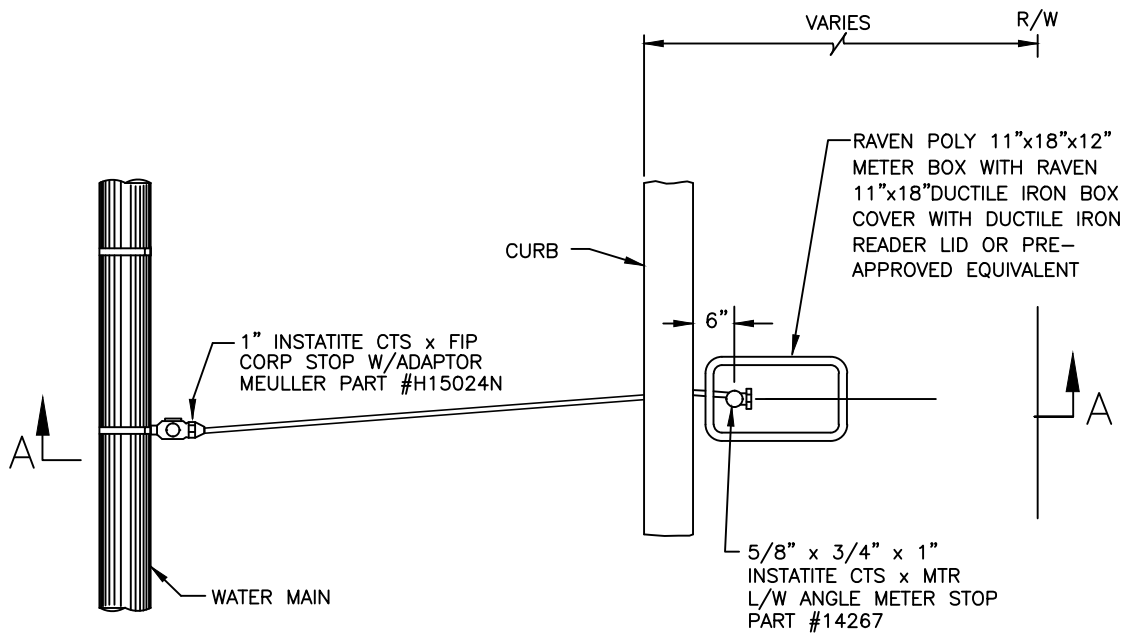
**STANDARD BLOWOFF  
(END OF LINE)**

WATER

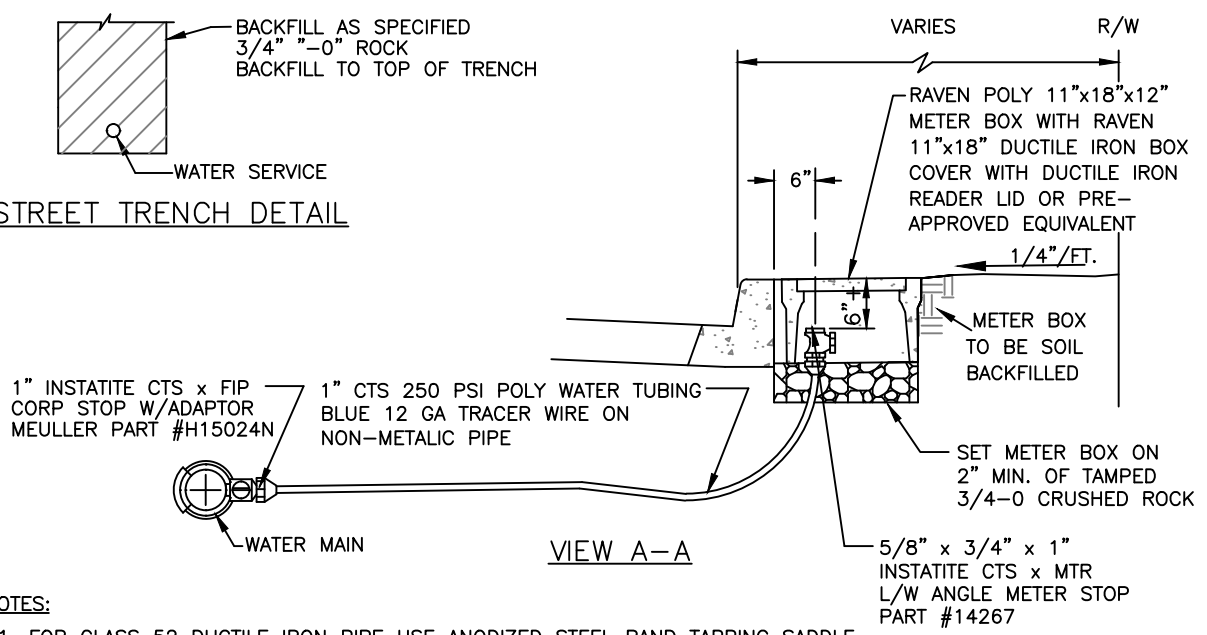
W - 6

7/18/16





STREET TRENCH DETAIL

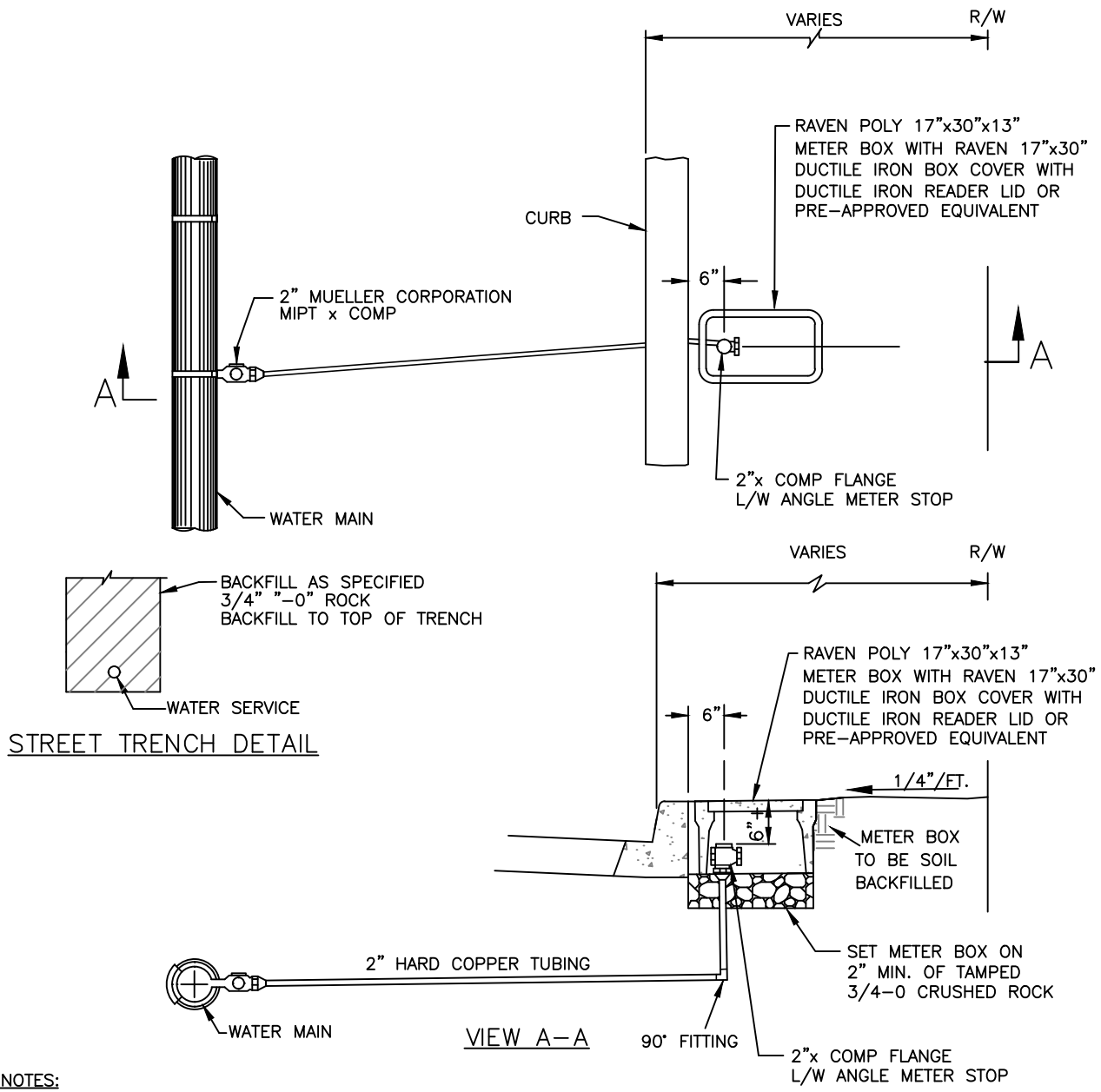


VIEW A-A

**NOTES:**

1. FOR CLASS 52 DUCTILE IRON PIPE USE ANODIZED STEEL BAND TAPPING SADDLE.
2. FOR C-900 PIPE USE WIDE STAINLESS STEEL BAND TAPPING SADDLE. APPROVED FOR PVC PIPE.
3. ALL BRASS FITTINGS TO BE MUELLER UNLESS PREVIOUSLY APPROVED BY THE CITY ENGINEER.
4. IF SIDEWALK IS CURB TIGHT, WATER METER SHALL BE LOCATED IMMEDIATELY BEHIND THE SIDEWALK.
5. SERVICE LINE TAPS TO MAIN LINE SHALL BE A MINIMUM OF 24 INCHES APART.
6. IF MULTIPLE LATERALS SHARE A COMMON TRENCH, THE LATERALS SHALL BE A MINIMUM OF 12 INCHES APART.

	<h2>DOMESTIC WATER SERVICE</h2>	WATER
		W - 7
		3/6/20



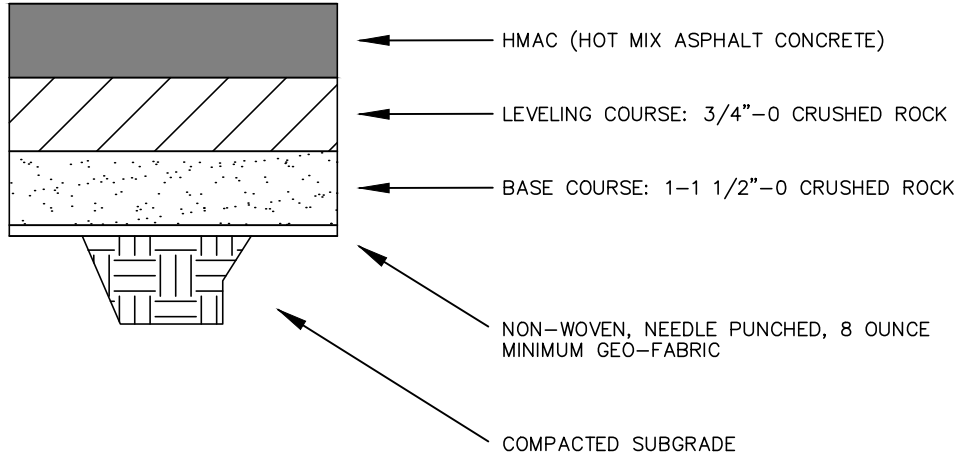
**NOTES:**

1. FOR CLASS 52 DUCTILE IRON PIPE USE ANODIZED STEEL BAND TAPPING SADDLE.
2. FOR C-900 PIPE USE WIDE STAINLESS STEEL BAND TAPPING SADDLE. APPROVED FOR PVC PIPE.
3. ALL BRASS FITTINGS TO BE MUELLER UNLESS PREVIOUSLY APPROVED BY THE CITY ENGINEER.
4. IF SIDEWALK IS CURB TIGHT, WATER METER SHALL BE LOCATED IMMEDIATELY BEHIND THE SIDEWALK.
5. SERVICE LINE TAPS TO MAIN LINE SHALL BE A MINIMUM OF 24 INCHES APART.
6. IF MULTIPLE LATERALS SHARE A COMMON TRENCH, THE LATERALS SHALL BE A MINIMUM OF 12 INCHES APART.

	<h2>2 INCH WATER SERVICE</h2>	WATER
		W - 8
		7/18/16

# Street Standard Details

CROSS-SECTION



THICKNESS

	ARTERIALS AND INDUSTRIAL STREETS	COLLECTORS	LOCAL STREETS	ALLEYS	MAINTENANCE ACCESS ROADS
HMAC	LEVEL 3 6"	LEVEL 2 6"	LEVEL 2 4"	LEVEL 2 3"	LEVEL 2 3"
LEVELING COURSE	2"	2"	2"	2"	2"
BASE COURSE	14"	14"	10"	10"	6"

NOTE:

1. THE MAXIMUM LIFT THICKNESS FOR HMAC SHALL BE 2 INCHES.
2. SUBGRADE COMPACTED TO 95% AASHTO T-99
3. ALLEYS ARE GENERALLY PAVED WITH CONCRETE. THE ALLEY COLUMN IN THE TABLE ABOVE IS FOR SITUATIONS WHERE ONLY A PORTION OF AN EXISTING ALLEY IS PAVED.



