RESOLUTION NO. 32-2001

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MILWAUKIE, OREGON, ADOPTING THE MILWAUKIE TRANPORTATION DESIGN MANUAL.

WHEREAS, the City of Milwaukie has received a state grant to implement the Milwaukie Transportation System Plan and prepare a transportation design manual; and

WHEREAS, a design manual entitled "Milwaukie Transportation Design Manual" has been prepared, a copy of which is attached as Exhibit 1; and

WHEREAS, the design manual contains policies and design standards that affect construction of improvements within rights-of-way located in the City; and

WHEREAS, the design manual is intended to facilitate uniform compliance with city policies and standards for construction of transportation improvements in right-of-way, and

WHEREAS, the City Council finds that the Design Manual is consistent with city policies and imposes appropriate standards for transportation improvements in the right of way; and

WHEREAS, Municipal Code Chapter 15.36 authorizes the City to adopt design standards for public works improvements by resolution,

NOW, THEREFORE, BE IT RESOLVED that City Council hereby adopts the Milwaukie Transportation Design Manual as shown in Exhibit 1 as the official City of Milwaukie design manual for transportation improvements in the right of way.

James Bernard, Mayor

ATTEST

Pat Duval, City Recorder

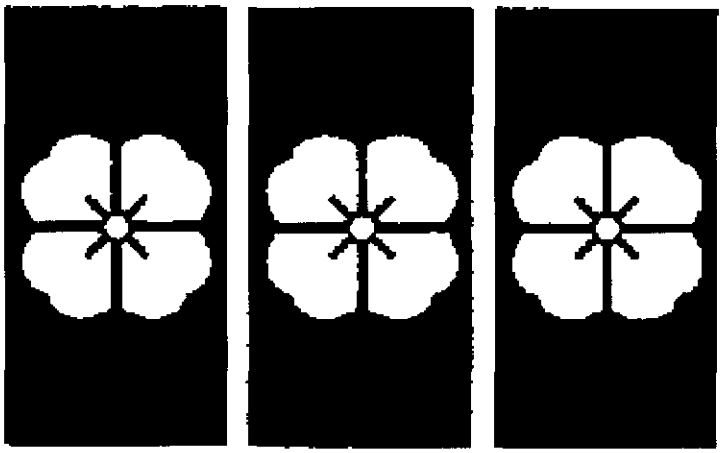
APPROVED AS TO FORM:
Ramis Crew Corrigan & Bachrach, LLP

City Attorney

EXHIBIT 1

TRANSPORTATION DESIGN MANUAL

CITY OF



MILWAUKIE

CITY OF MILWAUKIE
COMMUNITY DEVELOPMENT

September 7, 2001

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Chapter 1
Street Design Requirements

1.1 General Design Requirements

All street designs shall provide for the safe and efficient travel of all modes of travel for the public. Streets shall be designed to meet or exceed minimum guidelines set forth in the following references and as defined in this design manual, except that alternate design specifications may be accepted by the City Engineer based upon professional judgement and acceptable engineering practices:

"A Policy on Geometric Design of Highways and Streets," American Association of State Highway and Transportation Officials (latest edition, also referred to as the "Green Book")

"Manual on Uniform Traffic Control Devices for Streets and Highways," Federal Highway Administration, with Oregon Supplements, Oregon Department of Transportation (latest edition).

"Guide for the Development of Bicycle Facilities," AASHTO (latest edition)

"American National Standard Practice for Roadway Lighting," ANSI/IESNA R-8-00, Illuminating Engineering Society of America (latest edition)

"Highway Capacity Manual," Transportation Research Board (latest edition)

"Trip Generation," Institute of Transportation Engineers (latest edition)

"Parking Generation," Institute of Transportation Engineers (latest edition)

"Regional Transportation Plan," Metro, August 10, 2000.

"Oregon Highway Plan," Oregon Department of Transportation, May 1999, amendment December 13, 2000.

1.2 Jurisdiction and Street Designs

Streets within Milwaukie are under the jurisdiction of the City of Milwaukie. Figure 1 shows the areas of jurisdiction for Milwaukie, ODOT and Clackamas County (based upon the Clackamas County Road Map Atlas, 1997).

