

City of West Linn

Public Works Design Standards

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SECTION FIVE – STREET REQUIREMENTS

5.0000 STREETS

5.0010 General Design Requirements

- A. Performance Standards - All street designs shall provide for the safe and efficient travel of the public. Streets shall be designed to carry the recommended traffic volumes identified for each street classification.
- B. Streets shall be designed to meet or exceed minimum guidelines. These guidelines are set forth in the "AASHTO Policy on Geometric Design of Highways and Streets" (latest edition). Traffic Control Devices shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways", Federal Highway Administration, with Oregon Supplements, Oregon Department of Transportation (latest edition).
- C. All vertical and horizontal curves shall meet the guidelines of the AASHTO Policy on Geometric Design of Highways and Streets and the design speed for each street classification. Where practical, the Design Engineer shall provide the decision stopping sight distance set forth in the AASHTO policy. But in no case shall less than the minimum stopping sight distance given be permitted.

5.0011 Right-of-Way and Pavement Width

- A. Design Speeds for each street classification shall be as shown in **Subsection 5.0018, Design Speed**. The design speed can be equal to the 85th percentile vehicle speed. If the street improvement will increase the 85th percentile vehicle speed, the value of the design speed will be determined by the City Engineer. (Resolution 05-10 4/11/05)
- B. Refer to Chapter 85 of the Community Development Code for right-of-way width for each street classification. (Resolution 05-10 4/11/05)
- C. On streets with raised island medians, the minimum curb to curb pavement width shall be as required by the Community Development Code.

5.0012 Parking

Street Class	Parking Lanes	Parking Required
Arterial	None	May be allowed
Collector / Neighborhood Route	2	May be allowed
Local / Cul-de-sac	2	Yes

- A. Where on-street parking is required on selected arterials and collectors, pullout areas shall be provided.
- B. On Arterial and Collector streets, no parking is allowed within 45 ft. of the curb return.
- C. On neighborhood routes, local streets and cul-de-sacs, no parking is allowed within 30 ft. of curb return.
- D. One off-street parking space is required for each single-family residential unit.
- E. For streets designated collector and below, the City Engineer may consider design modifications to conserve major trees in the public right-of-way. Subject to approval by the City Engineer, parking lanes may be removed on one or both sides of a street.
- F. Diagonal parking will not be allowed on new streets.

- G. On-street parking standards may be modified as part of a design plan for “boulevard” or “main street” segments of Highway 43 and Willamette Falls Drive.

5.0013 Access

All development shall be provided public street access. Access roads (public and/or private), driveways, and easements shall be as set forth in other sections of these Design Standards.

5.0014 Traffic Analysis

- A. The City Engineer will require a traffic analysis report as determined by the type of development and its potential impact to existing street systems. A traffic analysis will generally be required for a development:
1. When it will generate 1,000 vehicle trips per weekday or more
 2. When a development's location, proposed site plan, and traffic characteristics could affect traffic safety, access management, street capacity, or known traffic problems or deficiencies in a development's study area.
- B. The report will be prepared by a traffic engineer licensed to practice in the State of Oregon. At a minimum, the report shall contain the following:
1. Purpose of Report and Study Objectives
 - a. A discussion of key traffic issues to be addressed and the transportation system and development objectives related to a specific development.
 - b. General transportation system objectives are:
 - to maintain easy and safe traffic flow on surrounding street system;
 - to provide effective and safe transfer of vehicle traffic between the site and the street system;
 - to provide convenient, safe and efficient on-site and off-site movement of vehicles, pedestrians, transit, service and delivery vehicles, and bicycles;
 - To effectively mitigate adverse site-generated traffic impacts on affected streets and intersections. Site-specific objectives may be established by the City for each study.
 2. Executive Summary

A concise summary of the study purpose/objectives, site location and study area, development description, key assumptions, findings, conclusions and recommendations.
 3. Description of Site and Study Area Roadways
 - a. A description of the site and study area, existing traffic conditions in the study area, and anticipated nearby development and committed roadway improvements which would affect future traffic in the study area.
 - b. The study area will be defined by:
 - All roads, ramps, and intersections through which peak hour site traffic composes at least 5% of the existing capacity of an intersection approach, or roadway sections on which accident character or residential traffic character is expected to be significantly impacted.
 4. On-site Traffic Evaluation

A study of the impacts of the development to traffic and an evaluation of the proposed (and alternative) site access locations, the adequacy of access drive depth, driveway lanes, and queuing storage, the safety and efficiency of proposed vehicular circulation, parking layout, pedestrian and

service vehicle routes/facilities, together with recommendations for on-site traffic markings and controls.