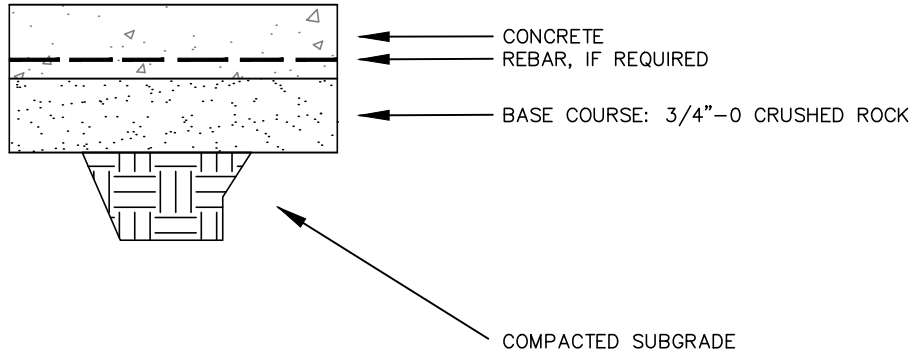
**ASPHALT PAVEMENT THICKNESS**

STREETS

S - 1

2/6/17

CROSS-SECTION



THICKNESS

	ON-STREET PARKING BAYS	ALLEYS AND WOONERFS	MAINTENANCE ACCESS ROADS	COMMERCIAL DRIVEWAYS	RESIDENTIAL DRIVEWAYS	SIDEWALK AND MULTI- USE PATHS
CONCRETE	6"	6"	6"	8"	6"	4"
REBAR	NO	NO	NO	YES	NO	NO
BASE COURSE	6"	8"	6"	4"	4"	4"

NOTE:

1. CONCRETE SHALL BE 4000 PSI, 28 DAY STRENGTH EXCEPT RESIDENTIAL DRIVEWAYS, SIDEWALKS AND MULTI-USE PATHS WHERE THE CONCRETE STRENGTH SHALL BE 3,300 PSI, 28-DAY.
2. SUBGRADE COMPACTED TO 95% AASHTO T-99
3. WHEREVER SIDEWALK CROSSES A ROADWAY, ALLEY, OR DRIVEWAY, THE ROADWAY CROSS-SECTION SHALL PREVAIL.



CONCRETE PAVEMENT  
THICKNESS

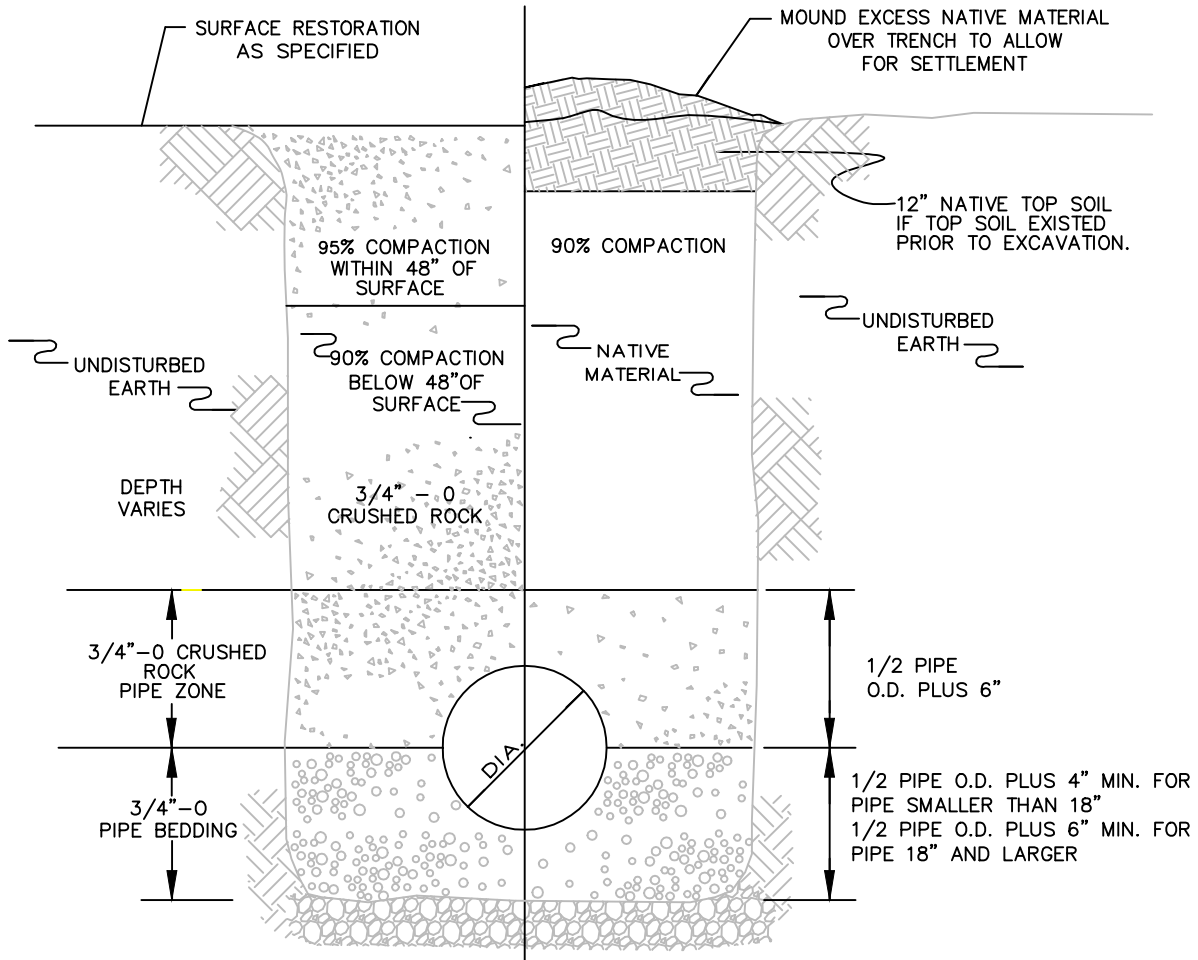
STREETS

S - 2

3/17/17

**WITHIN STREET  
RIGHT-OF-WAY  
(CLASS 'B' BACKFILL)**

**OUTSIDE STREET RIGHT-OF-WAY  
AS APPROVED BY CITY ENGINEER  
(CLASS 'A' BACKFILL)**



**NOTE:**

1. ALL COMPACTION REQUIREMENTS PER AASHTO T-99 AND ODOT APWA SPEC 00405.
2. TRENCH STABILIZATION: IF REQUIRED, TRENCH STABILIZATION SHALL BE SPECIFIED SEPARATELY AND PLACED PRIOR TO PLACEMENT OF BEDDING MATERIAL.
3. THE TRENCH WIDTH AT THE GROUND SURFACE SHALL BE KEPT TO THE MINIMUM NECESSARY TO INSTALL THE PIPE IN A SAFE MANNER.
4. THE MINIMUM WIDTH IN THE PIPE ZONE SHALL PROVIDE A CLEAR WORKING SPACE OF AT LEAST SIX INCHES OUTSIDE THE OUTSIDE DIAMETER OF THE PIPE BEING INSTALLED.
5. IN ALL CASES, TRENCHES SHALL BE OF SUFFICIENT WIDTH TO ALLOW FOR SHORING, PROPER JOINING OF PIPE, AND BACKFILLING OF MATERIAL ALONG THE SIDES OF THE PIPE.
6. TRACER WIRE SHALL BE PLACED ABOVE NON-METALLIC PIPE, EXCEPT WHERE SECTIONS BETWEEN STRUCTURES (MANHOLES AND CATCH BASINS) ARE STRAIGHT.

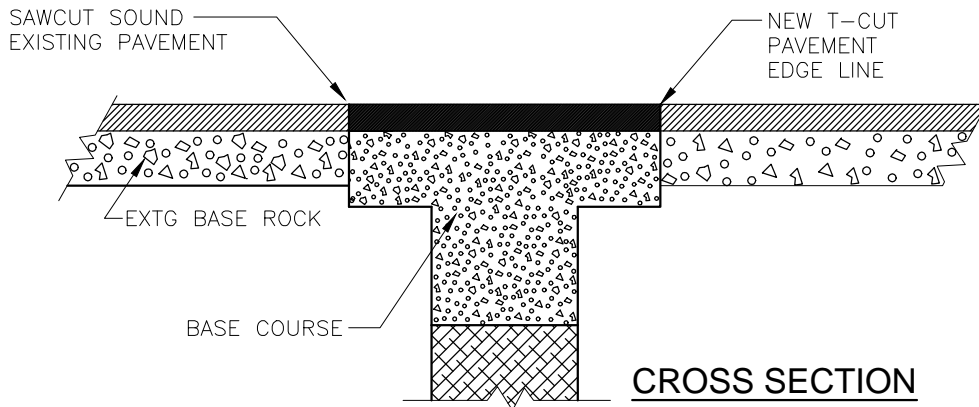
**Cornelius**  
Oregon's Family Town

**TRENCH BACKFILL**

STREETS

S - 3

10/17/19



NOTES:

1. SAWCUT EXISTING PAVEMENT TO FULL DEPTH.
2. CITY STREETS SHALL BE RESTORED TO THE PAVEMENT AND BASE THICKNESS AND DESIGN IDENTIFIED FOR THAT TYPE OF STREET IN THESE STANDARDS.
3. HWY 8 PAVEMENT RESTORATION WILL BE DICTATED BY ODOT.
4. ALL CUT EDGES OF AC SHALL BE SAND SEALED WITH CRS-1 OR CRS-2 EMULSIFIED ASPHALT OR EQUAL.
5. IF NEW EDGE OF PAVEMENT IS LESS THAN THREE FEET FROM ANOTHER PATCH, CURB OR EDGE OF STREET, REPLACE THE PAVEMENT IN BETWEEN, IF REQUIRED BY CITY ENGINEER.
6. IF ANY PART OF MORE THAN ONE PRE-EXISTING PATCH EDGE IS WITHIN 3 FEET OF THE T-CUT, THE PAVEMENT TO THE FAR EDGE OF THE FURTHEST PRE-EXISTING PATCH SHALL BE REMOVED AND RESTORED.
7. ON LONGITUDINAL PAVEMENT CUTS, THE EDGE OF THE T-CUT SHALL NOT LIE IN A WHEEL PATH.
8. IF AN EDGE OF A T-CUT IS WITHIN 5 FEET OR LESS OF AN AREA OF DISTRESSED EXISTING PAVEMENT, THE LENGTH AND WIDTH OF THE PAVEMENT RESTORATION MAY BE MODIFIED BY THE CITY ENGINEER TO ENSURE THE INTEGRITY OF THE PAVEMENT RESTORATION.
9. THE WIDTH FROM EDGE OF TRENCH SHALL BE 6 INCHES MINIMUM FOR TRENCHES THAT ARE 12 INCHES WIDE OR LESS AND 12 INCHES MINIMUM FOR TRENCHES WIDER THAN 12 INCHES. THE CITY ENGINEER MAY INCREASE THE WIDTH UP TO 10 FEET ON BOTH SIDES OF THE PAVEMENT CUT IF NEEDED TO ENSURE LONG-TERM INTEGRITY OF THE PAVEMENT.



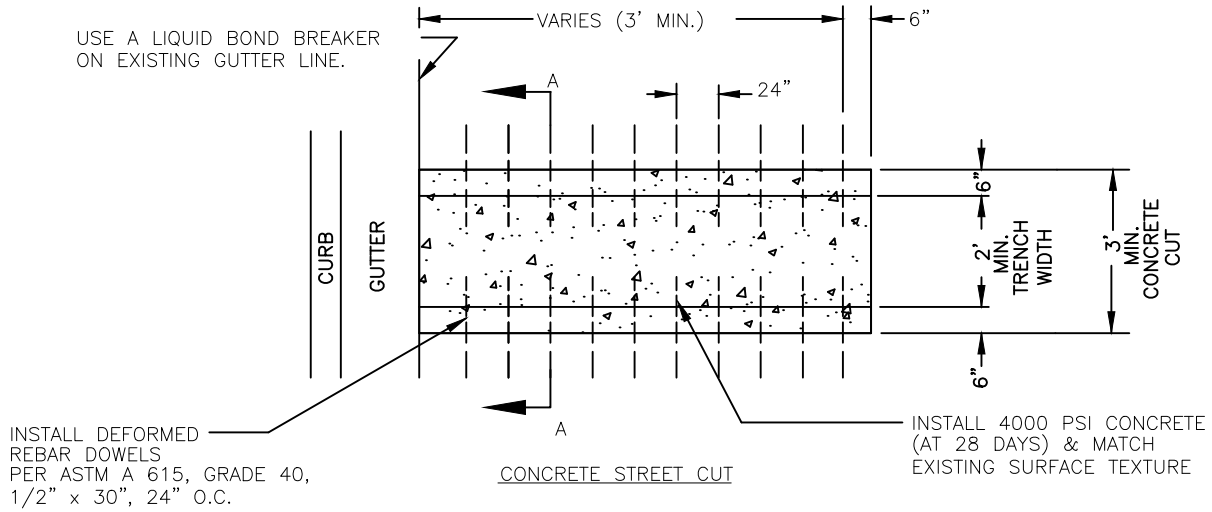
## ASPHALT PAVEMENT CUT RESTORATION

STREETS

S - 4

7/18/16

USE A LIQUID BOND BREAKER ON EXISTING GUTTER LINE.



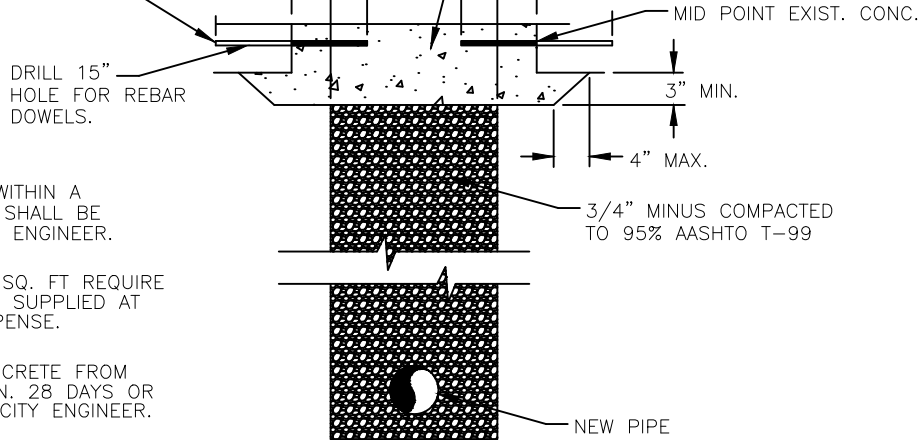
INSTALL DEFORMED REBAR DOWELS PER ASTM A 615, GRADE 40, 1/2" x 30", 24" O.C.