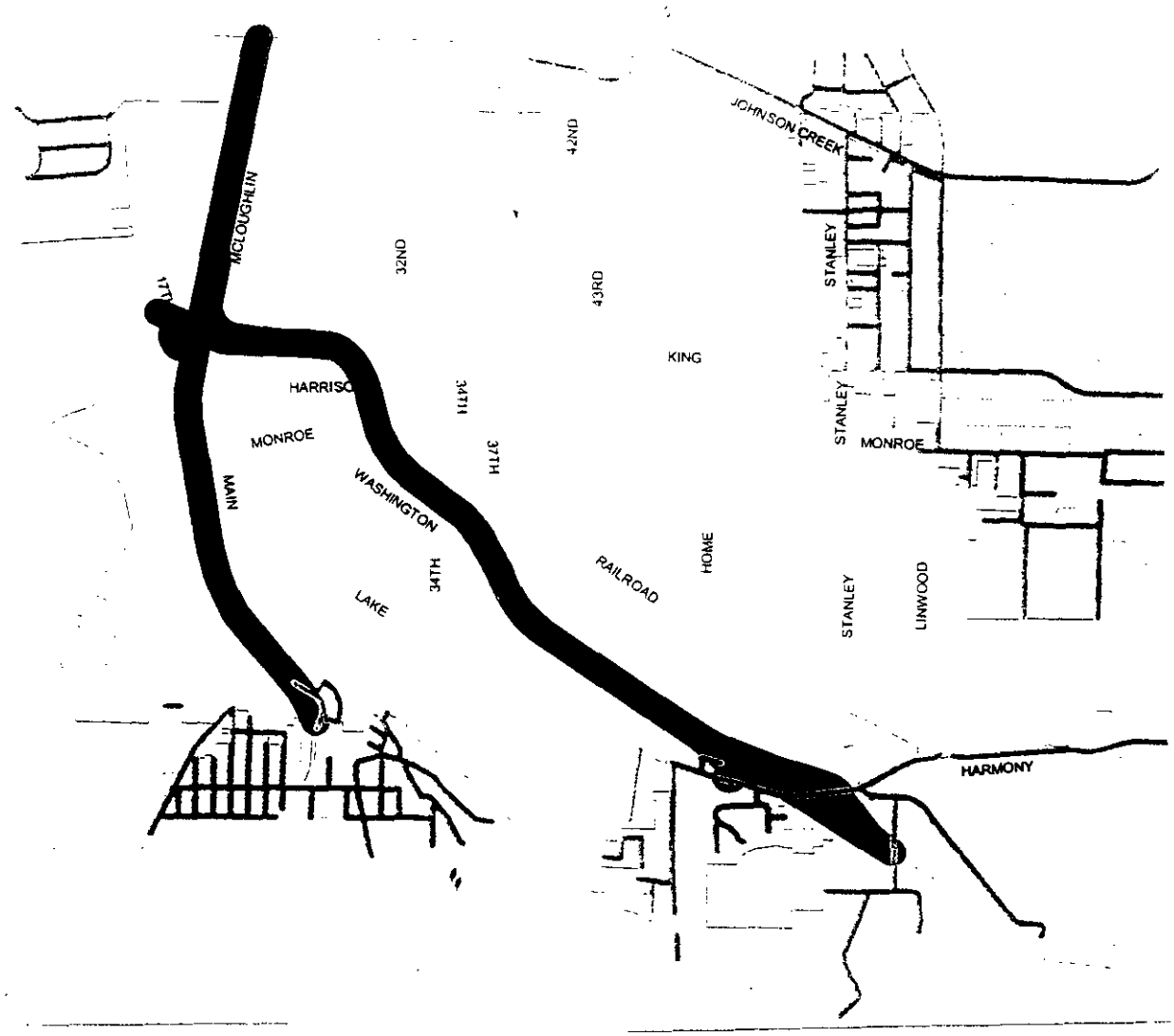


Figure 1
ODOT and County Jurisdiction

1.3 Functional Classification and its Relationship to Design

The street functional classifications as defined in Chapter 5 of the City of Milwaukie Comprehensive Plan shall be utilized to determine:

- the appropriate mix of modal activities/cross section,
- intersection and access spacing standards, and
- design parameters (design speed, curvature, grade, ...etc.)

Classifications are defined in the Comprehensive Plan as freeways, arterials, collectors, neighborhood routes and local streets. The following sections outline the relationship between street design and functional classification.

1.3.1 Cross Sections/Right-of-Way/Pavement Width

Functional classification is used to group the types of street cross sections. All streets in Milwaukie shall have a minimum of 50 feet of right-of-way. Exceptions to this standard include the following:

- Arterial and collector streets with greater traffic needs (with rights-of-way defined in Figure 2);
- Certain streets within the jurisdiction of ODOT or Clackamas County;
- Alleys in residential areas where no driveway frontage is provided or commercial areas for loading access (as approved by the City Engineer)

How is Right-of-way Determined for a Street? The standard right-of-way is 50 feet. The selection of an appropriate street cross section for a residential street is based upon ultimate traffic volume. When a residential street has a traffic volume of less than 1,500 vehicles per day, the right-of-way is width is 50 feet and the pavement cross section is 28 feet curb to curb. For residential streets that carry 1,500 or more vehicles per day, the right-of-way is width is 52 feet and the pavement cross section is 32 feet curb to curb.

Existing collector streets requiring standard 52 feet of right-of-way include the following:

- Monroe west of ORE 224
- Stanley Avenue
- 34th for 600 feet north of Lake Road
- 32nd Avenue
- 43rd Avenue/Howe Street/42nd Avenue

City streets where 60 feet or more of right-of-way are required are documented in Figure 2. Streets requiring 60 feet or more of required right-of-way include multi-lane streets (three lanes or more), two lane arterial/collector streets and any two-lane industrial streets. The use of street cross sections with less than a 50 foot right-of-way requires

written documentation regarding the safety of the application and the approval of the City Engineer.

Figures 3 and 4 outline arterial/collector and local/neighborhood cross sections to be used in Milwaukie. Together with Figure 2, these provide the definitions to right-of-way needs. Any request for right-of-way deviations (Milwaukie Municipal Code Chapter 19.1400) shall be approved prior to preparation of engineering submittals or design plans to the City.

Multiple Lane Streets. The Transportation System Plan (TSP) and, where necessary, the Transportation Impact Study will provide identification of streets that require more than two lanes for travel. This includes the need for turning lanes (left or right turn) or bicycle lanes. While the TSP outlines certain locations where bicycle lanes or additional vehicle turning lanes are necessary, evaluation of site impacts may dictate provision of other turning lanes. Right-of-way for right turning lanes is not included in the cross section diagrams (Figures 3 and 4) and must be added to the basic right-of-way requirement. Additionally, where a center left turn lane is required on a two lane cross section, additional right-of-way may be necessary at such intersections.

Medians. Raised medians are required for any street with five or more lanes. When medians are utilized and design speeds are at or above 35 MPH, two feet of shy distance will be required (between the face of median curb and the edge of travel lane). At design speeds of 30 MPH, one foot of shy distance should be utilized, and at or below 25 MPH, no shy distance is required. Street lighting meeting the standard for the functional classification of street shall be utilized when medians are provided.