5. Technical Appendix

A technical appendix including worksheets, charts, and drawings to support findings described in the body of the report.

6. Recommendations for Public Improvements

- a. Recommendations should be made for external roadway improvements to mitigate traffic impacts, such as additional through lanes and turn lanes, and traffic control devices necessitated as a result of the development. Recommended improvements to transit facilities, and pedestrian and bike circulation should also be reported.
- b. The recommendations should specify the time period within which improvements should be made, particularly if improvements are associated with a phased development, the estimated cost of improvements, and any monitoring of operating conditions and improvements that may be needed. If needed street improvements unrelated to the development are identified during the analysis, such improvements should be reported.

7. Access Management

On sites with arterial and collector street frontages, the report shall evaluate and recommend the use of access management plans or techniques:

- a. To separate basic conflict areas (reduce number of driveways or increase spacing between driveways and intersections);
- b. To remove turning vehicles or queues from the through lanes (reduce both the frequency and severity of conflicts by providing separate paths and storage area for turning vehicles and queues).
- c. These techniques may include turn restrictions, striping, medians, frontage roads, channelization of lanes or driveways, shared driveways and access between similar uses, access consolidation, lanes for left or right turns, and other Transportation System Management (TSM) actions.

8. A review of alternative access points for site access to highways, city streets, and county roads.

9. The analysis of alternate access proposals should include:

- a. Existing daily and P.M. peak hour counts by traffic movements at intersections effected by generated traffic from the development (use traffic flow diagrams).
- b. Projected daily and P.M. peak hour volumes for these same intersections and proposed access points when the development is in full service. (Use traffic flow diagrams)
- c. A determination of the existing levels of service and projected levels of service at each intersection and access points studied.
- d. A discussion of the need for traffic signals. This should include a traffic warrant computation based on the MUTCD.

10. The recommendations made in the report should be specific, and shall be based on the acceptable level of service as defined by the Transportation System Plan adopted by the City. As an example, if a traffic signal is recommended, the recommendation should include the type of traffic signal control and what movements should be signalized. If storage lanes for right turns or left turns are warranted, the recommendation should include the amount of storage needed. If several intersections are involved for signalization and an interconnect system is considered, specific analysis shall be made concerning progression of traffic between intersections.

11. The report shall include a discussion of bike and pedestrian usage and the availability of mass transit to serve the development.

5.0015 Intersections

- A. Connecting street intersections shall be located to provide for traffic flow, safety, and turning movements, as conditions warrant.
- B. At intersecting centerlines, a tangent section of a minimum of 25 ft. shall be carried in each direction away from the intersection.
- C. Arterial Intersections: Exclusive left and right turn lanes shall be provided; bus turnouts shall be provided if traffic flow and safety conditions warrant; designated crosswalks shall be provided at controlled locations; street alignments across intersections shall be continuous.
- D. Collector, Neighborhood Routes and Local Street Intersections: Street and intersection alignments shall facilitate local circulation and discourage non-local, through traffic.
- E. Streets shall be aligned so as to intersect at right angles (90°). Angles between 90° and 75° must be approved by the City Engineer. Angles of 75° and lower will not be permitted. Intersection of more than two streets at one point will not be permitted.
- F. New streets shall intersect with existing street intersections so that centerlines are not offset, except as provided below. Where existing streets adjacent to a proposed development do not align properly, conditions may be required of the development to provide for proper alignment.
- G. For intersections which are not directly aligned with street centerlines, the centerline spacing must meet the minimum separation distance shown in the table below.