INSTALL 4000 PSI CONCRETE (AT 28 DAYS) & MATCH EXISTING SURFACE TEXTURE

INSTALL DEFORMED REBAR DOWELS PER ASTM A 615, GRADE 40, 1/2" x 30", 24" O.C.

DRILL 15" HOLE FOR REBAR DOWELS.

INSTALL 4000 PSI CONCRETE (AT 28 DAYS) & MATCH EXISTING SURFACE TEXTURE



**NOTES:**

1. ALL EXCAVATIONS WITHIN A CONCRETE STREET SHALL BE APPROVED BY CITY ENGINEER.
2. POURS OVER 100 SQ. FT REQUIRE CONCRETE TESTING SUPPLIED AT CONTRACTOR'S EXPENSE.
3. PROTECT NEW CONCRETE FROM TRAFFIC FOR A MIN. 28 DAYS OR AS APPROVED BY CITY ENGINEER.
4. AS ALTERNATIVE TO STREET CUT REPAIR DETAIL, ENTIRE AFFECTED PANEL CAN BE REPLACED WITHOUT REBAR.

SECTION A-A



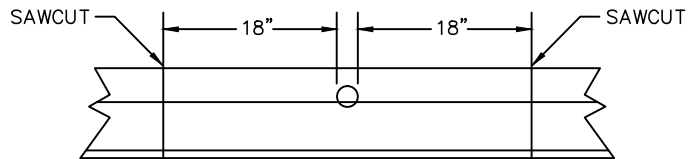
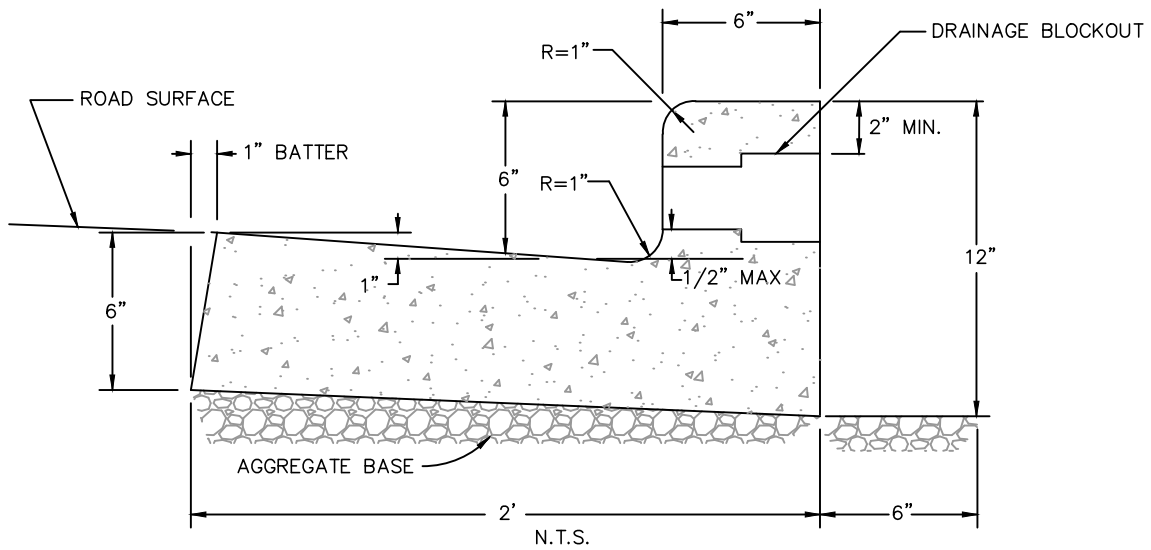
**CONCRETE PAVEMENT CUT RESTORATION**

STREETS

S - 5

7/18/16





**DETAIL A**  
N.T.S.

NOTES:

1. CONCRETE TO HAVE A COMPRESSIVE STRENGTH ( $f_c$ ) OF 3300 P.S.I. AFTER 28 DAYS.
2. CONTRACTION JOINTS.
  - A. SPACE NOT MORE THAN 10 FEET
  - B. DEPTH OF JOINT SHALL BE AT LEAST  $1/3$  DEPTH OF CONCRETE
  - C. CENTER WEEPHOLES WITH CONTRACTION JOINTS
3. USE  $1-1/2"-0"$  OR  $3/4"-0"$  AGGREGATE BASE COMPACTED TO 100% OF AASHTO T-99. PLACE TO SUBGRADE, STREET STRUCTURE, OR 10" DEPTH, WHICHEVER IS GREATER. EXTEND AT LEAST 6" BEHIND CURB.
4. DRAINAGE BLOCKOUT (REQUIRE CITY ENGINEER APPROVAL)
  - A. 3" DIAMETER ABS PLASTIC PIPE WITH COUPLING
  - B. 2 PER LOT, 5' IN FROM PROPERTY LINES OR LOCATE TO EXISTING ROOF DOWNSPOUTS
  - C. CORE DRILL DRAINAGE ACCESS THROUGH EXISTING CURBS OR VERTICALLY SAWCUT CURB AND GUTTER 18" ON EACH SIDE OF DRAIN AND REPOUR TO FULL DEPTH OF CURB AS SHOWN IN DETAIL A.

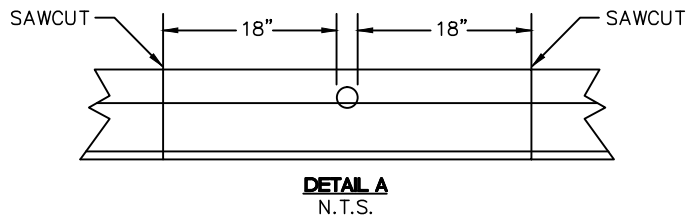
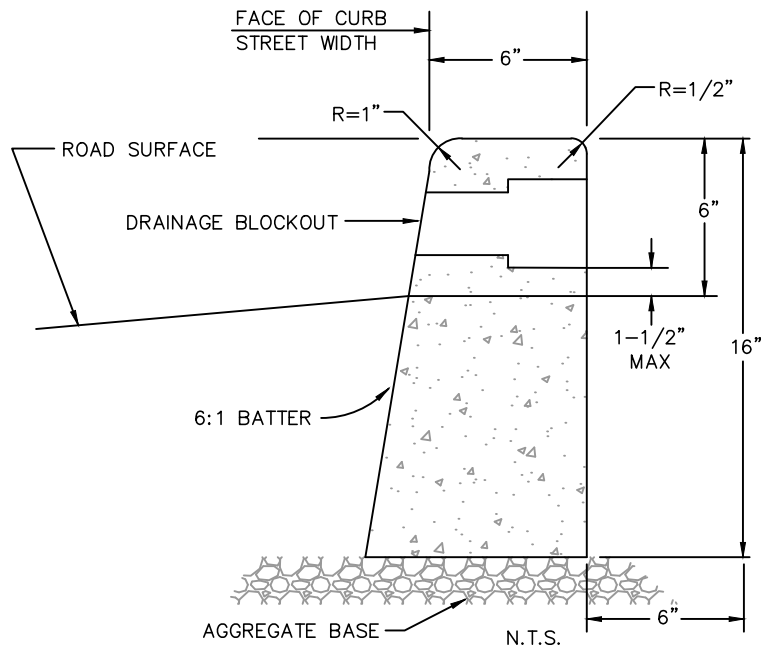
**Cornelius**  
Oregon's Family Town

**CURB & GUTTER**

STREETS

S - 11

7/18/16



**NOTES:**

1. CONCRETE TO HAVE A COMPRESSIVE STRENGTH ( $f_c$ ) OF 3300 P.S.I. AFTER 28 DAYS.
2. CONTRACTION JOINTS.
  - A. SPACE NOT MORE THAN 10 FEET
  - B. DEPTH OF JOINT SHALL BE AT LEAST 1/3 DEPTH OF CONCRETE
  - C. CENTER WEEPHOLES WITH CONTRACTION JOINTS
3. USE 1-1/2"-0" OR 3/4"-0" AGGREGATE BASE COMPACTED TO 100% OF AASHTO T-99. PLACE TO SUBGRADE, STREET STRUCTURE, OR 10" DEPTH, WHICHEVER IS GREATER. EXTEND AT LEAST 6" BEHIND CURB.
4. DRAINAGE BLOCKOUT (REQUIRE CITY ENGINEER APPROVAL)
  - A. 3" DIAMETER ABS PLASTIC PIPE WITH COUPLING
  - B. 2 PER LOT, 5' IN FROM PROPERTY LINES OR LOCATE TO EXISTING ROOF DOWNSPOUTS
  - C. CORE DRILL DRAINAGE ACCESS THROUGH EXISTING CURBS OR VERTICALLY SAWCUT CURB AND GUTTER 18" ON EACH SIDE OF DRAIN AND REPOUR TO FULL DEPTH OF CURB AS SHOWN IN DETAIL A.

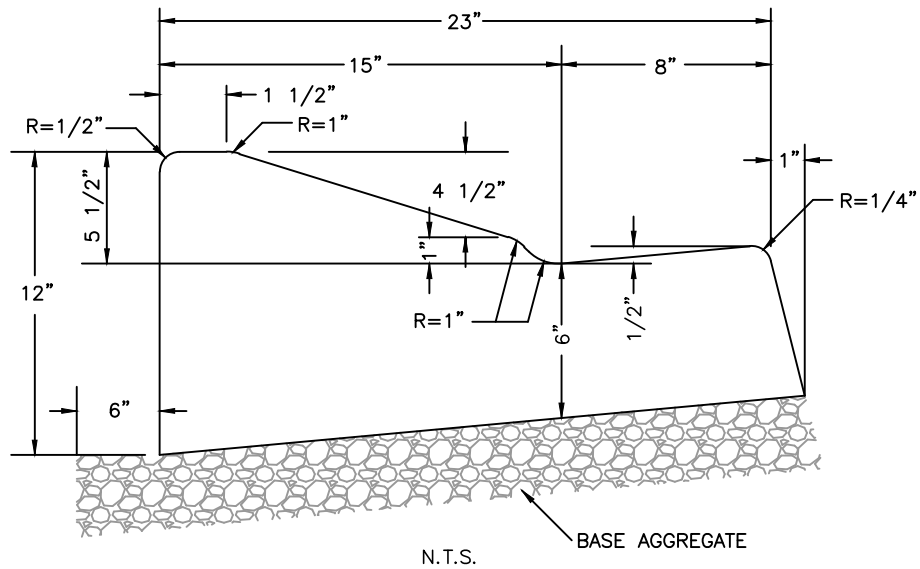
**Cornelius**  
Oregon's Family Town

**VERTICAL CURB**

STREETS

S - 12

7/18/16



NOTES:

1. CONCRETE TO HAVE A COMPRESSIVE STRENGTH ( $f_c$ ) OF 4000 P.S.I. AFTER 28 DAYS.
2. CONTRACTION JOINTS.
  - A. SPACE NOT MORE THAN 10 FEET
  - B. DEPTH OF JOINT SHALL BE AT LEAST 1/3 DEPTH OF CONCRETE
  - C. CENTER WEEPHOLES WITH CONTRACTION JOINTS
3. USE 1-1/2"-0" OR 3/4"-0" AGGREGATE BASE COMPACTED TO 100% OF AASHTO T-99. PLACE TO SUBGRADE, STREET STRUCTURE, OR 10" DEPTH, WHICHEVER IS GREATER. EXTEND AT LEAST 6" BEHIND CURB.

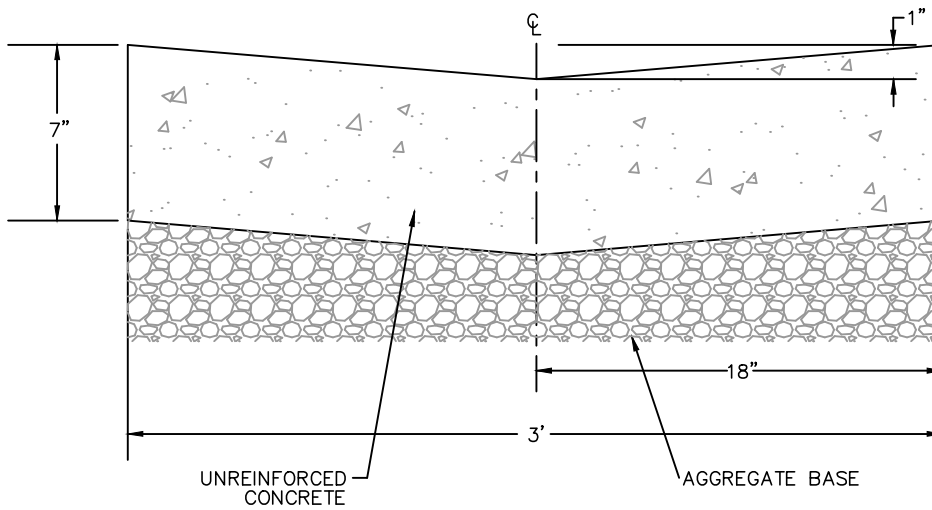
**Cornelius**  
Oregon's Family Town

**MOUNTABLE CURB**

STREETS

S - 13

7/18/16



N.T.S.

NOTES:

1. CONCRETE TO HAVE A COMPRESSIVE STRENGTH ( $f_c$ ) OF 4000 P.S.I. AFTER 28 DAYS.
3. USE 1-1/2"-0" OR 3/4"-0" AGGREGATE BASE COMPACTED TO 100% OF AASHTO T-99. PLACE TO SUBGRADE, STREET STRUCTURE, OR 10" DEPTH, WHICHEVER IS GREATER.