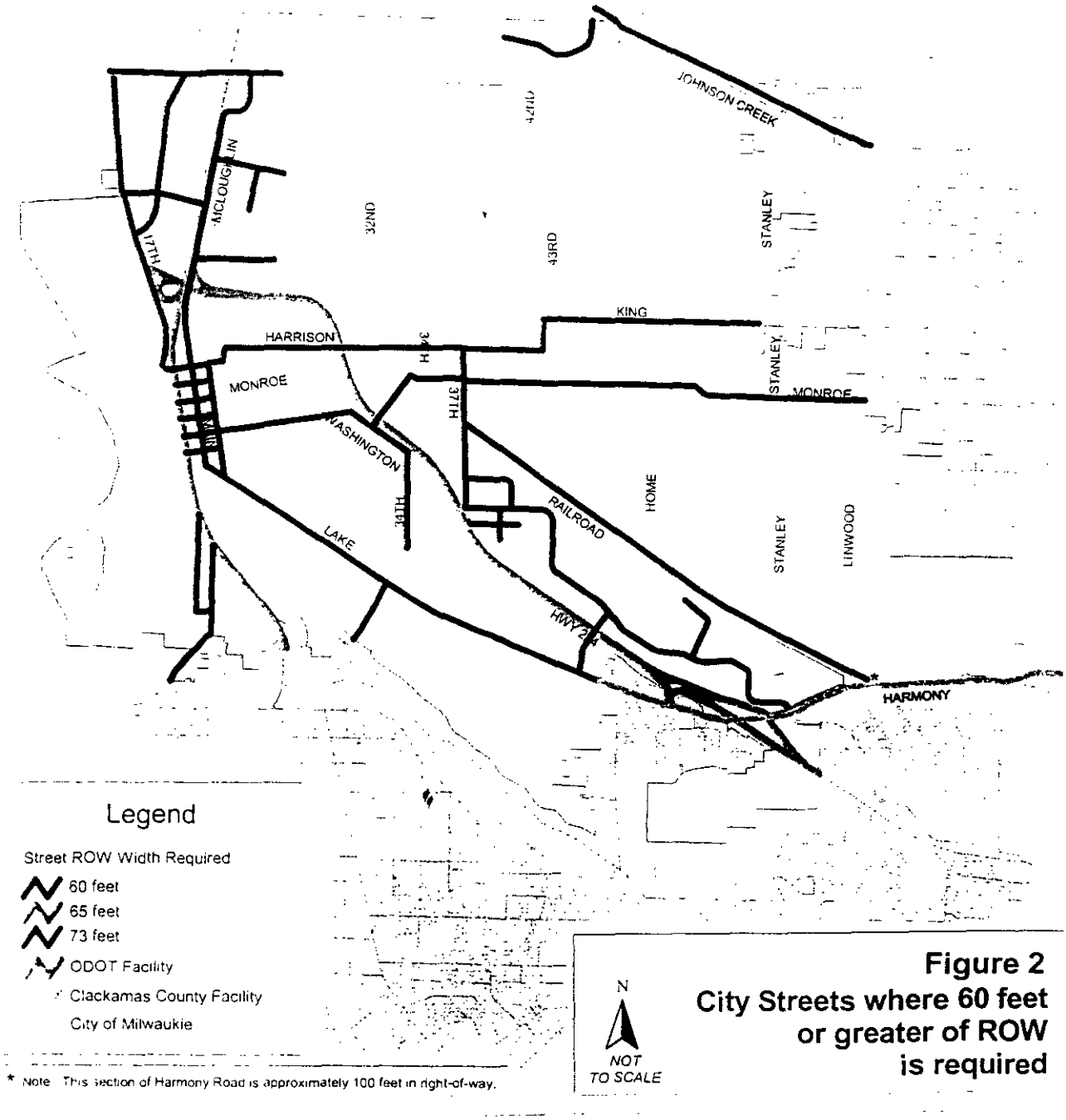
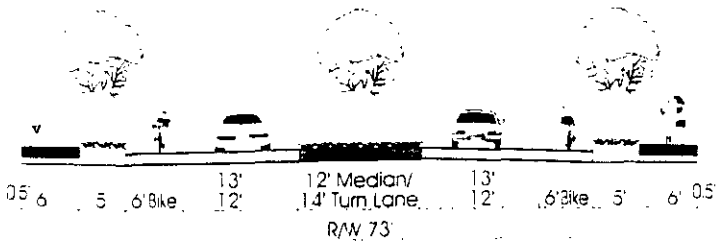
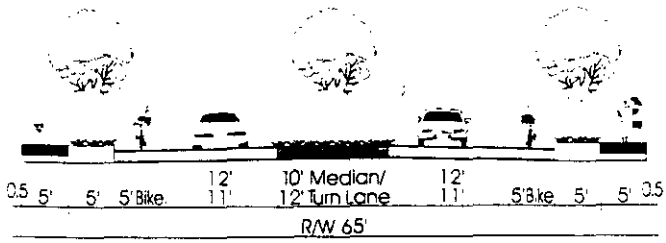


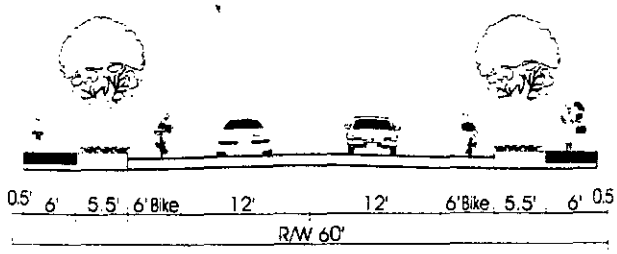
Figure 2
City Streets where 60 feet or greater of ROW is required



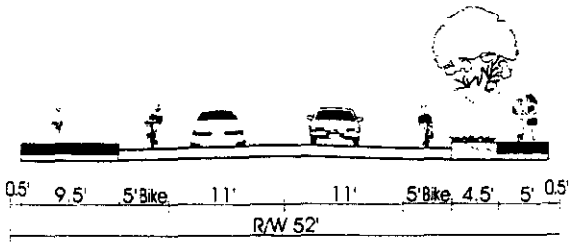
Arterial 73'



Arterial 65'



Arterial/Collector 60'

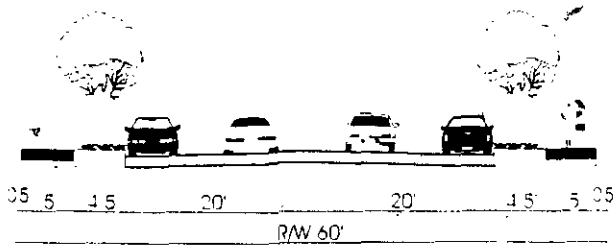


Collector 52'

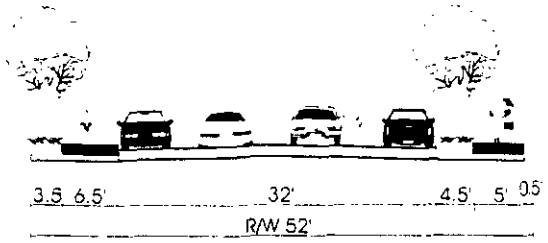
Notes:

1. *Turn lanes (left and right turns) may require additional right-of-way.*
2. *Dimension for on-street parking in addition to those stated.*
3. *Sidewalk 5' minimum with landscape strip. Where sidewalk is curb tight 9.5' minimum for Collector, 10' minimum for Arterial. For a landscape strip adjacent to the curb or curb tight sidewalks, width includes curb.*
4. *When median provided add 1' shy distance for 30 mph streets, 2' for streets 35 mph or greater.*

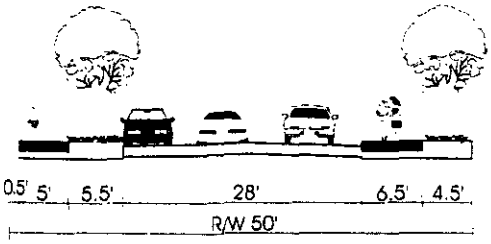
CITY OF MILWAUKIE	CITY OF MILWAUKIE, OREGON – PUBLIC WORKS DEPT.	
	ATERIAL/COLLECTOR STREET CROSS SECTIONS	**Figure 3**