Street Class	Intersection Spacing (Ft.)
Arterial	500*
Collector	200*
Neighborhood Route / Local / Cul-de-sac	150

*The City Engineer may permit a minimum spacing of not less than 300 ft. (Arterial), 150 ft. (Collector), when findings are made to establish that:

1. Without the change, there could be no public street access from the parcel(s) to the existing street, or
2. The change is necessary to support local pedestrian, bicycle circulation and access, and
3. The change is necessary due to topographic constraints, and
4. All other provisions of the street design requirements can be met.

5.0016 Half-Street plus Travel Lane Construction

- A. Half-streets will only be approved when the abutting or opposite frontage property is undeveloped and the full improvement will be provided with development of the abutting or opposite (upon right-of-way dedication) frontage property. Where such a street is justified, the right-of-way and pavement width will be determined by the City Engineer. In no case shall the pavement width required be less than that necessary to provide two lanes of traffic to pass at a safe distance.
- B. A development on an unimproved street shall be responsible for constructing a continuous, City-standard street connection to the nearest developed (publicly-maintained) street.

5.0017 Street Classification

All streets within the City shall be classified as designated in the Transportation System Plan. The classification for any street not listed shall be that determined by the City Engineer.

5.0018 Design Speed

- A. Design speeds for classified streets shall be as shown in the table below.

Arterial	35-45 MPH
Collector	30 MPH
Neighborhood Route / Local / Cul-de-sac	25 MPH or based on minimum 150-200 ft. stopping sight distance

- B. Where existing traffic conditions identify speeds in excess of design speeds listed, then the higher speed shall be used for design purposes.

5.0020 Horizontal/Vertical Curves, and Grades

5.0021 Horizontal Curves

- A. Horizontal curve alignments shall meet the minimum radius requirements shown in the following tables.

Arterial and Collector Streets

Design Speed (MPH)	Friction Factor (F)	E= -4%	-2.5%	0%	2.5%	4.0%	6.0%
		Centerline radius, in feet					
25	0.165	333	298	252	219	203	185
30	0.160	500	444	375	324	300	273
35	0.155	710	628	527	454	419	380
40	0.150	970	853	711	609	561	508
45	0.145	1286	1125	931	794	730	658
50	0.140	1667	1449	1190	1010	926	833
55	0.130	2241	1921	1551	1301	1186	1061

Neighborhood Routes, Local Streets and Cul-de-sacs

Design Speed (MPH)	Friction Factor (F)	E= -4%	-2.5%	0%	2.5%	4.0%	6.0%
		Centerline radius, in feet					
25	0.252	196	184	165	150	143	134
30	0.221	332	306	272	244	230	214

- B. Where superelevation is used, street curves shall be designed as determined/approved by the City Engineer for maximum superelevation rate of 0.04. If terrain dictates sharp curvature, a maximum superelevation rate of 0.06 is justified if the curve is long enough by AASHTO Policy to provide an adequate superelevation transition.

- C. Request for design speeds less than 25 MPH will be determined/approved by the City Engineer based on topography, right-of-way, or geographic conditions for the applicant. Request must show that a reduction in centerline radius will not compromise safety.

$R = \frac{V^2}{15(e + f)}$	f = friction factor
	e = superelevation, in feet
	R = centerline radius, in feet
	V = design speed, in MPH

5.0022 Vertical Curves

- A. Vertical curve length shall be based on AASHTO Policy design criteria which includes design speed, crest vertical curve, and sag vertical curve. Stopping sight distance for crest and sag vertical curves shall be based on sight distance and headlight sight distance, respectively.
- B. All vertical curves shall be parabolic and the length shall meet the minimum length required for each location.

5.0023 Grades

- A. Maximum grades for each street classification shall be as listed in the table below, except as approved by the City Engineer.

Arterial	08%
Collector	10%
Neighborhood Route / Local / Cul-de-sac	15%

- B. Minimum grade for all streets shall be 0.0075 ft. per ft. however, in all cases street grades shall allow for proper and adequate drainage. Cul-de-sac "bulbs" shall have a minimum slope of 0.0075 ft. per ft. Any grade change of more than 1% shall be accomplished with vertical curves.