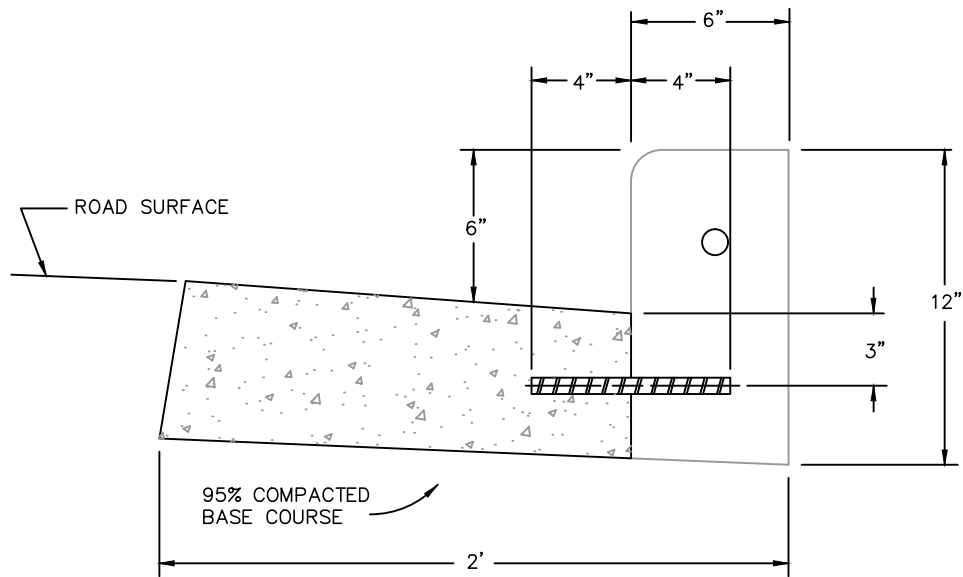
**Cornelius**  
Oregon's Family Town

VALLEY GUTTER

STREETS

S - 14

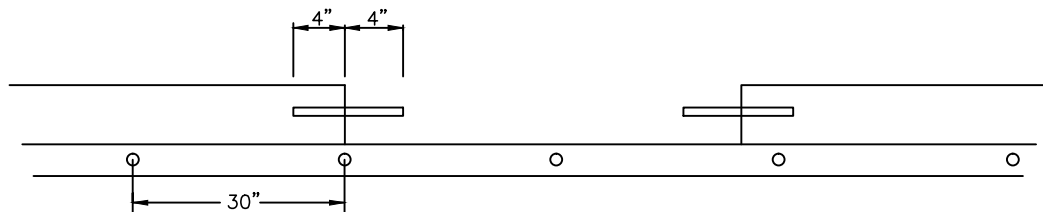
2/6/17



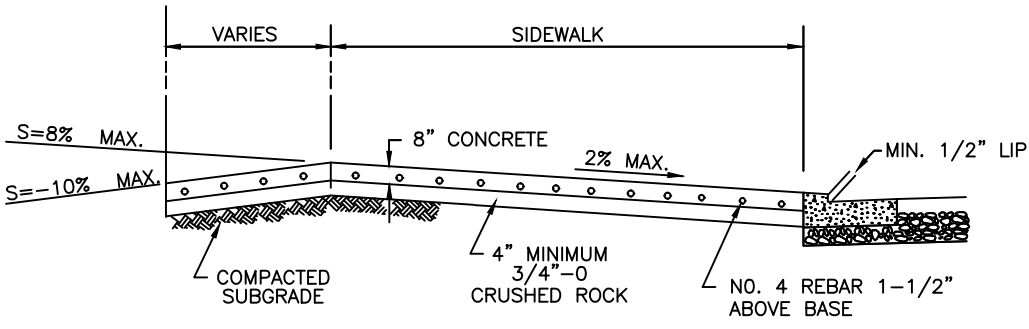
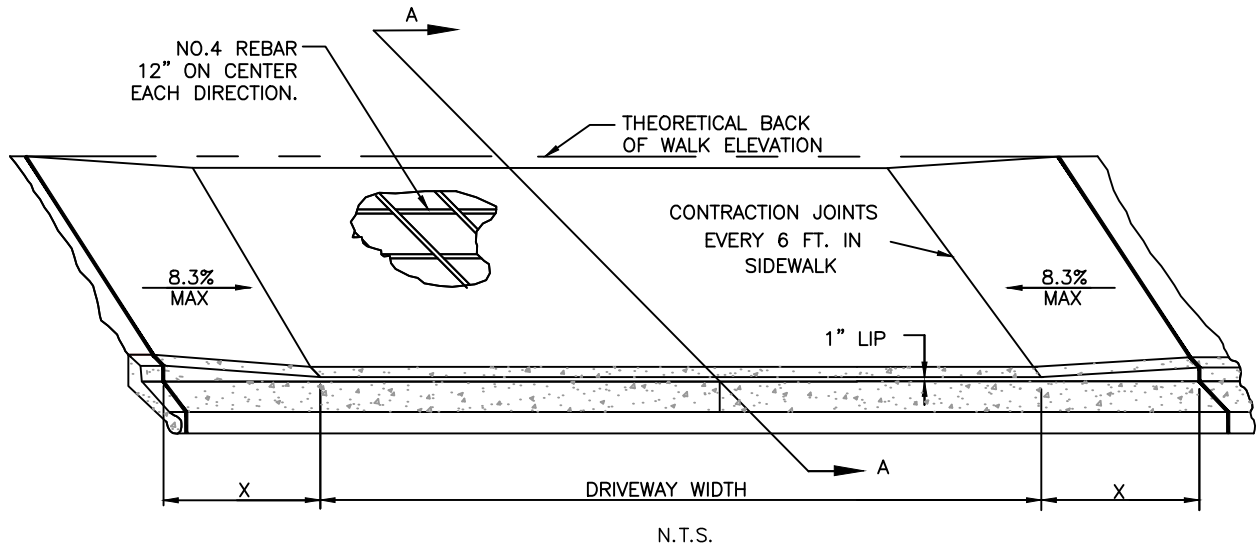
N.T.S.

NOTES:

1. FOR ALL CURBS REMOVED, GUTTERS MUST BE REMOVED WITH CURBS IF FINAL ASPHALT LIFT IS NOT YET IN PLACE, OR IF PAVEMENT IS PCC. IF ALL ASPHALT LIFTS ARE IN PLACE, CURB ONLY IS TO BE REMOVED, AT FULL DEPTH, AND REINSTALLED WITH #4 REBAR. REBAR NEEDS TO BE INBEDDED 4", DOWELED EVERY 30", BEGINNING AT REPLACEMENT. REBAR TO BE PLACED 3" BELOW TOP OF GUTTER. SEE DRAWING ABOVE.
2. TIE ENDS OF CURB TO EXISTING CURB WITH #4 REBAR DOWELS CENTERED AND 3" BELOW TOP OF CURB.



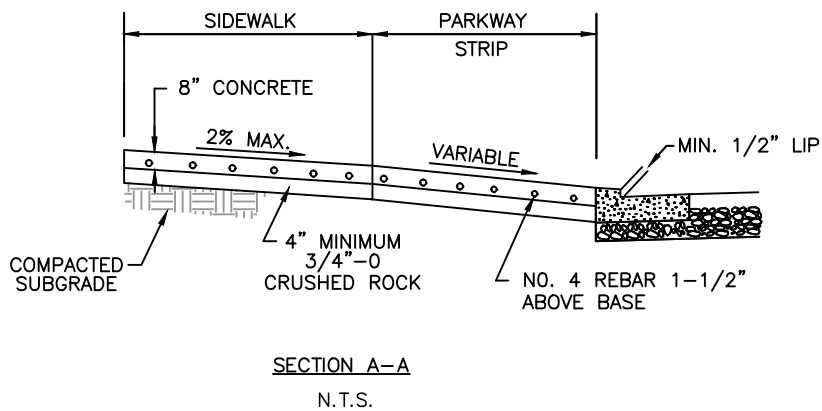
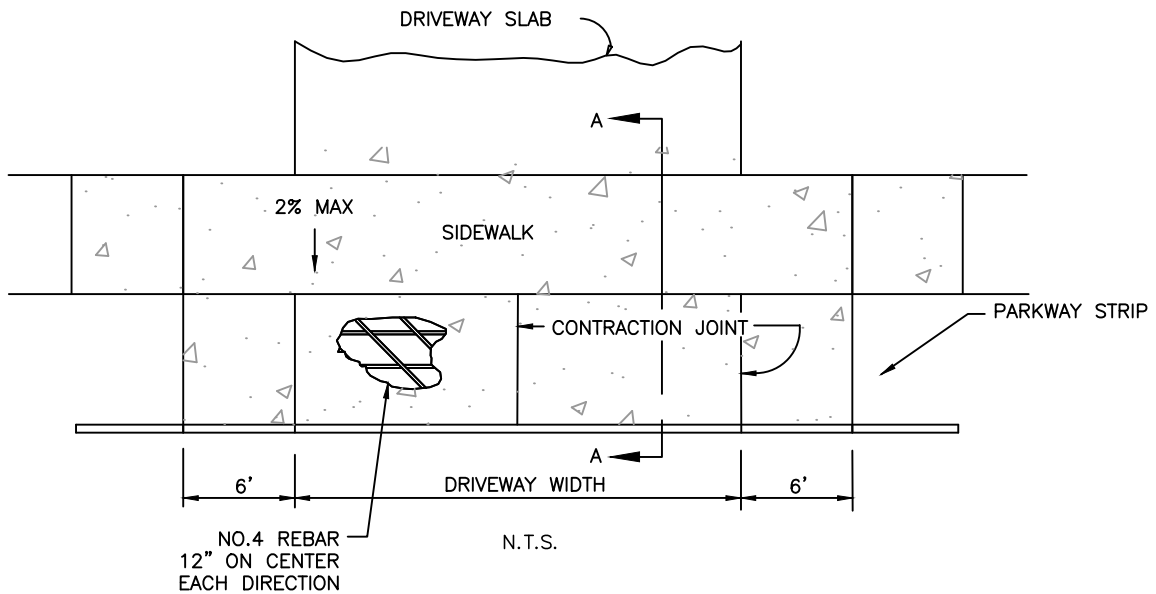
N.T.S.



SECTION A-A  
N.T.S.

- NOTES:
1. CALL PUBLIC WORKS (503) 357-3011 FOR FORM INSPECTION AT LEAST 24 HRS. PRIOR TO PLACEMENT.
  2. DRIVEWAY APPROACH MUST EXTEND TO BACK OF RIGHT-OF-WAY (R/W).
  3. CONCRETE SHALL HAVE A MINIMUM BEARING STRENGTH OF 4000 PSI AFTER 28 DAYS.
  4. REBAR TO BE SUPPORTED ON 1-1/2" BLOCKS.
  5. DIMENSION "X" IS TYPICALLY 6 FEET WITH A 6 INCH HIGH CURB. THE CRITICAL DIMENSION FOR THE WING IS THE 8.3% MAXIMUM SLOPE TO MEET A.D.A. STANDARDS.

	<p>COMMERCIAL DRIVEWAY WITH CURB-TIGHT SIDEWALK</p>	STREETS
		S - 21
		7/18/16



**NOTES:**

1. CALL PUBLIC WORKS (503) 357-3011 FOR FORM INSPECTION AT LEAST 24 HRS. PRIOR TO PLACEMENT.
2. DRIVEWAY APPROACH MUST EXTEND TO BACK OF RIGHT-OF-WAY (R/W).
3. CONCRETE SHALL HAVE A MINIMUM BEARING STRENGTH OF 4000 PSI AFTER 28 DAYS.
4. REBAR TO BE SUPPORTED ON 1-1/2" BLOCKS.

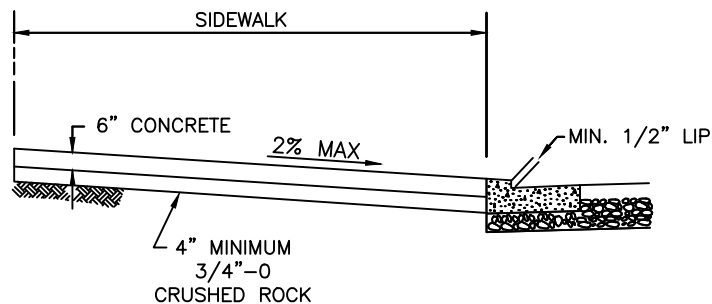
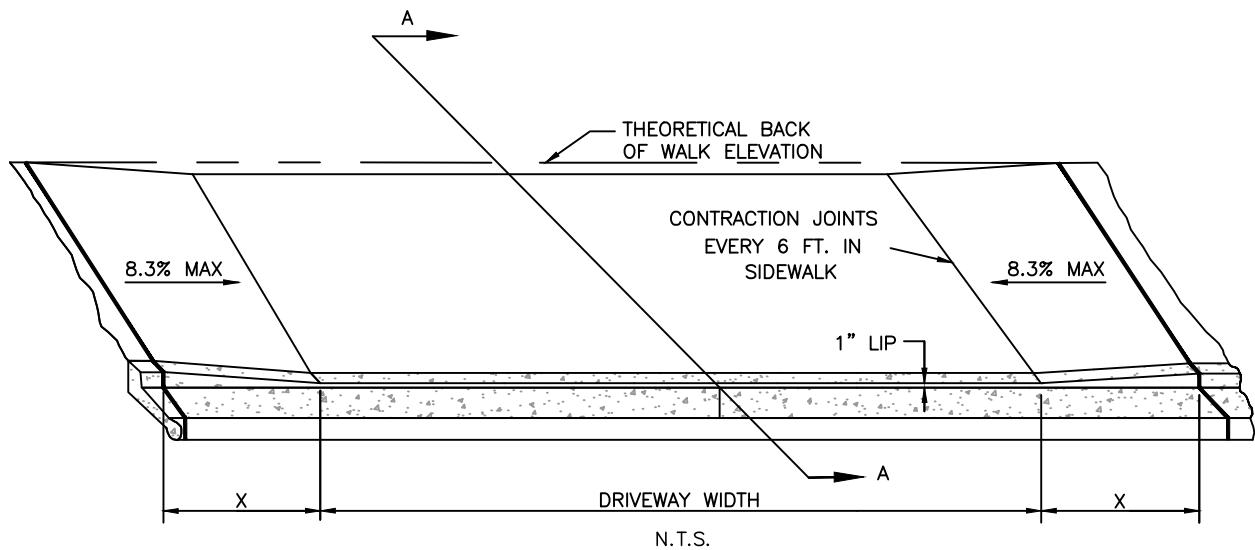
**Cornelius**  
Oregon's Family Town

**COMMERCIAL DRIVEWAY  
WITH PARKWAY STRIP**

STREETS

S - 22

7/18/16



SECTION A-A  
N.T.S.