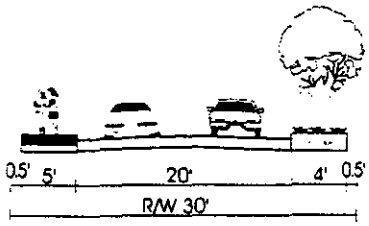
Commercial/Industrial 60'
On-street Parking



Neighborhood Residential 52' **>1500 vpd**
On-street Parking



Local Residential 50' **<1500 vpd**
One Side On-street Parking



Alley 30'
No On-street Parking

Notes:

1. *Use of landscape strip typically symetric about street cross section. Samples show examples of landscape strip and curb tight sidewalk for reference.*
2. *Sidewalk 5' minimum with landscape strip. Where sidewalk is curb tight, provide 6' sidewalk on Local/Neighborhood Street, not including curb width. For alley minimum sidewalk 4.5', for cul-de-sac minimum sidewalk 5' (not including curb width).*

CITY OF MILWAUKIE	CITY OF MILWAUKIE, OREGON – PUBLIC WORKS DEPT.	
	LOCAL/NEIGHBORHOOD STREET CROSS SECTIONS	**Figure 4**

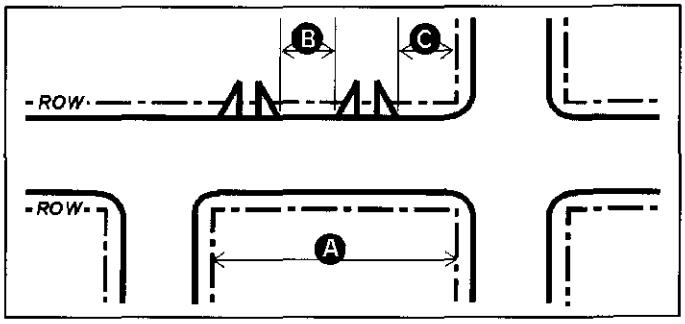
Design Variations. Table 1 provides design guidance where the individual street elements of a cross section may need to vary to accommodate unique features of an individual corridor to address issues of severe topography, barriers, such as freeways, railroads or environmental constraints such as wetlands, water features, historic trees or other sensitive environmental features. Table 1 is applicable only in conditions that can be described as constrained for the above reasons and provides the minimum design dimensions that can be applied to tailor a cross section to the unique circumstances, with the approval of the City Engineer.

Table 1
Minimum Criteria in Assessment of Street Cross Section Elements in Right-of-Way

Vehicle Lane Widths: (minimum widths)	Truck Route=12 feet Bus Route=11 feet Arterial=11 feet Collector=10 feet Neighborhood=10 feet Local=9 feet Turn Lane=10 feet
On-Street Parking:	Industrial Street = 8 feet Commercial Street = 7 feet Residential Street = 6 feet
Bike Lanes: (minimum widths)	New Construction = 6 feet Reconstruction = 5 feet
Bike Accommodation: (minimum width)	New Construction=15 feet Reconstruction=14 feet
Curb Extensions for Pedestrians:	Consider on any Walkway
Sidewalks: (minimum width, not including width of curb)	With landscape strip = 5 feet Without landscape strip = 4.5 feet (alley), 5 feet (culdesac) 6 feet (local/neighborhood) 8 feet (collector) 10 feet (arterial)
Landscape Strips:	Preferred (Consider on any Walkway)
Medians:	5-Lane=Required 3-Lane=Optional
Neighborhood Traffic Management:	Local/Neighborhood/Collector = Appropriate (collectors must consider emergency and transit needs) Arterials = Allowable with Council approval and minimum of 50% frontage zoned residential (must also consider emergency and transit needs)
Transit	Arterial or Collector Streets (Neighborhood Streets=Under Special Circumstances)
Access Control	Arterial: Max. Public Street Spacing = 1000 feet Minimum Public Street Spacing = 530 feet Collector: Max. Public Street Spacing = 600 feet Minimum Public Street Spacing = 300 feet
Turning Lanes	When required, width must be added to right-of-way at intersection (common for streets above 5,000 vehicles per day)

1.3.2 Intersections and Access Spacing

Access spacing involves the placement of driveways and public streets in relation to one another, as seen below. When traffic volumes increase and access spacing is frequent, the safety of motor vehicles, pedestrians, bicycles freight movement and transit is directly impacted. The design of intersections also influences access spacing issues. Milwaukie Municipal Code Chapter 19.1400 addresses several elements of intersection and access spacing design including:



- Minimum Spacing
- Driveways
- Clear Sight Zone
- Connectivity

This manual provides additional information regarding those elements and addresses the following:

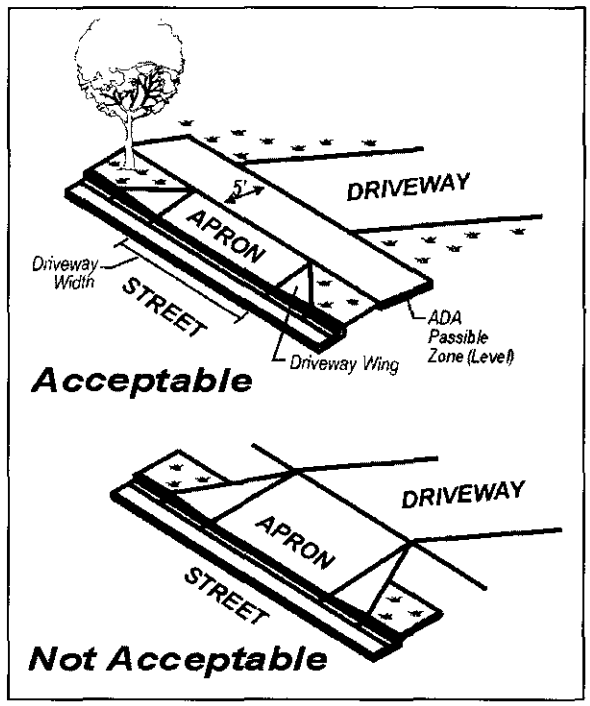
- Intersection Alignment
- Turn Lanes
- Curb Returns

Minimum Spacing. Access spacing criteria is based upon several factors including stopping sight distance, ability of turning traffic to leave a through lane with minimal disruption to operation, minimizing right turn conflict overlaps, maximizing egress capacity and reducing compound turning conflicts where queues for turning/decelerating traffic encounter conflicting movements from entering/exiting streets/driveways. All development must have access to a public street. Access roads (public and/or private), driveways, and easements shall be in accordance with Milwaukie Municipal Code Chapter 19.1400. Minimum spacing on arterial or collector streets facilitates safe operation of traffic and preserves their functional integrity. Minimum spacing is measured between the nearest points of the right of way lines (see A above) of public streets or the top of the wings of any driveway (see B and C above).