5.0030 Pavement Design

- A. In general, all streets shall be constructed with asphaltic concrete; however, Portland Cement Concrete (PCC) streets are permitted as approved by the City Engineer.
- B. Typical flexible pavement thickness for neighborhood routes, local streets and alleys shall be as shown in the Standard Drawings.
- C. The Design Engineer shall provide a street structural design section for all roadways classified collector and higher, and for all streets, including local streets, in industrial zones.
- D. Asphalt pavement may be designed using any nationally recognized procedure. The procedures contained in the following references are preferred.
1. "AASHTO Guide for Design of Pavement Structures, 1986". American Association of State Highway and Transportation Officials.
 2. "Thickness Design – Asphalt Pavements for Highways and Streets". The Asphalt Institute, September, 1981.
- E. Concrete pavement may be designed using any nationally recognized procedure. The procedures contained in the following references are preferred.
1. "AASHTO Guide for Design of Pavement Structures", 1986.
 2. "Thickness Design for Concrete Highway and Street Pavements", Portland Cement Association, 1984.

- F. The minimum approved Street section shall be as follows:
1. Local streets – 4 in. of asphaltic concrete, consisting of 2 in. of Class C over 2 in. of Class B, with 12 in. rock base.
 2. Neighborhood routes – 4 in. of asphaltic concrete, consisting of 2 in. of Class C over 2 in. of Class B, with 12 in. rock base.
 3. Collectors – 5 in. of asphaltic concrete, consisting of two 1-1/2 in. lifts of Class C over 2 in. of Class B, with 14 in. rock base.
 4. Arterial – 6 in. of asphaltic concrete, consisting of 2 in. of Class C over 4 in. of Class B in two lifts, with 14 in. rock base.
 5. Each lift shall be tested, approved and accepted prior to the next one being placed over.
 6. Rock base shall consist of required amount of 1-1/2" -0 crushed rock and 2 in. of 3/4" -0 leveling course.
- G. Fabric may be required on any of the street types depending on soil and weather conditions. (Resolution 05-10 4/11/05)

5.0040 Concrete Curb

- A. All new development projects shall construct street improvements with concrete curbs. Monolithic Curb and Gutter, as shown in the Standard Drawings, shall be used unless Standard Curb is approved by the City Engineer.
- B. Top of curb elevation and centerline elevations shall be equal in standard street cross-sections, unless otherwise approved by the City Engineer. In non-standard street cross-sections, the maximum cross-slope shall be 3.5%.
- C. Control joint spacing in curbs shall be at a 15 ft. maximum at all curb return points and at driveway curb-drop transition points.
- D. A minimum of two drainage block-outs to accommodate 3 in. drain pipe shall be provided for each lot. Typically these block-outs are located 5 ft. from each side of property line and shall extend 3 in. beyond the sidewalk.

5.0041 Curb Return Radius

- A. Curb return radius at street intersections shall be designed to accommodate all expected traffic. Curb extensions and/or special crosswalk/sidewalk features designed to enhance pedestrian safety may be required to encourage pedestrian usage. Minimum curb radii required are as shown in the table below.

Intersection	Radius
Arterial – Arterial	45 ft.
Arterial – Collector	35 ft.
Arterial – Neighborhood Route or Local Street	25 ft.
Collector – Collector	35 ft.
Collector – Neighborhood Route or Local Street	25 ft.
Neighborhood Route – Neighborhood Route	25 ft.
Local Street – Local Street	25 ft.

- B. Larger curb radii may be required on streets serving commercial/industrial properties for vehicle movements.