NOTES:

1. CALL PUBLIC WORKS (503) 357-3011 FOR FORM INSPECTION AT LEAST 24 HRS. PRIOR TO PLACEMENT.
2. DRIVEWAY APPROACH MUST EXTEND TO BACK OF RIGHT-OF-WAY (R/W).
3. CONCRETE SHALL HAVE A MINIMUM BEARING STRENGTH OF 3300 PSI AFTER 28 DAYS.
4. DIMENSION "X" IS TYPICALLY 6 FEET WITH A 6 INCH HIGH CURB. THE CRITICAL DIMENSION FOR THE WING IS THE 8.3% MAXIMUM SLOPE TO MEET A.D.A. STANDARDS.

**Cornelius**  
Oregon's Family Town

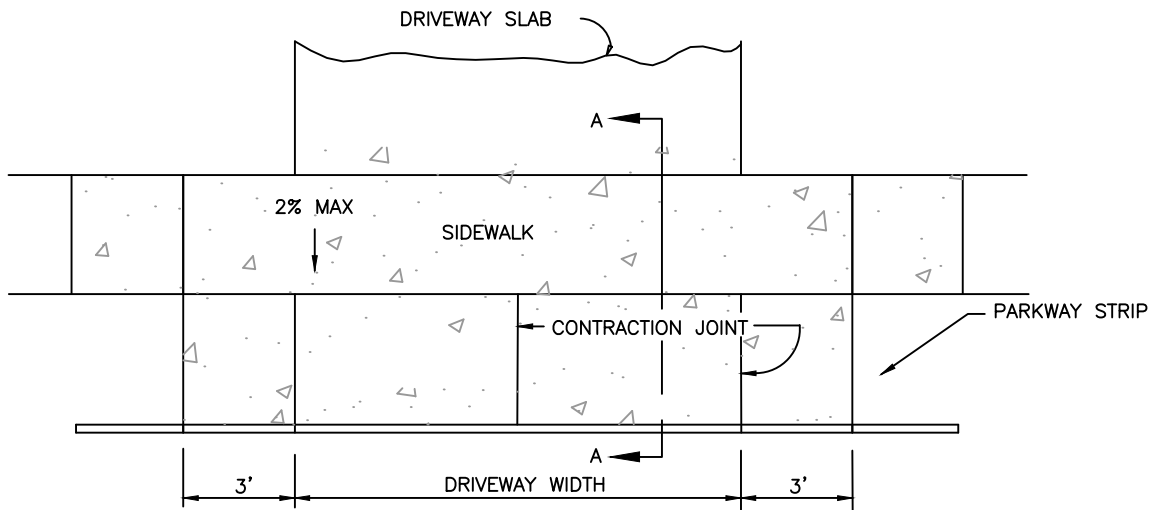
RESIDENTIAL DRIVEWAY  
WITH CURB-TIGHT SIDEWALK

STREETS

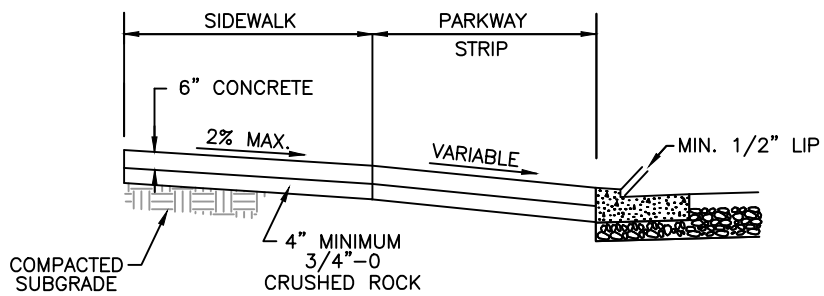
S - 23

3/17/17





N.T.S.



SECTION A-A

N.T.S.

NOTES:

1. CALL PUBLIC WORKS (503) 357-3011 FOR FORM INSPECTION AT LEAST 24 HRS. PRIOR TO PLACEMENT.
2. DRIVEWAY APPROACH MUST EXTEND TO BACK OF RIGHT-OF-WAY (R/W).
3. CONCRETE SHALL HAVE A MINIMUM BEARING STRENGTH OF 3300 PSI AFTER 28 DAYS.

**Cornelius**  
Oregon's Family Town

RESIDENTIAL DRIVEWAY  
WITH PARKWAY STRIP

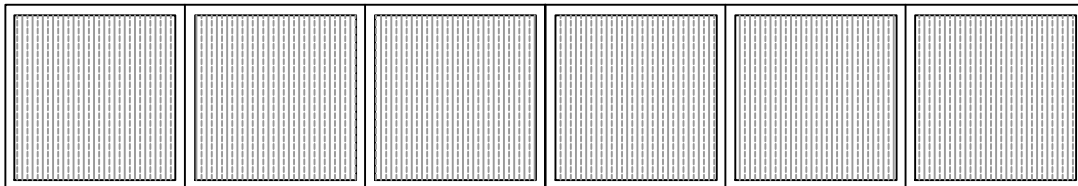
STREETS

S - 24

3/17/17

FINISHING NOTES:

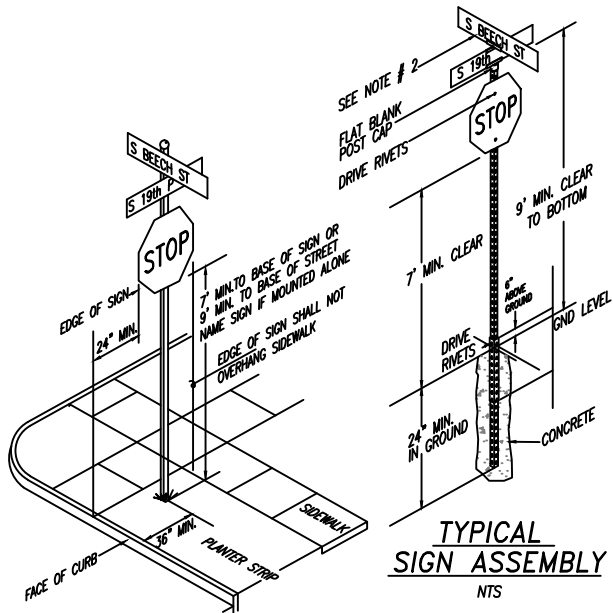
1. ALL SIDEWALKS SHALL HAVE A BROOMED SURFACE UNLESS OTHERWISE SPECIFIED.
2. FINISHED SURFACES SHALL BE FREE FROM HUMPS, SAGS, OR OTHER IRREGULARITIES.
3. ALL SURFACES SHALL BE BROOMED TRANSVERSE TO THE DIRECTION OF TRAFFIC.
4. THE EDGES SHALL BE FINISHED WITH A 3" SHINE ON ALL SIDES AS SHOWN BELOW.



INSPECTION NOTES:

1. ALL SIDEWALK FORMS ARE TO BE INSPECTED BY THE PUBLIC WORKS INSPECTOR TWICE. ONCE PRIOR TO PLACING, TO CHECK FORMS, AND AGAIN AFTER POURING TO ENSURE CONFORMANCE TO FINISHING SPECIFICATIONS.
2. INSPECTION REQUESTS MUST BE MADE AT LEAST 24 HOURS IN ADVANCE BY CONTACTING PUBLIC WORKS.
3. IF FORMS ARE NOT INSPECTED AND APPROVED OR FINISH WORK IS SUBSTANDARD, THE INSPECTOR SHALL REQUIRE THE CONCRETE BE REMOVED AND REPLACED.

- 1) CITY OF CORNELIUS WILL NOT SUPPLY ANY SIGNS, SIGN MATERIALS, OR POSTS.
- 2) ALL SIGNING SHALL CONFORM TO OREGON DEPARTMENT OF TRANSPORTATION'S SPECIFICATIONS (LATEST EDITION) AND THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
- 3) ALL POSTS SHALL BE PERFORATED "UNISTRUT'S TELES PAR" POSTS UNLESS OTHERWISE SPECIFIED. SEE NOTES UNDER INSTALLATION DETAIL.
- 4) SIGNS SHALL BE INSTALLED PER THE TYPICAL SIGN INSTALLATION DETAIL UTILIZING THE SPECIFIED HARDWARE. FOR SPECIFIC SIGN DETAILS (SUCH AS THE "STREET STUB SIGN") CONTACT PUBLIC WORKS
- 5) CONTRACTOR SHALL BE RESPONSIBLE FOR STAKING SIGN LOCATIONS AND OBTAINING UTILITY LOCATES FOR STAKED SIGN LOCATIONS. SIGNS SHALL BE LOCATED PER THE TYPICAL SIGN LOCATION OR AS SHOWN ON THE APPROVED PLANS.
- 6) ALL SIGNS SHALL BE 6" GREEN DOUBLE-FACED EXTRUDED ALUMINUM WITH 4" UPPER CASE LETTERS.



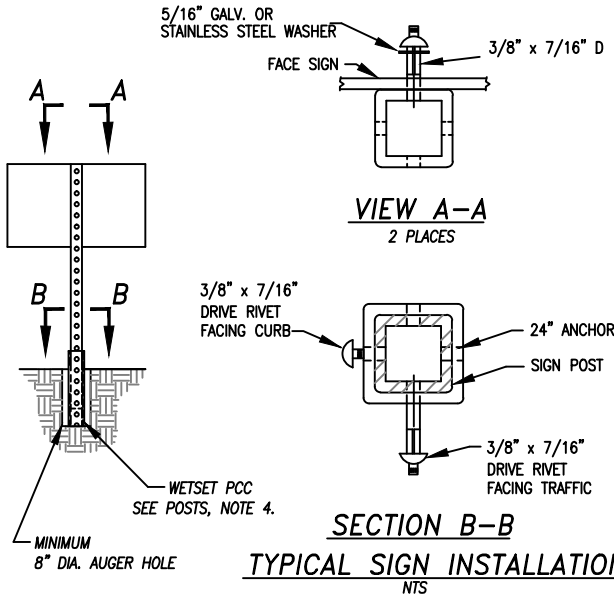
SIGN END VIEW



CHANNEL BRACKET

TYPICAL SIGN DETAIL

NTS



POSTS

1. A MINIMUM OF 2 X 2-INCH X 10-FOOT GALVANIZED "UNISTRUT'S TELES PAR".
2. A 2 X 2-INCH X 12-FOOT (MIN.) 12-GAUGE GALVANIZED "UNISTRUT'S TELES PAR" SHALL BE USED WHEN A COMBINATION OF SIGNS IS MORE THAN 36 INCHES IN HEIGHT. SIGN POST IS 2-INCH SQUARE TUBING AND MUST BE EMBEDDED A MINIMUM OF 12 INCHES INTO THE BASE.
3. ROUND METAL POSTS WILL NOT BE PERMITTED. WOOD POSTS MAY BE USED ONLY WITH PRIOR APPROVAL OF THE CITY ENGINEER AND MUST BE CONFIGURED AND DRILLED FOR BREAKAWAY AS PER ODOT SPECIFICATIONS.
4. ANCHOR TO BE WETSET IN PCC A MINIMUM OF 24" DEEP.