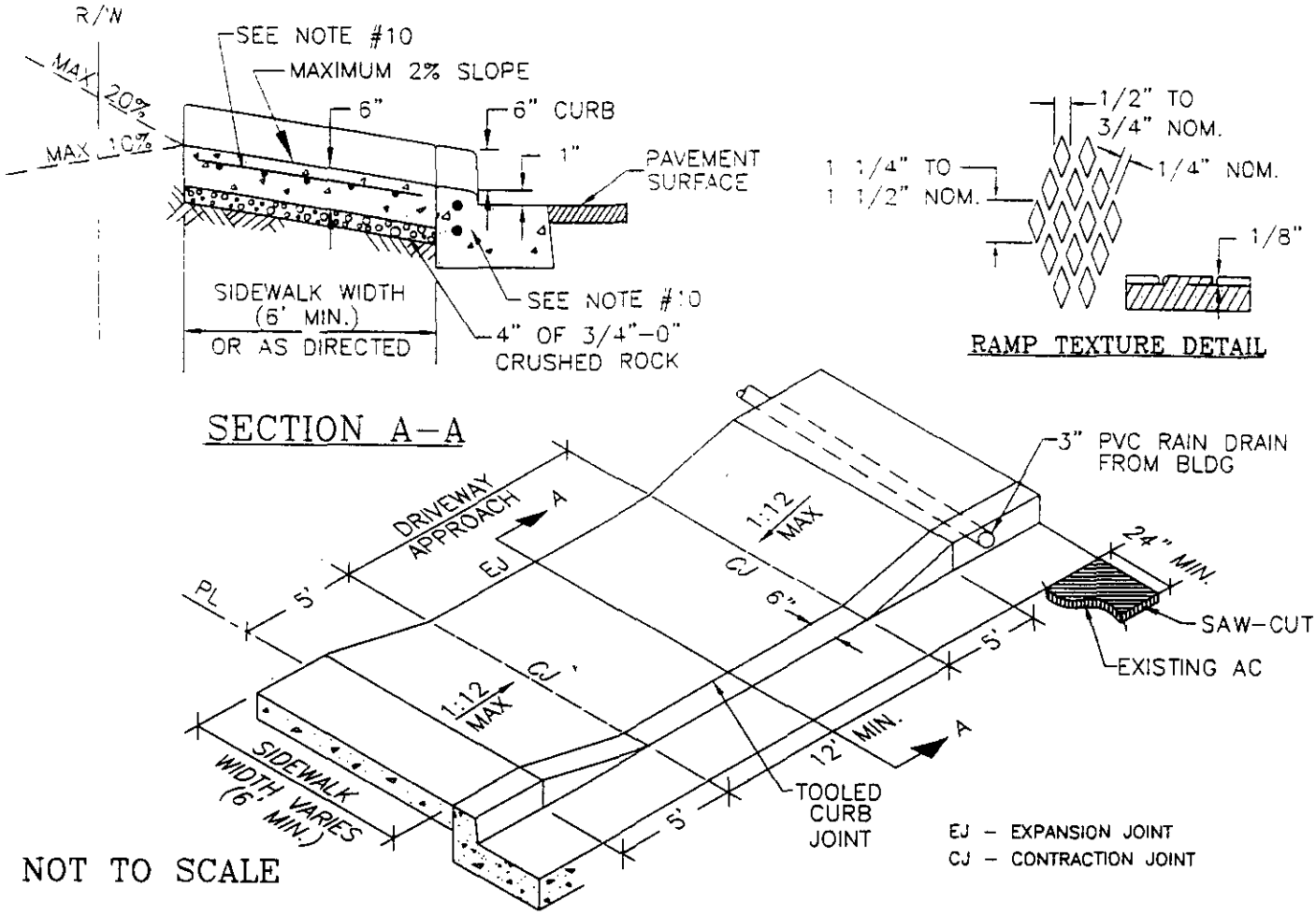
Access Studies: Any proposed access point on a street or driveway that does not meet the minimum spacing standards shall require a transportation impact analysis to be conducted. The scoping of this study may be refined or limited, prior to analysis, with the approval of the City Engineer.

Driveways. Access to private property shall be permitted with the use of driveway curb cuts, as outlined in Milwaukie Municipal Code Chapter 19.1400. The number of driveway points with public streets shall be the minimum necessary to provide access while not inhibiting the safe circulation and carrying capacity of the street. Driveways shall meet all applicable guidelines of the Americans with Disabilities Act (ADA). This includes a level area for passage as shown at right. Driveways shall be constructed per standards shown in Figures 5 (residential) and 6 (commercial).

Shared Driveways. Within commercial, industrial, and multi-family areas, shared driveways and internal access between similar uses are encouraged to reduce the number of 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 can be established by means of common access easements at the time of development. For commercial, industrial and multi-family uses driveway placement should minimize directing traffic through local residential streets.



Shared driveways should be considered when the space between a proposed driveway and adjacent property line is less than ½ the minimum driveway/public street spacing standard. Driveway spacing criteria shall not be construed to prohibit access to small parcels. If minimum spacing requirement would result in no access to the site, a driveway with restricted turn movements or temporary access may be permitted until such time as adjoining parcels develop allowing for the potential to share access points.