5.0050 Sidewalks

- A. In general, new sidewalks with curbs are required for any development requiring a development permit. The location of the sidewalk within a development will be determined in the Development Review process.
- B. All sidewalks and curb ramps shall comply with and be constructed in accordance with all current ADA standards.
- C. Sidewalks shall be a minimum 6 ft. wide, unless otherwise approved by the City Engineer and shall be typically separated from the face of the curb by a 6 ft. planter strip. The minimum permitted slope across the planter strip shall be 1:50 (2%). The maximum permitted slope across the planter strip shall be 1:4 (25%).
- D. Sidewalks shall be within the dedicated right-of-way, unless specifically approved by the City Engineer.
- E. Sidewalks and curb ramps shall have a maximum running slope 1:12 (8.33%) and a maximum cross slope of 1:50 (2%). Where steeply sloped roadways and constrained right-of-way preclude a running slope of 1:12 (8.33%), the least possible running slope shall be provided.
- F. Pedestrian curb ramps shall have yellow truncated domes that extend the full width of the ramp and cover the first 2 ft. of the ramp closest to the street. Transitions from the ramp to the walkway, gutter, and street must be flush (level) and free of abrupt level changes. The gutter or adjacent roadway must have a slope of no more than 1:20 (5%) toward the ramp. The flared sides or “wings” of the curb ramp shall typically be 1:12 (8.33%) in slope, but shall not exceed 1:10 (10%).
- G. Sidewalk joints shall be finished with a 3 in. shine in new construction, or if construction is infill work, finish shall match existing pattern. A light broom finish is required on all sidewalk and curb ramps perpendicular to the direction of travel.
- H. Any damaged, cracked, or broken sidewalk panels shall be removed and replaced in whole. No partial repairs.
- I. All structures in the sidewalk area shall be located to provide a minimum unobstructed width of 48 in. horizontal. Where mailboxes or other objects are within the sidewalk area, the walk shall be widened to provide adequate clearance, or be aligned to go around any obstacles. Alternate alignments and widths must be approved by the City Engineer. A 7 ft. vertical clearance above the sidewalk shall be maintained. (Resolution 05-10 4/11/05)

5.0051 Sidewalk Ramps

All intersections shall contain sidewalk ramps (for access) located within the curb return. All street intersections shall typically have twin curb ramps as shown in Standard Drawing WL-507B. Sidewalk ramps shall be located with regard to storm water flows, street grades, utility or light pole locations and existing opposing ramps. Sidewalk ramps shall meet all applicable guidelines of the Americans with Disabilities Act (ADA).

5.0060 Bikeways/Bike Paths

The need for bikeways shall be determined by the City’s Transportation System Plan. Bikeway facilities shall meet the requirements of the following documents:

1. AASHTO, “Guide to Development of Bicycle Facilities”
2. ODOT, “Oregon Bicycle & Pedestrian Plan”, latest edition
3. “Manual on Uniform Traffic Control Devices” (MUTCD) with Oregon supplements by Oregon Transportation Commission

5.0061 Bikeway Location, Width

Bikeway location and width shall be as determined by the City’s Transportation System Plan.

5.0062 Design Criteria

- A. In general, bikeway design shall meet the adopted standards referred to in Subsection 5.0060, Bikeways/Bike Paths.
- B. All bikeways shall have a minimum slope of 2% in any direction and a maximum cross-slope of 5%. On curved alignments, the cross-slope shall be to the inside of the curve.
- C. Bikeway curvature will be based on a minimum design speed of 20 MPH.
- D. Bikeway grades shall be limited to a maximum of 5%. Where topography dictates, grades over 5% are acceptable when a higher design speed is used and additional width is provided.
- E. All design shall conform to the minimum requirements of the Oregon Bike and Pedestrian (ODOT) standards.
- F. When bikeways are integrated with a curb, all inlet grates shall be designed to protect the bicyclist from the grate or opening.

5.0063 Construction

- A. Bikeways shall be either asphalt or concrete surfaced. The structural section of the bikeway shall conform to the requirements shown in Standard Drawing WL-510.
- B. When drainage such as side ditches is required parallel with the bikeway, the ditch centerline shall be at least 5 ft. from the edge of the pavement. Ditch side slope adjacent to the bikeway shall be no steeper than 2:1 when measuring the horizontal distance to the vertical distance.
- C. When culverts cross bikeways, the ends of the pipe shall be no closer than 5 ft. from the edge of the bikeway.