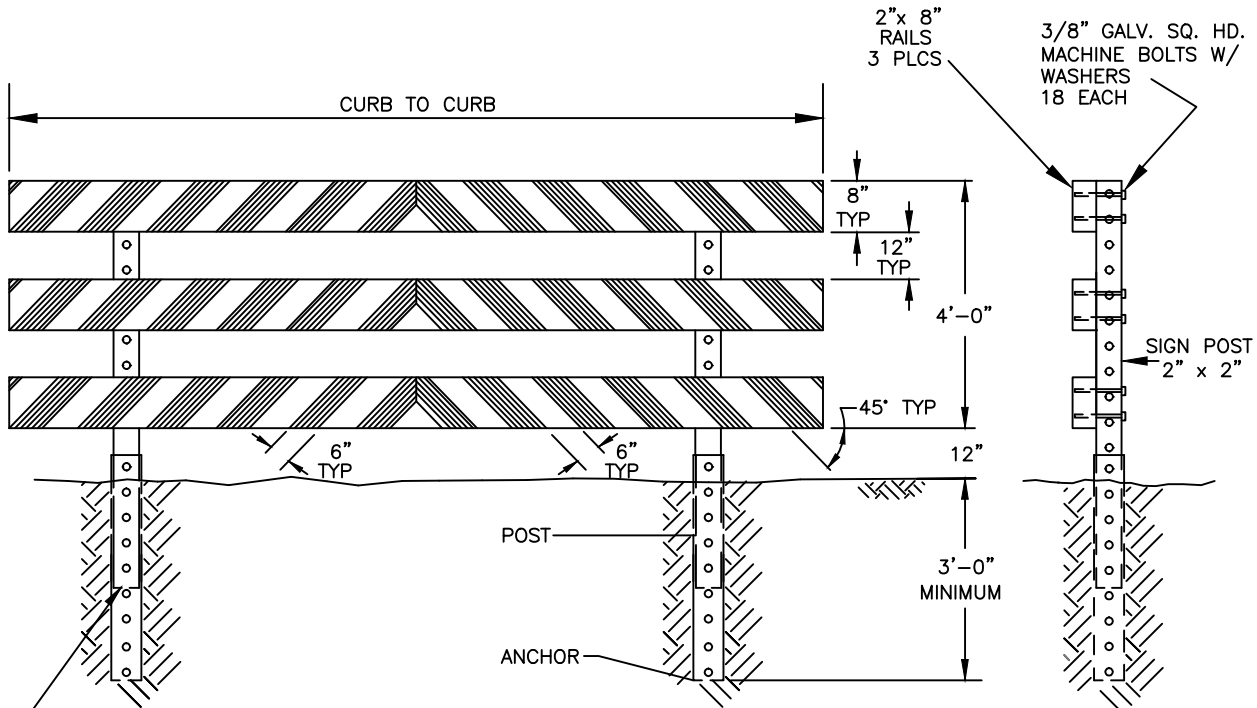


PERMANENT SIGN  
INSTALLATION

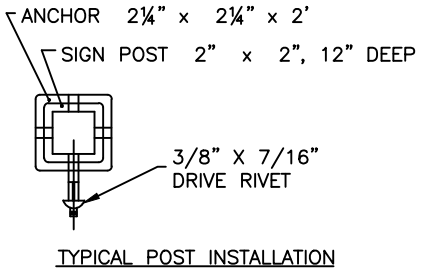
STREETS

S - 31

3/17/17

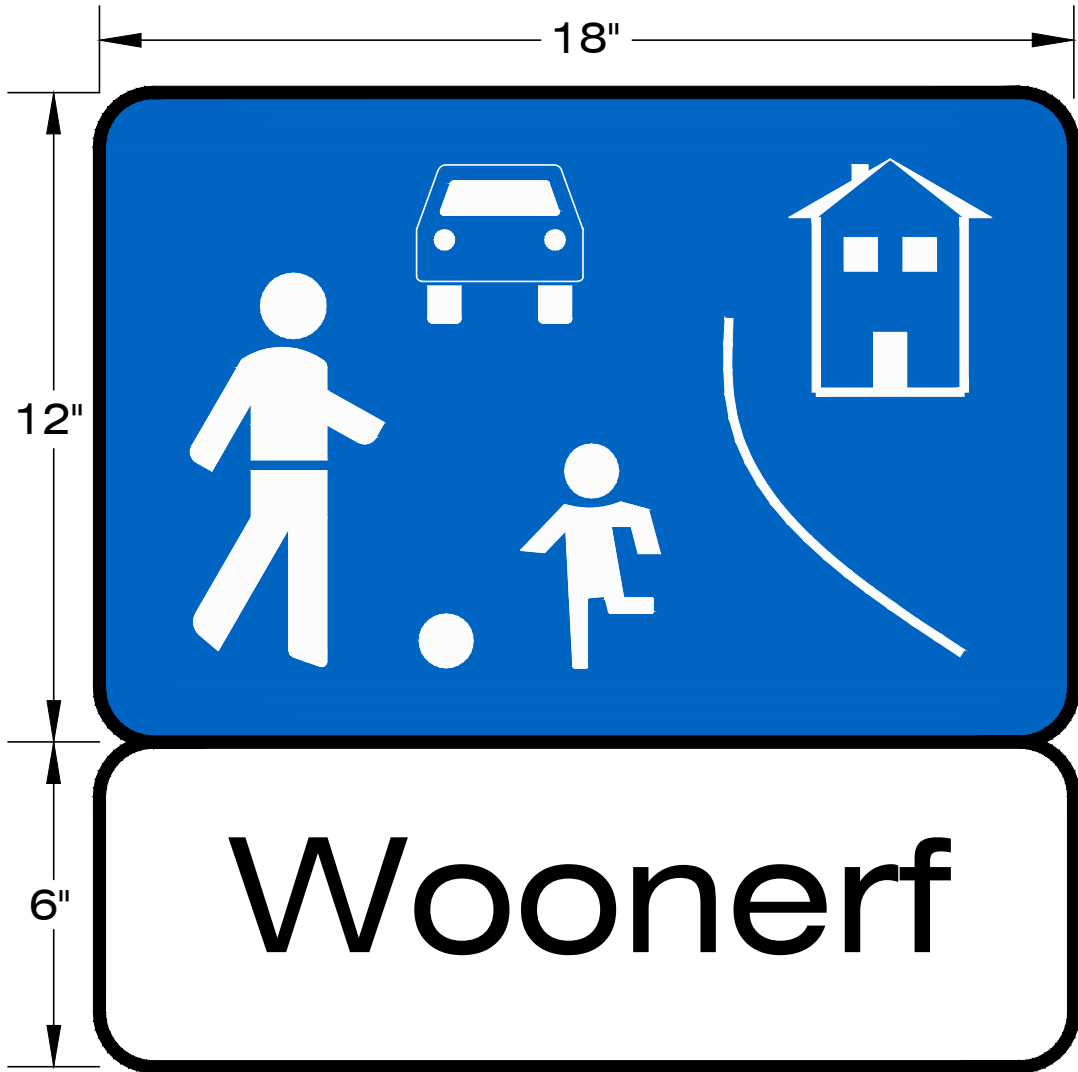


A MINIMUM OF 2" x 2" x 6 FOOT GALVANIZED "UNISTRUT TELES PAR" 12 GAUGE PERFORATED POSTS OR APPROVED EQUIVALENT SHALL BE USED.



**NOTE:**  
RAILS TO BE WHITE WITH ORANGE REFLECTORIZED STRIPES.  
FOR WIDER APPLICATIONS, MULTIPLE SECTIONS AS SHOWN SHALL BE USED.

	<h2>TYPE III BARRICADE</h2>	STREETS
		S - 32
		7/18/16



NOTES:

1. SIGN SHALL BE AS PER DIMENSIONS WITH 3/8 INCH WHITE BORDER AND BLUE BACKGROUND.
2. LETTERING SHALL BE 3 1/2 INCH, IN WHITE.

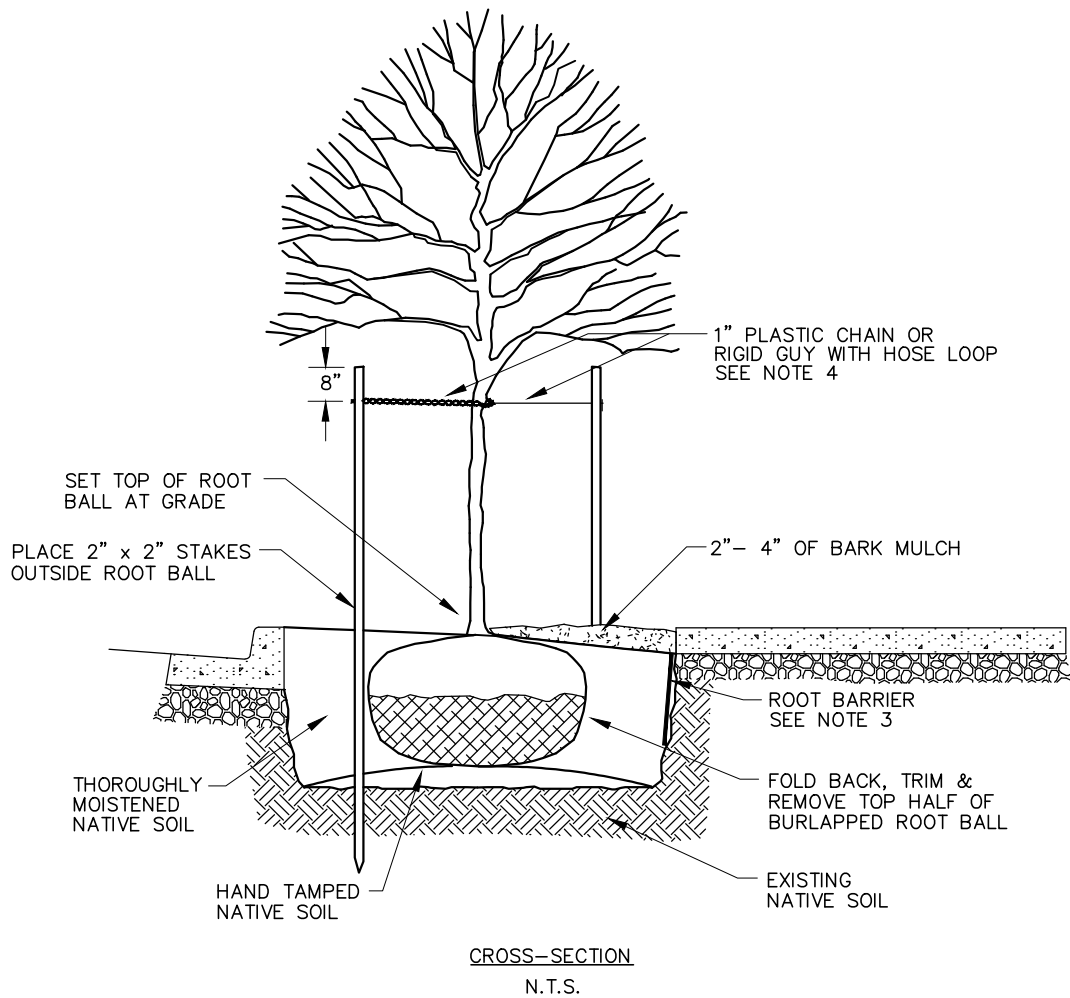
*Cornelius*  
Oregon's Family Town

WOONERF SIGN

STREET

S-34

10/17/19



NOTES:

1. ADJUST PLANTING LOCATIONS SO THE TREE CROWN OR ROOT BALL DOES NOT CONFLICT WITH ABOVE OR BELOW-GROUND UTILITIES.
2. DO NOT UNDERMINE CURB OR SIDEWALK WHEN EXCAVATING.
3. AN 18 INCH DEEP ROOT BARRIER SHALL BE REQUIRED WHEN A TREE IS PLANTED IN A PARKWAY STRIP.
4. PROVIDE A LOOP IN CHAIN LOCK OR GUY HOSE LARGE ENOUGH TO ALLOW FOR TRUNK GROWTH.
5. TREE STAKES ARE TO BE REMOVED AT THE END OF THE WARRANTY PERIOD UNLESS THE CITY ENGINEER DETERMINES THE STAKES SHALL REMAIN IN PLACE.
6. AT A MINIMUM, TREES SHALL BE IRRIGATED FOR TWO YEARS, AFTER PLANTING.

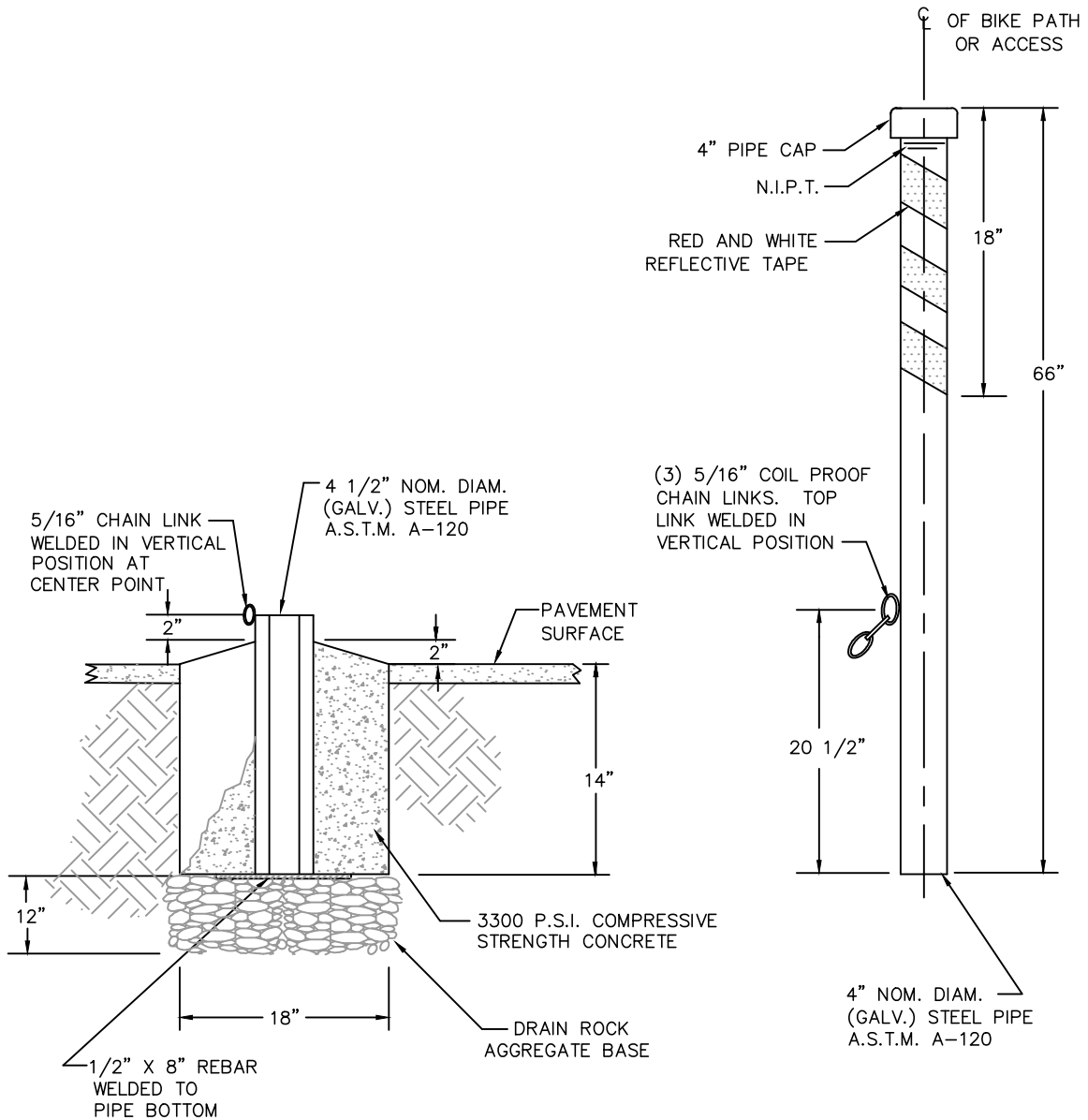
**Cornelius**  
Oregon's Family Town

**STANDARD  
SIDEWALK TREETWELL**

STREETS

S - 41

10/17/19



**NOTES**

1. ONLY TO BE USED WHEN SPECIFICALLY APPROVED BY CITY ENGINEER.
2. ALL BOLLARDS TO BE LOCKED WITH KNOX PADLOCK #3753 OR APPROVED EQUAL, CONTACT CORNELIUS FIRE DEPARTMENT FOR ADDITIONAL INFORMATION.