1. WIDTH OF SIDEWALK VARIES WITH STREET FUNCTIONAL CLASSIFICATION OR AS DIRECTED BY THE CITY ENGINEER.
2. EXPANSION JOINTS SHALL BE 1/2" WIDE, PREFORMED ASPHALT IMPREGNATED MATERIAL OR EQUAL EXTENDING FROM SUBGRADE TO FINISHED GRADE.
3. CONTRACTION JOINTS SHALL BE 1/8" TO 1/4" WIDE. DEPTH OF THE JOINT SHALL BE A MIN. OF 1/3 THE THICKNESS OF THE CONCRETE.
4. ALL SURFACES SHALL BE LIGHTLY BROOMED AND EDGED IN A WORKMANLIKE MANNER. PLACE TACTILE WARNING PATTERN ON RAMPS.
5. SAW CUT EXISTING CURBS THAT ARE TO BE REMOVED. IF LESS THAN 3' TO EXISTING JOINT, REMOVE TO THE JOINT.
6. EXISTING A/C IN FRONT OF THE APPROACH SHALL BE SAW CUT ALONG A LINE PARALLEL TO THE CURB AT A MIN. DISTANCE OF 24" AWAY FROM THE FACE OF THE CURB (OR CONCRETE GUTTER OUTER EDGE) AND REPLACED WITH HOT "C" MIX WITH MIN. THICKNESS OF 4" OR MATCH EXISTING, WHICHEVER IS GREATER. MAY REQUIRE INFRARED REPAIR.
7. CONCRETE SHALL BE 3500 PSI AT 28 DAYS.
8. CURB JOINT SHALL BE A TROWLED JOINT WITH A MINIMUM 1/2" RADIUS ALONG THE BACK OF CURB.
9. 8' CURB TRANSITIONS WILL BE REQUIRED IF WARRANTED BY LOCAL TRAFFIC CONDITIONS.
10. AT DISCRETION OF THE CITY ENGINEER, 6" X 6" #10 WIRE MESH IN APPROACH, #4 REBAR IN CURB AND MONO-POUR OF APPROACH & CURB MAY BE REQUIRED.

CITY OF MILWAUKIE

CITY OF MILWAUKIE, OREGON - PUBLIC WORKS DEPT.

RESIDENTIAL DRIVEWAY (CURBLINE SIDEWALK WITH ADA RAMPS)

DRAWING NO. **Figure 5**

APPROVED

CITY ENGINEER DATE

NO.	REVISIONS	DATE	BY
1	AC REPLACEMENT REQUIREMENTS, NOTES	10/6/98	AS

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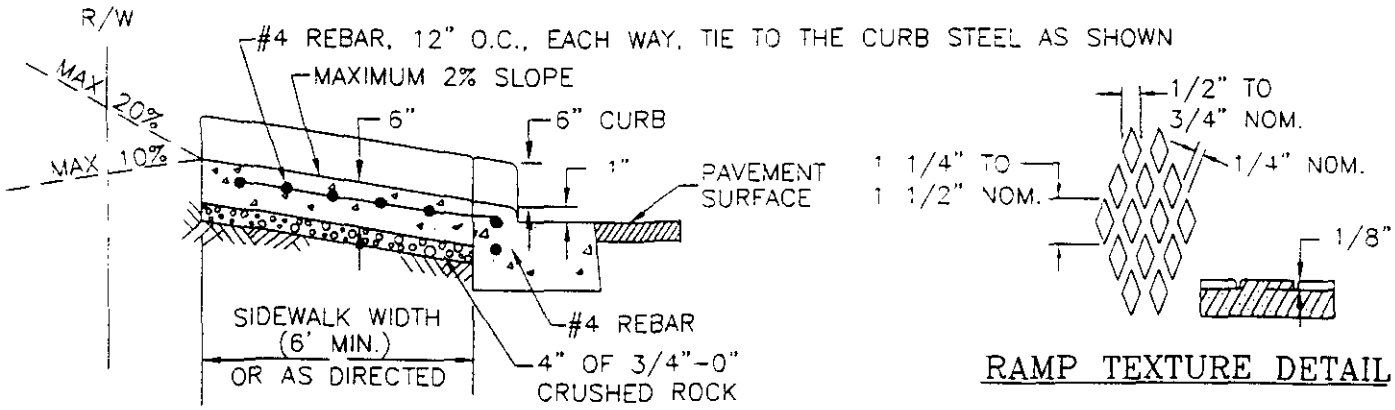

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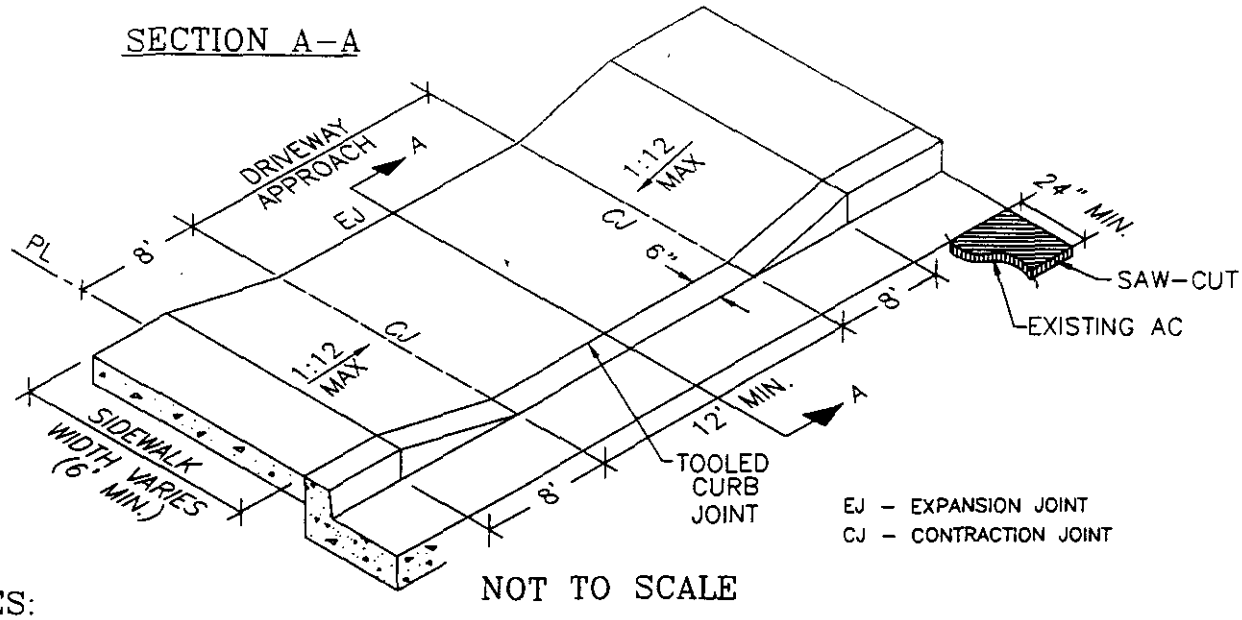
SECTION A–A



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NOTES:

1. WIDTH OF SIDEWALK VARIES WITH STREET FUNCTIONAL CLASSIFICATION OR AS DIRECTED BY THE CITY ENGINEER.
2. EXPANSION JOINTS SHALL BE 1/2" WIDE, PREFORMED ASPHALT IMPREGNATED MATERIAL OR EQUAL EXTENDING FROM SUBGRADE TO FINISHED GRADE.
3. CONTRACTION JOINTS SHALL BE 1/8" TO 1/4" WIDE. DEPTH OF THE JOINT SHALL BE A MIN. OF 1/3 THE THICKNESS OF THE CONCRETE.
4. ALL SURFACES SHALL BE LIGHTLY BROOMED AND EDGED IN A WORKMANLIKE MANNER. PLACE TACTILE WARNING PATTERN ON RAMPS PER ADA STANDARDS.
5. SAW CUT EXISTING CURBS THAT ARE TO BE REMOVED. IF LESS THAN 3' TO EXISTING JOINT, REMOVE TO THE JOINT.
6. EXISTING A/C IN FRONT OF THE APPROACH SHALL BE SAW CUT ALONG A LINE PARALLEL TO THE CURB AT A MIN. DISTANCE OF 24" AWAY FROM THE FACE OF THE CURB (OR CONCRETE GUTTER OUTER EDGE) AND REPLACED WITH HOT "C" MIX WITH MIN. THICKNESS OF 4" OR MATCH EXISTING, WHICHEVER IS GREATER. MAY REQUIRE INFRARED REPAIR.
7. CONCRETE SHALL BE 3500 PSI AT 28 DAYS. 4000 PSI CONCRETE AND MONO–POUR OF APPROACH AND CURB MAY BE REQUIRED AT DISCRETION OF THE CITY ENGINEER.
8. CURB JOINT SHALL BE A TROWLED JOINT WITH A MINIMUM 1/2" RADIUS ALONG THE BACK OF CURB.

CITY OF MILWAUKIE

CITY OF MILWAUKIE, OREGON – PUBLIC WORKS

COMMERCIAL DRIVEWAY
(CURBLINE SIDEWALK WITH ADA RAMPS)

DRAWING NO. **Figure 6**

APPROVED

CITY ENGINEER DATE

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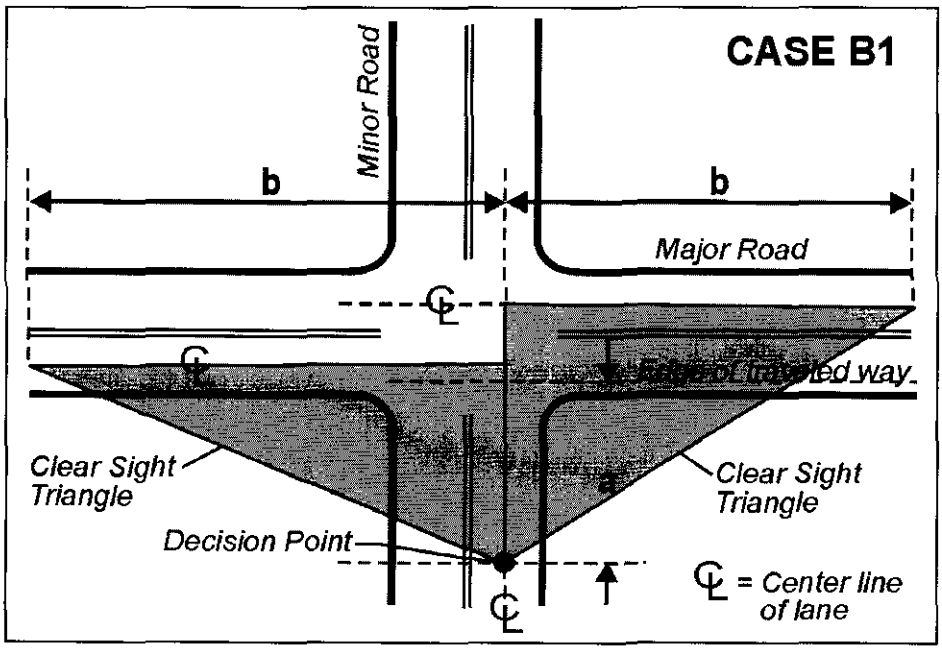
Clear Sight Zones/Sight Distance. All new or modified access points shall provide for clear sight distance meeting the requirements outlined in the AASHTO Green Book. A registered Civil or Traffic Engineer from the State of Oregon shall sign a document indicating the adequate provision of clear sight distance for every new or modified access point (driveway or public street). Within the sight distance triangle, no obstruction to sight distance above three feet high shall be permitted. This is particularly important for sight distance between vehicles and pedestrians.

AASHTO outlines sight distance requirements for various conditions. As a minimum, three conditions for sight distance must be met:

1. Intersection of public streets or driveways with arterial and collector streets where the minor street is stop controlled (AASHTO Case B1)
2. Driveways to local residential and commercial streets
3. Uncontrolled intersections (AASHTO Case A)

Sight distance requirements for Case B1 (vehicles turning left from a minor street stop condition) are summarized in Table 2. This criteria applies to all intersecting public streets, driveways intersecting arterial and collector streets and industrial driveways. The basic calculation assumptions are described below and outlined in the attached sketch. A driver on the approach street should be able to see each vehicle on the intersecting street within the criteria for sight distance established in the Green Book. Poles, trees and similar obstructions are allowable within the sight distance area only if it can be shown that such obstructions do not prevent the continuous view of the vehicle approaching on the intersecting street (exceptions may be granted by the City Engineer based on the provisions of Milwaukie Municipal Code Chapter 19.1400).



Speed – Posted speed at 25 MPH or below. Above 25 MPH, highest of 85th percentile, design speed or posted speed for all others.

Driver Eye Position (a) – 14.4 to 17.8 feet back from near edge of traveled way, 3.5 to 7.6 feet above the pavement (to account for passenger car and truck drivers eye heights)

Edge of Travel Way – Based upon a marked edge line (such as a bicycle lane stripe or right edge line) or the edge of pavement or the extension of the curb line across the intersection or driveway throat.