5.0070 Driveways and Approaches

- A. Access to private property shall be permitted with the use of driveway curb cuts. The access points with the street shall be the minimum necessary to provide access while not inhibiting the safe circulation and carrying capacity of the street. Curb cuts are measured from the top of approach wing to the top of approach wing (i.e. the width of the allowable curb cut section or approach includes all lowered or dropped curb sections, NOT just the "throat" or drivable section of the approach). Driveways shall meet all applicable guidelines of the Americans with Disabilities Act (ADA).
- B. On arterial and collector streets and above, one driveway/approach per site frontage will be the normal maximum number. Double frontage lots and corner lots on these streets may be limited to access from a single street, usually the lower classification street. If additional driveways are approved by the City Engineer, a finding shall be made that no imminent traffic hazard would result and impacts on through traffic would be minimal. Restrictions may be imposed on additional driveways, such as limited turn movements, shared access between uses, closure of existing driveways, or other access management actions. Commercial developments with frontage greater than 250 ft. may request an additional driveway if needed.
- C. Driveways and approaches shall conform to Standard Drawing WL-503A, WL-503B, 504A and 504B, to specifications listed in this section, and to Street Technical Requirements and Concrete Structures Technical requirements of this manual, and shall consist of a standard gray commercially mixed concrete in the right of way with a minimum breaking strength of 3300 psi after 28 days. No expansion joints are allowed in the street right-of-way. In existing developments the approach may be asphalt to match the neighboring properties, but only as specifically approved by the City Engineer. If asphalt is approved, the following street section applies: 10 in. rock base with 4 in. asphalt (size of rock and class of asphalt per Public Works Construction Standards). All approaches at their intersection with the street shall be not greater than 36 ft.
- D. Width and Location of Curb Cuts

1. Minimum curb cut width shall be 16 ft.
2. Maximum curb cut width shall be 36 ft., except along Highway 43 in which case the maximum curb cut shall be 40 ft.
3. No curb cuts shall be allowed any closer to an intersecting street right-of-way line than the following:
 - a. On an arterial when intersected by another arterial, 150 ft.
 - b. On an arterial when intersected by a collector, neighborhood route or local street 100 ft.
 - c. On a collector when intersecting an arterial, 100 ft.
 - d. On a collector when intersected by another collector, a neighborhood route or local street, 35 ft.
 - e. On a neighborhood route when intersecting any other street, 35 ft.
 - f. On a local street when intersecting any other street, 35 ft.
4. There shall be a minimum distance between any two adjacent curb cuts on the same side of a public street except for one-way entrances and exits, as follows:
 - a. On an arterial street, 150 ft.
 - b. On a collector street, 75 ft.
 - c. Between any two curb cuts on the same lot on a neighborhood route or local street, 30 ft.
5. Curb cuts shall be kept to a minimum, particularly on Highway 43. Consolidation of driveways is preferred. The standard on Highway 43 is one curb cut per business if consolidation of driveways is not possible.
6. Adequate line of sight pursuant to engineering standards should be afforded at each driveway.
7. Curb cuts shall be a minimum of 5 ft. from the property line, unless a shared driveway is installed.
8. For classification of collector and above, driveways adjacent to street intersections shall be located beyond the required queue length for traffic movements at the intersection. If this requirement prohibits access to the site, a driveway with restricted turn movements may be allowed.
9. Within commercial, industrial, and multi-family areas, shared driveways and internal access between similar uses are encouraged to reduce the access points to the higher classified roadways; to improve internal site circulation; and to reduce local trips or movements on the street system. Shared driveways or internal access between uses will be established by means of common access easements at the time of development.
10. Multi-family access driveways will be required to meet the same access requirements as commercial driveways if the multi-family site generates 100 or more trips per day.

5.0080 Street Lighting, Trees, Names and Signage

5.0081 Street Lighting

- A. A complete street lighting system shall be the responsibility of the development. All streets fronting the property shall be provided adequate lighting as determined by the City Engineer. For lighting requirements, all developments will be required to submit a lighting plan to the City Engineer. The lighting plan shall conform to Illuminating Engineering Society (IES) standards except as modified by the City.
- B. For new subdivisions or land use actions requiring street light installation, all plans for street lights shall be submitted with the construction plan submittal. Approvals for street light plans will be issued as part of the construction plan package.