**Cornelius**  
Oregon's Family Town

**BOLLARD**

STREETS

S - 51

7/18/16

# Standard Notes



## City of Cornelius Standard Notes

The black, non-italic text *below are standard notes that should be incorporated into engineering plan sets for public infrastructure. The blue text below is simply explanatory notes for the designer. These standard notes are based on the City of Cornelius Public Works Standards. Notes below that are not relevant to a project can be omitted.*

### Water

- All new and replacement public water mains shall be class DR18 C900.  
*(However, the standards allow Class 52 Ductile Iron pipe to be used on short runs, 18 feet or less, between valves, tees, crosses, and reducers).*
- Hydrant assemblies shall use Class 52 Ductile Iron pipe to connect the gate valve to the hydrant and shall be installed as shown in City of Cornelius Detail W-1.
- Valves shall be resilient seated gate valves.
- All valves shall be Mueller brand.
- Valves shall be set as shown in City of Cornelius Detail W-2.
- A minimum of three lengths of pipe shall be restrained at all water system dead-ends.  
*(This note only applies if the plans include a dead end line).*
- Mechanical restraints shall be used on all tees, crosses, valves, and changes in pipe direction of more than 10 degrees. Field lock gaskets alone are insufficient to meet this requirement for mechanical restraints.
- Concrete thrust blocks shall only be used in special cases and when directed by the City Engineer or City's engineering inspector. When required, thrust blocks shall be installed in accordance with City of Cornelius Details W-3 and W-4.
- Water services 2-inch and smaller shall be installed in accordance with City of Cornelius Detail W-7.
- The party constructing a new water main shall be responsible for constructing all 2-inch and smaller service connections. These connections include the connection to the main line, service, meter box, and curb stop. The City will set the meter.
- Where service lines will be constructed for adjoining lots, the service lines shall be laid in the same trench, whenever possible, to minimize street cuts. The taps into the main line and the centerline of the meter boxes shall be a minimum of 24" apart. Service lines shall be a minimum of 12" apart.
- 12-gauge copper tracer wire is required on all service lines between the water main and the meter.
- 12-gauge copper tracer wire is required on main lines where the run between valve boxes is not linear.

- Trenching backfill in public right-of-way or public easements shall be accomplished in accordance with City of Cornelius Detail S-3.
- Pavement shall be restored to pre-existing conditions or better. Pavement restoration shall follow the requirements of City of Cornelius Details S-4 and S-5.

### **Sanitary and Storm Sewers**

- In general, the latest version of the Clean Water Services (CWS) *Design and Construction Standards for Sanitary Sewer and Surface Water Management* standards shall govern construction and design of sanitary sewer and storm and erosion control facilities. Where conflicts exist between the City of Cornelius Public Works Standards and the CWS Standards, the City standards shall prevail.
- All non-metallic pipe, including main lines and laterals, shall have 12-gauge, green-coated tracer wire installed directly on top of the pipe. The tracer wire shall climb the outside of the manhole to the top pick hole and go behind steps and tie to the top step with a 30" tail.
- Tracer wire is not required on straight sections of pipe between structures (manholes and catch basins).
- Trenching backfill in public right-of-way or public easements shall be accomplished in accordance with City of Cornelius Detail S-3.
- Pavement shall be restored to pre-existing conditions or better. Pavement restoration shall follow the requirements of City of Cornelius Details S-4 and S-5.

### **Streets**

- Where storm and sanitary laterals traverse under a curb, the curb shall be stamped to identify the lateral type.
- Restoration of an existing curb and gutter is shown in City of Cornelius Detail S-15
- Sidewalks shall meet ADA requirements unless steep terrain makes this impossible.
- The pedestrian zone, which includes sidewalks, pathways, and bulb-outs, must remain free of obstacles. Obstacles include above ground obstructions including but not limited to: fire hydrants, mailboxes, utility pedestals, utility poles, above ground utility vaults, trees, sign posts and signs, street light poles, signal poles, and signal control equipment. The only exception to this rule is where the sidewalk is more than 6 feet wide. In the cases of these wide sidewalks, the above ground obstructions should be placed as close as possible to the curb so that a clear corridor for pedestrians at least 5-feet wide is maintained.
- Pedestals, power meter boxes, power transformers, cable closures, and similar franchise utility facilities shall be located outside the right-of-way in the public utility easement, unless approved by the City Engineer.
- Sidewalk finishing requirements are shown in City of Cornelius Detail S-25.

## **Signing and Striping**

- Signs projecting over sidewalks shall be mounted such that they are at least 7 feet above a sidewalk or pathway.
- The width of the bottom of the ADA ramp shall be at least as wide as the sidewalk or pathway it serves.
- Signing and striping shall follow the latest edition of the *Manual on Uniform Traffic Control Devices for Streets and Highways* by the Federal Highway Administration except as noted in these notes.
- Arterials shall be striped with the appropriate lane markings.
- Bike lanes shall be striped.
- Parking spaces in parallel parking bays can be marked with a simple “T” at the corner of the spaces adjacent to the travel lanes.
- Parking spaces in head-in parking bays must be striped between the spaces.
- All striping shall be thermoplastic.
- Permanent signs shall be installed in accordance with City of Cornelius Detail S-31.

## **Landscaping**

- Broadleaf trees planted in single-family and duplex neighborhoods, shall be a minimum caliper size of 1.5”.
- Broadleaf trees planted in other than single-family and duplex neighborhoods shall be a minimum caliper size of 2”.
- Conifers must be a minimum 5 feet in height at time of planting.
- Trees in parkway strips shall be installed with an 18-inch deep root barrier.
- The appropriate planting methods for trees are shown in City of Cornelius Detail S-41.
- Watering of newly planted trees is required. Watering shall be accomplished through use of a temporary irrigation system or with individual portable tree watering devices such as “gator bags.”

## **Street Lighting**

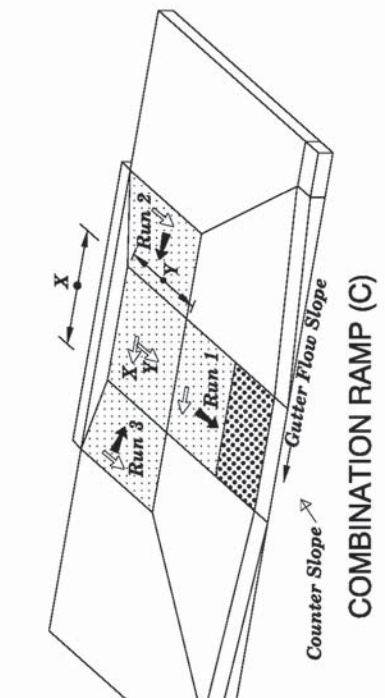
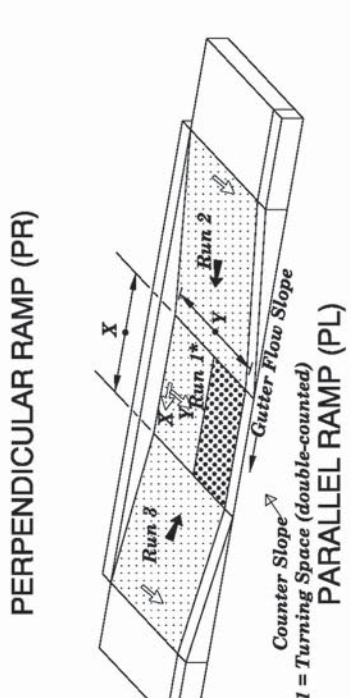
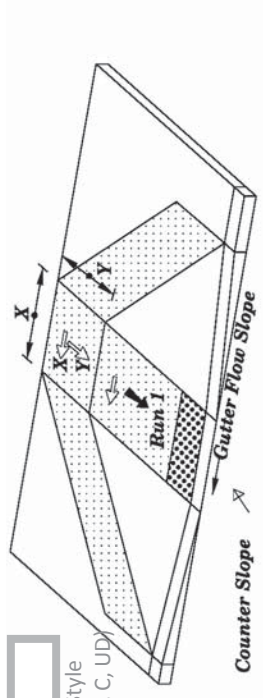
- Street lighting shall be LED.
- Street light fixtures shall emit no light upward.
- Color temperature (CCT) shall not exceed 3000K.

- All street lighting shall be Option C, in other words, owned and maintained by the City.

# Guides

# ADA Ramp Inspection Form

Project Name (Section)  Construction Year  Contract No.  Highway No.  MP  Cross Street Name



- UNIQUE DESIGN (UD) - take photo**
- Pedestrian Access Route (to measure clear width)
  - Truncated dome detectable warning surface
  - Cross Slope (2.0% max.)
  - Running Slope (8.3% max.)
  - Counter Slope (5.0% max.)
  - Landing Area (X & Y) (2.0% max. / 4' x 4' min.)
  - Gutter Flow Slope (as directed)

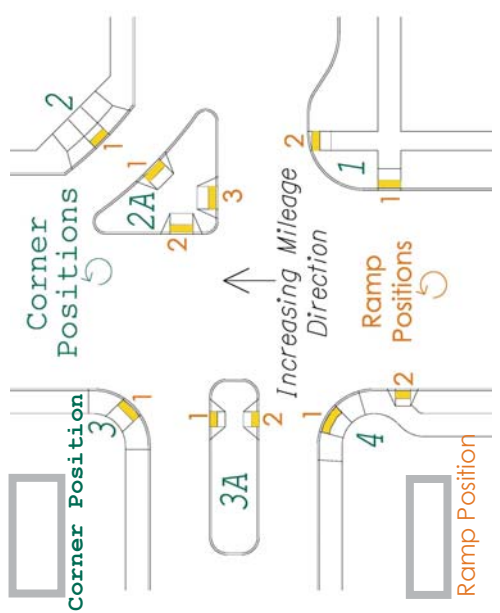
RAMP RUN 1	Pass	Fail
Running Slope 1	<input type="radio"/> ≤ 8.3%	<input type="radio"/> > 8.3%
Cross Slope 1	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%
Detectable Warning	<input type="radio"/> (TD, X)	<input type="radio"/> None
Lip Height	<input type="radio"/> ≤ 1/4"	<input type="radio"/> > 1/4"
Gutter Flow Slope	<input type="radio"/> ≤ 5.0%	<input type="radio"/> > 5.0%
Counter Slope (+/-)	<input type="radio"/> ≤ 5.0%	<input type="radio"/> > 5.0%
Slope Differential =	<input type="radio"/> ≤ 5.0%	<input type="radio"/> > 5.0%
Running Slope 1	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%
+ Counter Slope	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%

RAMP RUN 2	Pass	Fail
Running Slope 2	<input type="radio"/> ≤ 8.3%	<input type="radio"/> > 8.3%
Cross Slope 2	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%

RAMP RUN 3	Pass	Fail
Running Slope 3	<input type="radio"/> ≤ 8.3%	<input type="radio"/> > 8.3%
Cross Slope 3	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%

TURNING SPACE	Pass	Fail
Landing Width X	<input type="radio"/> ≥ 4'	<input type="radio"/> < 4'
Landing Length Y	<input type="radio"/> ≥ 4' and <input type="radio"/> ≤ 2.0%	<input type="radio"/> or <input type="radio"/> > 2.0%
Landing Slope X	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%
Landing Slope Y	<input type="radio"/> ≤ 2.0%	<input type="radio"/> > 2.0%

MISCELLANEOUS	Pass	Fail
Clear Width (feet)	<input type="radio"/> ≥ 4'	<input type="radio"/> < 4'
Physical Condition (G,F,P)	<input type="radio"/>	<input type="radio"/>
ADA Design Exception (Y,N)	<input type="radio"/>	<input type="radio"/>
Design Ex. Control Number	<input type="text"/>	<input type="text"/>



Function Condition (G,F,P)

Good (G) = all applicable boxes on left pass.  
 Fair (F) = all boxes on left pass, except detectable warning  
 Poor (P) = any box fails other than detectable warning

See also Standard Drawings RD755 and TM458 to assess provisions not shown: (flares, inlets, pushbutton reach, alignment, etc.)