- C. Required street lights shall be acquired through Portland General Electric (PGE) under the Option "B" plan (City-owned equipment, maintenance and energy from PGE). Standard fixtures shall be:
1. Intersections: Cobrahead, Drop Lens (flat lens to avoid residential conflicts), 150 W High Pressure Sodium (HPS) lamp.
 2. Mid Block Collector: Shoebox, Flat lens, 100 W HPS lamp or Cobrahead, Flat lens, 100 W HPS lamp. Additionally, PGE approved Acorn Streetlight with Tall Aluminum Roof, and Techtra Streetlight (Black) are allowed. (Revised 4/06)
 3. Arterial: Cobrahead, Drop Lens, 150 W HPS lamp
- D. Non-standard fixtures approved for installation shall be acquired through PGE under the Option "C" plan (Customer-owned equipment and maintenance, energy from PGE) and an agreement for maintenance responsibility shall be in place prior to street light installation.
- E. The City shall determine the appropriate street light fixtures for development based upon its location.
- F. It is the policy of the City to light streets to the IES Standards listed below with the following exceptions:

Street Classification	Area Classification	Average Maintained Illumination	Uniformity Average to Minimum
Arterials	Commercial Intermediate Residential	1.7 foot-candles 1.3 foot-candles 0.9 foot-candles	3 to 1
Collector	Commercial Intermediate Residential	1.2 foot-candles 0.9 foot-candles 0.6 foot-candles	4 to 1
Neighborhood Route Local Cul-de-sac	Commercial Intermediate Residential	0.9 foot-candles 0.7 foot-candles 0.4 foot-candles	6 to 1

G. Definitions

Arterials: That part of a roadway system which serves as the principal network for through-traffic flow. These are the routes that connect areas of principal traffic generation and important rural highways entering the City.

Collector: The distributor and collector roadways servicing traffic between major and local roadways. These are roadways used mainly for traffic movements within residential, commercial and industrial areas.

Neighborhood Route and Local: Roadways used primarily for direct access to residential, commercial, industrial or other abutting property. They do not include roadways carrying through traffic.

Commercial: A business area of the City where ordinarily there are many pedestrians during night hours. This definition applies to densely developed business areas outside, as well as within, the central part of the City. The area contains land use which attracts a relatively heavy volume of nighttime vehicular and/or pedestrian traffic on a frequent basis.

Intermediate: Those areas of a municipality often with moderately heavy nighttime pedestrian activity such as in blocks having libraries, community recreation centers, large apartment buildings, industrial buildings, or neighborhood retail stores.

Residential: A residential development, or a mixture of residential and small commercial establishments, with few pedestrians at night.

5.0082 Street Trees

Street trees in the public right-of-way, or within the yard setback and/or buffer area immediately adjacent to the right-of-way, will be required of all developments. The particular species will be reviewed and approved as part of overall project submittals. A deposit for street trees to assure installation of the trees prior to occupancy shall be required prior to subdivision acceptance by the City and the release of building permits by the Building Official.

5.0083 Street Names, Traffic Control Signage, and Pavement Markings

Street names for all new development will be approved by the City prior to recording of any maps or plats. The development shall pay for all street name and traffic control signage prior to the signing of the final plat or map by the City. All new signage and pavement markings will be installed by the City in new developments.

5.0090 Dead-end Streets and Cul-de-sacs

- A. A standard cul-de-sac turnaround shall be provided at the end of a dead-end street that does not provide looped circulation. Alternative turnaround configurations may be used when the dead-end street is less than 200 ft. long or when conditions warrant, with approval from the City Engineer.
- B. Cul-de-sacs shall not be more than 400 ft. in length, measured along the centerline of the street right-of-way. The measurement shall be taken from the intersecting street centerline to the farthest point of the cul-de-sac.
- C. The minimum outside curb radius for cul-de-sac bulbs shall be 45 ft., unless otherwise approved by the City Engineer.
- D. Turnaround requirements from the Community Development Code Chapter 85 shall be applied to all dead-end streets.
- E. Type III barricade shall be installed at the end of all dead-end streets, unless the City Engineer approves another type of traffic control device. (Resolution 05-10 4/11/05)

5.0100 Alleys and Private Residential Streets/Accessways

5.0101 Alleys

A. Alleys - Commercial and Industrial

- 1. Alleyways may be provided in commercial and industrial developments with approval by the City Engineer. When approved, alleyways shall be dedicated to the City. Standard alleyway dimensions shall be a 12 ft. wide paved surface inside a 16 ft. wide right-of-way.
- 2. Design for alleyways shall meet the same criteria as other public streets. The exception to those criteria may be centerline radius and design speed. Generally, alleyways shall be designed for one-way operation.