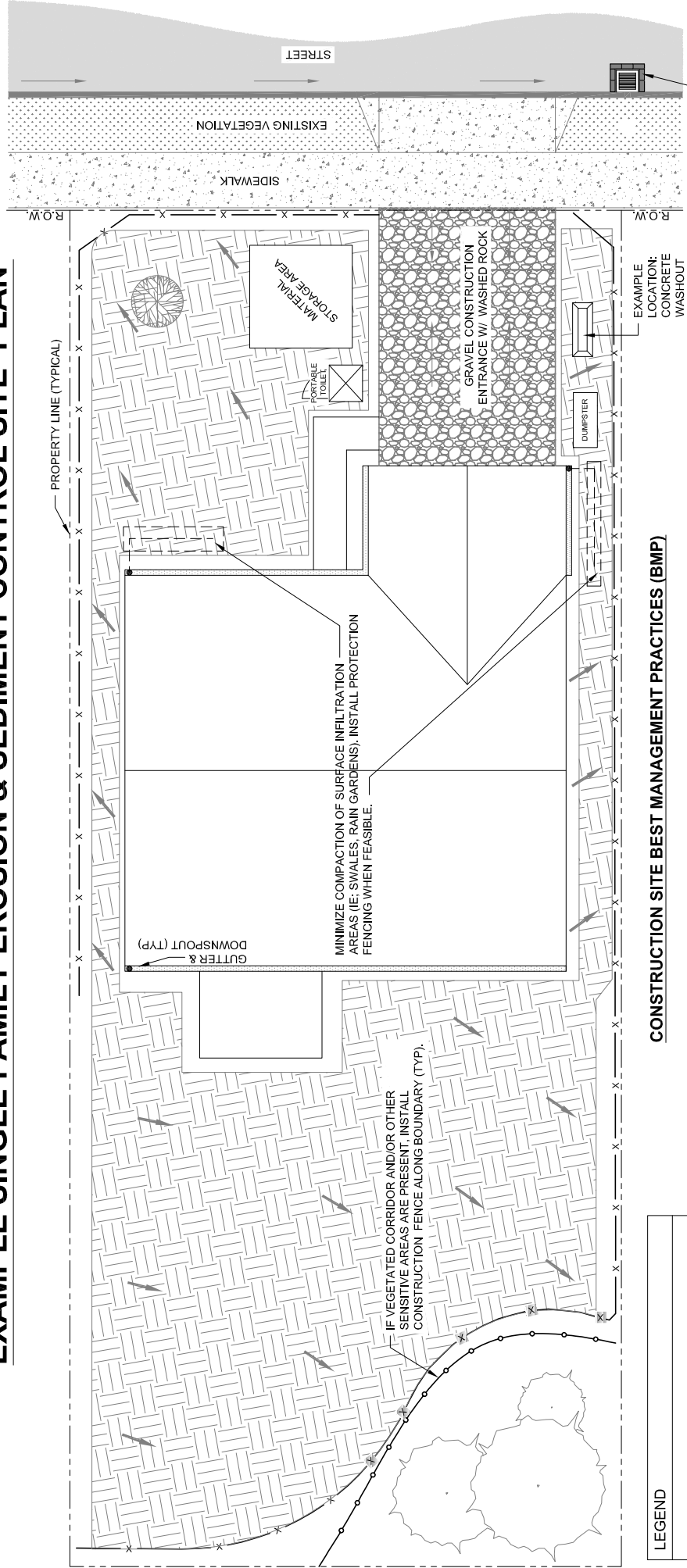
Comment:

Inspector's Signature  Date

Print name clearly  Certification No.

Company/Agency  Crew No. (ODOT)

# EXAMPLE SINGLE FAMILY EROSION & SEDIMENT CONTROL SITE PLAN



## CONSTRUCTION SITE BEST MANAGEMENT PRACTICES (BMP)

### REQUIRED BASE MEASURES

- PERIMETER SEDIMENT CONTROL
- CONSTRUCTION SITE ENTRANCE
- STORM DRAIN INLET PROTECTION

### NON-STORMWATER POLLUTION CONTROL BMPS

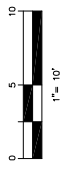
- STORE ALL PAINTS, STAINS, SOLVENTS AND HAZARDOUS MATERIAL IN A COVERED STORAGE AREA.
- DISPOSE OF ALL TRASH AND/OR DEBRIS THAT COULD ENTER STORM SYSTEM IN A DUMPSTER OR TRASH CAN.
- CLEAN UP SPILLS PROMPTLY USING DRY CLEANUP METHODS.
- DISPOSE OF CONCRETE WASHOUT IN APPROVED LOCATIONS TO REDUCE POTENTIAL FOR DISCHARGE FROM CONSTRUCTION SITE.

### ADDITIONAL CONSTRUCTION SITE BMPS

- SWEEP STREET AND/OR HARD SURFACES DAILY AND PROPERLY DISPOSE OF ALL MATERIALS.
- REMOVE TEMPORARY CONTROL MEASURES WHEN NO LONGER NEEDED.
- INSTALL GUTTERS & DOWNSPOUTS AS EARLY AS POSSIBLE. CAPTURE RUNOFF TO PREVENT ADDITIONAL ONSITE EROSION E.G. SWALE, RAIN GARDEN, FRENCH DRAIN.
- IF EXISTING VEGETATION IN RIGHT OF WAY IS EXPOSED, AND SOIL IS DISTURBED, INSTALL PERIMETER SEDIMENT CONTROL TO PREVENT MATERIAL FROM ENTERING ROADWAY.

**LEGEND**

- PROPERTY LINE
- x- PERIMETER SEDIMENT CONTROL
- o- TEMP. CONSTRUCTION FENCE
- GROUND SLOPE DIRECTION
- [Pattern] EXISTING VEGETATION
- [Pattern] STABILIZED SOIL
- [Symbol] EXISTING TREE
- [Symbol] EXISTING VEGETATION



**DO NOT DUMP OR WASH ANY MATERIAL INTO THE STORM DRAIN.**

DISCLAIMER: FOR GUIDANCE ONLY. BEST MANAGEMENT PRACTICES MAY VARY DEPENDING ON CONSTRUCTION SITE CHARACTERISTICS. FOR MORE INFORMATION ON EROSION CONTROL MEASURES PLEASE SEE CLEAN WATER SERVICES D&C STANDARDS CHAPTER 6 OR THE EROSION PREVENTION & SEDIMENT CONTROL MANUAL. (VERSION 1, MAY 5, 2016)

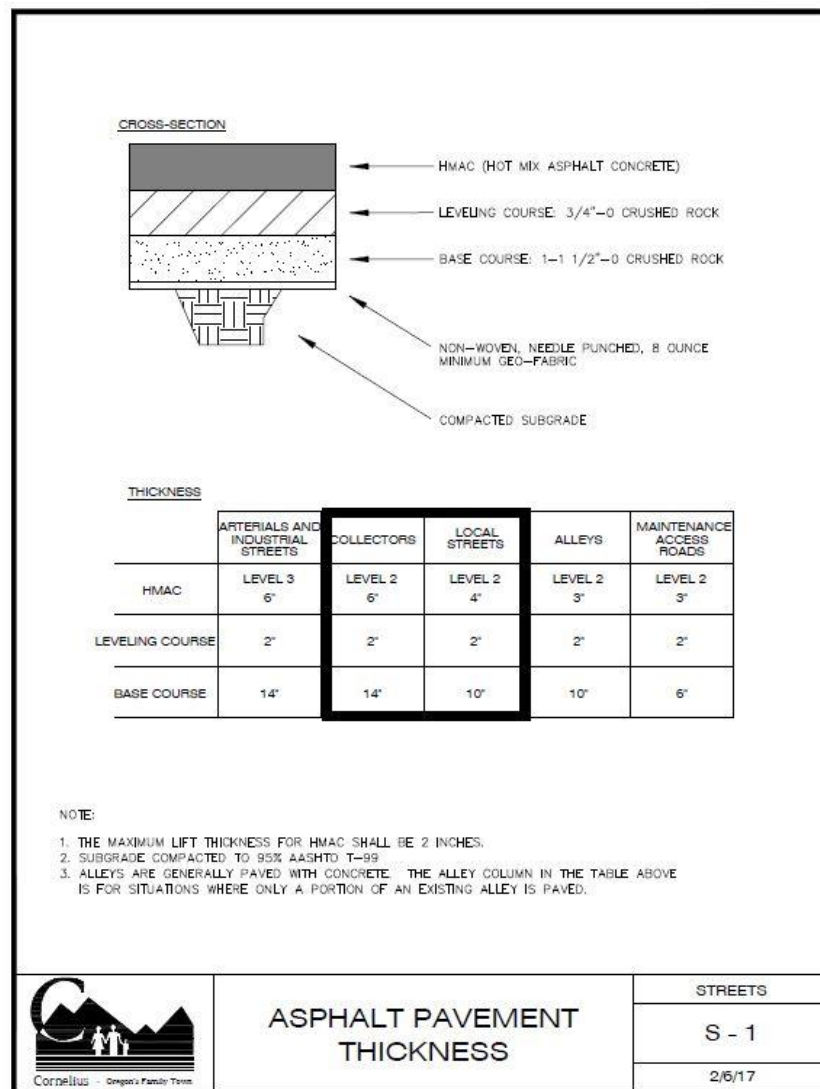


## Using the Cornelius Pavement Details (S-1 and S-2) in a Plan Set

The Cornelius Public Works Standards do not include cross-sections for all types of streets and sidewalks. Instead, the pavement requirements are consolidated into two details, S-1 for asphalt and S-2 for concrete. Designers can create their own pavement cross sections to include in their plans or they can use the S-1 and S-2 details. If the standard details are used, they should be modified as follows:

- Put a bold box around the street, sidewalk, or driveway sections that are included in your plans.
- Under the standard detail, note which streets, sidewalks, and driveways the column in the table applies.

An example of this approach is shown below. Note that the streets where each of the columns in the chart applies are listed below the detail.



Use the **Collector** cross-section for S. 29<sup>th</sup>, S. 26<sup>th</sup> Ave., S. Jasper Dr., and S. Kodiak Street.  
Use the **Local Streets** cross-section for all other streets.



## Appendix B Revision History

This Appendix lists all revisions made to the standards since their adoption by the City Council on July 18, 2016.

Major revisions indicate those changes involving policy. Major revisions are approved/adopted by the City Council. Minor revisions are changes of a technical nature. The City Engineer issues minor revisions.

Revision Date	Major or Minor	Section	Revision Description
7-20-16	Minor	5.12 (a)	Additional specifications added for LED street lighting including no upward light emitted, CCT no greater than 3000K, and S/P no greater than 1.2.
2-6-17	Major	Chapters 4, 5, and Details	A number of minor changes made to clarify requirements. Other revisions incorporated are more major and include: <ul style="list-style-type: none"> <li>• Introduction of a new street type called a <i>woonerf</i></li> <li>• Introduction of the option for head-in parking</li> <li>• Additional requirements for street tree diversity</li> <li>• Roundabouts defined as the preferred traffic</li> <li>• Modification of stormwater treatment requirements to align with upcoming changes to CWS rules</li> <li>• Prohibition on use of clean-outs on public sanitary sewers</li> <li>• Requirement that street lighting <sup>plans</sup> be designed by a professional engineer</li> </ul>
2-7-17	Minor	5.12 (c)	Revised light pole height from 30 to 25 feet.
3-16-17	Minor	5.13 (a)	Text correction for an incorrect line break.
3-16-17	Minor	App. A	Added City of Cornelius Standard Notes
3-17-17	Minor	Details S-2, S-23, & S-24	Reduced pavement strength spec for concrete sidewalks, multi-use paths, and residential driveways.
3-17-17	Minor	Detail S-31	Eliminated portion of detail calling for street signs on two corners of an intersection.
10-17-19	Minor	4.02 (b)	Clarification on allowable catch basin types.
		4.02 (f)	New prohibition on Inserta-tees for pipes less than 12".
		5.02 (b)	Baseline east of 20 <sup>th</sup> Avenue added to <i>Other Arterials</i>
		5.05 (f)	Clarification that PUEs are typically not required on alleys.
		5.06 (a)(3)	Requirement that sidewalks and pathways outside of a right-of-way shall be paved with concrete added.
		5.06 (b)	Requirement for 85% of homes to be complete prior to second lift of asphalt eliminated.
		5.08 (c)(3)	Prohibition on diagonal ADA ramps added.
5.08 (c)(4)	<i>Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way</i> now cited as the ADA design guide for Cornelius.		

10-17-19	Minor	5.10 (c)	Sign section reorganized and the following additions made: <ul style="list-style-type: none"> <li>• Stop sign location requirements and size</li> <li>• Requirements for Object Markers</li> <li>• Woonerf Sign requirement</li> </ul>
		5.11 (a)	The preface to the landscaping requirements amended to stress the goal of formation of tree canopies over the streets.
		5.11 (c)(1)	Tree canopy added as a required characteristic of a street tree.
		5.11 (c)(4)	Portland Approved Street Tree Planting List incorporated into the standards
		5.11 (i)	Tree grates required to be plastic or composite material and cast-iron grates prohibited.
		5.12 (a)	The S/P ratio requirement eliminated since requiring an LED with color temperature not exceeding 3000K sets the S/P ratio.
		Detail W-7	Corp fitting modified.
		Detail S-3	Trench backfill detail modified to include aspects of the CWS trench backfill detail.
		Detail S-33	Delete <i>Sidewalk Ends Barricade</i> . Standards change to require object markers (OM 4-2) at end of sidewalks.
		Detail S-34	New Woonerf sign
		Detail S-41	Modified detail to require street tree irrigation for two years.
Detail S-42	Delete <i>Street Tree Grate</i> detail. Details from manufacture shall be used instead.		
10-30-19	Minor	Detail W-7	Corrected a part number on the detail.
3-2-20	Major	Chapter 7	Addition of a new chapter dealing with Small Wireless Facilities in the Public Right-of-Way
3-13-20	Minor	Chapter 7	A series of minor wording changes incorporated into the new Chapter 7 for clarification.
		Detail W-7	Updated detail to reflect currently available materials.