B. Alleys - Residential Districts

To serve development, alleys allow for efficient lot use, support front yard pedestrian orientation and landscape spaces, and reduce lot coverage by driveways. Alleys serve as a common driveway for access, utilities, and deliveries. Alley design shall conform to the latest adopted Transportation System Plan.

5.0102 Private Residential Accessways

In general, private residential streets and accessways shall be provided for multi-family developments such as condominiums and apartments. Interior design for private accessways in a manufactured home park shall meet the standards of Chapter 48 of the Community Development Code. The standards for private residential accessways include:

1. Dead-end accessways which exceed 150 ft. in length shall be provided with an approved turnaround.
2. "Private Street" signage and driveway approach shall be placed at the intersection with the public street to clearly identify the private accessway.
3. Private maintenance of the private streets/accessways shall be provided by a Homeowner's Association or other appropriate entity. Maintenance shall ensure continual emergency accessibility at all times.
4. Location of private accessways shall meet the Uniform Fire Code and meet the minimum pavement section of local residential streets.
5. Private residential accessways will be allowed in Manufactured Home Parks but shall not be allowed in Manufactured Home Subdivisions.

5.0110 Local Street Design for Adverse Topography

- A. In standard local street design, the top of curb elevations shall equal the finished centerline elevations, except in situations of adverse topography. The Design Engineer may utilize an "offset" or unequal crown section when the existing ground slope exceeds 8% across the roadway section.
- B. The offset crown design shall meet the following conditions:
 1. Minimum distance from "crown" to face of curb is 10 ft.
 2. Maximum cross-slope of pavement is 5%.
 3. Maximum differential in top of curb elevation from one side to the other is 1 ft.
- C. The existing ground "side-slope" criteria are based on the relationship of the slope of the ground to the transverse slope of the roadway profile. This relationship shall be met for the entire length of the roadway alignment utilizing an offset crown.

5.0120 Medians

Raised medians are allowed on certain streets, but must be approved by the City Engineer. If medians are allowed, the following criteria must be met:

1. The median must be set back at least 2 ft. from the median lane on both sides.
2. Street lighting shall be sufficient to provide illumination of the median.
3. Objects such as trees, shrubs, signs, light poles, etc., shall not physically or visually interfere with vehicle or pedestrian traffic or traveled way. Medians and objects within the median can be site specific and will be subject to City approvals.
4. Medians in the public right-of-way are maintained by the Public Works Department. Planting and irrigation plans for medians shall be submitted to the Public Works Department for its review and approval. Inspections of planting and irrigation systems shall be coordinated directly with the Public Works Department Street Utility Supervisor. Irrigation of medians shall be designed to water lawn areas and shrub areas separately.

5.0130 Guardrails

- A. The decision of whether to install guardrails shall be based on the information found in the AASHTO publication, AASHTO RSDG-3 "Roadside Design Guide."
- B. Guardrails shall be designed and constructed per ODOT's Standard Drawings for Design and Construction.

5.0140 Pavement Transitions

- A. In the direction of vehicular traffic, street width transitions from a narrower width to a wider width shall be designed with a three to one taper. Delineators, as approved by the City, shall be installed to define the configurations.
- B. In the direction of vehicular traffic, street width transitions from a wider width to a narrower width and the length of transition taper shall be determined as shown below.

$L = S \times W \quad \text{for } S = 45 \text{ MPH or greater}$	Where L = minimum length of taper (ft.) S = Design speed (MPH) W = EP to EP offset width EP = Edge of pavement to center line
$L = \frac{S^2 \times W}{60} \quad \text{for } S \text{ less than } 45 \text{ MPH}$	

- C. Delineators, as approved by the City, may be installed to define the configuration. Maximum spacing of delineators shall be the numerical value of the design speed, in ft. (e.g. 35 ft. spacing for 35 MPH).

5.0150 Monument Boxes

Monument boxes shall be installed and be in accordance with all Clackamas County surveyor specifications and requirements.

5.0160 (Intentionally Left Blank)

5.0170 Private Streets

Private streets must meet the identical requirements of public or City streets with respect to design and construction standards; however, the City has no maintenance responsibilities for private streets.