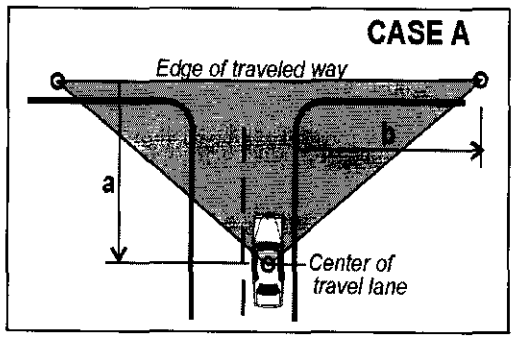
Table 2
Corner Intersection Sight Distance Guide
Minor Road Stop Condition: Case B1

Speed (MPH)	Minimum Corner Sight Distance – b (Feet)
20	225
25	280
30	335
35	390
40	445
45	500

Note: Use of this table does not preclude the need of designers to meet requirements set forth in the AASHTO Green Book for intersection sight distance.

When considering sight distance for driveways on residential local or neighborhood streets or commercial driveways on local streets, the (a) dimension would be 14.4 feet and would be measured to the extended curb line or six feet toward the center line of the roadway if on-street parking is allowed on the adjoining side of street. The (b) dimension is as follows (based upon AASHTO Green Book Case A, no traffic control):

- Residential local (25 MPH) b = 115 feet
- Neighborhood street (25 MPH) b = 115 feet
- Commercial local street (20 MPH) b = 90 feet



The final case is for uncontrolled intersections (no stop signs on any approach – AASHTO Case A). The criteria for this situation require the (a) and (b) dimensions to be the same (115 feet for 25 MPH, 90 feet for 20 MPH).

Connectivity. Connectivity shall conform to the Milwaukie Municipal Code Chapter 19.1400.

Intersection Alignment: New streets shall intersect with existing street intersections so that centerlines are not offset, except as provided by the public street spacing criteria in the Milwaukie Municipal Code Chapter 19.1400. Where existing streets adjacent to a proposed development do not align properly, conditions may be required of the development to provide for proper alignment. The interior angle of intersecting streets should be as close to right angles (90 degrees) as possible. In no case shall the interior angle of the centerline of an intersecting street be less than 75 degrees.

Intersection Approach Tangent. All intersections should have at least 25 feet of tangent approach to an intersection measured along the intersecting right-of-way lines.

Turn Lanes: The warrants for left or right turn lanes shall be determined by the following sources:

1. Unsignalized Left Turn Lanes – "Volume Warrants for Left Turn Storage Lanes at Unsignalized Grade Intersections," Highway Research Board, Report Number 211, 1967.

2. Unsignalized Right Turn Lanes – "Intersection Channelization Design Guide," National Cooperative Highway Research Program Report 279, 1985, pages 63-65.

3. Signalized Intersections – Based upon capacity needs to retain adequate performance at determined in "Highway Capacity Manual," Transportation Research Board HCM 2000, 2000.

Turn Lane Tapers: The deceleration taper approaching turn lane can be designed as straight line or reversing curves. The length of the taper shall be defined in AASHTO's Green Book as an 8:1 taper for design speeds of 30 mph and 15:1 for design speeds of and above 50 mph. For speeds in between 30 mph and 50 mph, taper rates should be interpolated. For design speeds below 30 mph, the minimum taper shall be as identified in the AASHTO Green Book (50 feet). For example a 12 foot left turn lane on a 30 mph street would require a 96 foot deceleration taper.

Curb Return Radius: 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 radius required shall be as follows:

Intersection Type	Minimum Radius
Local/Neighborhood with Collector/ Local/Neighborhood	20'
Local/Neighborhood with Arterial	25'
Collector with Arterial/Collector	25'
Turning Transit Route on Arterial or Collector	35'
Arterial with Arterial	35'

Streets serving significant traffic volume, commercial/industrial properties or bus routes may be required to install larger curb radius as required for large vehicle movements, as determined by the City Engineer. Truck turning paths should be checked for each new or modified public street intersection, providing notation of truck types that are unable to turn between travel lanes without encroaching into on-coming traffic on any arterial or collector. The City Engineer will need to approve any intersection design that limits any vehicle movements and/or allows encroachment into on-coming lanes.

1.3.3 Design Speed

Design speeds for classified streets shall be as follows:

Arterial	30 - 45 mph
Collector	25 - 35 mph
Neighborhood	25 mph
Local	25 mph

Where the 85th percentile vehicle speed of existing traffic is a speed in excess of design speeds listed, the higher speed will be used for design purposes. For new local and neighborhood streets, design speeds will not exceed 25 mph without the approval of the City Engineer or designee (design of these streets should attempt to maintain 85th percentile speeds at the design speed). Above 35 mph, the design speed should be set 5 mph above the posted speed zone. At or below 35 mph, the design speed and posted speed should be the same.

1.3.4 Street Curvature and Grade

Horizontal Curves: Horizontal curve radius (on centerline) for each street classification shall be designed according to the roadway design speed per the AASHTO Green Book. The radius shall not be less than the following, as established in the Subdivision Ordinance:

Functional Classification	Subdivision Ordinance	AASHTO Green Book
Arterial	300'	600' - 750'
Collector	150'	150' - 500'
Local/Neighborhood	75'	100' - 165'

Vertical Curves: Vertical curve length shall be utilized when the profile of the street grade changes. Curves are based on the design criteria in the AASHTO Green Book which include: (1) design speed, (2) crest vertical curve, and (3) sag vertical curve. Stopping sight distance for crest and sag vertical curves shall be based on sight distance and headlight sight distance, respectively. All vertical curves shall be parabolic and the length shall be computed for each location.

Grades: Minimum grade for all streets shall be 0.0050 feet per foot (0.50%) however, in all cases street grades shall allow for proper and adequate drainage. Cul-de-sac "bulbs" shall have a minimum slope of 0.0060 feet per foot (0.60%). Maximum grades for each street classification shall be as follows:

Arterial	0.060 ft./ft.	(6%)
Collector	0.100 ft./ft.	(10%)
Neighborhood/Local/Driveway	0.150 ft./ft.	(15%)

1.3.5 Street Lighting

Street lighting plans shall conform to American National Standard Practice for Roadway Lighting (latest edition), by functional classification of roadway.

1.3.6 Neighborhood Traffic Management

The City of Milwaukie has a separate policy and process that address traffic calming on city streets. The program involves only residential streets. Residential streets, as defined in the plan, are either a "Local" street, a "Neighborhood Route," or a "Collector" street as identified in the Transportation System Plan. Emergency and transit needs must be considered for collector and arterial streets. Arterials will only be considered in the neighborhood traffic management program if approved by the City Council. More than 50% of the abutting properties must be zoned Residential before the street or street section can be classified as residential.

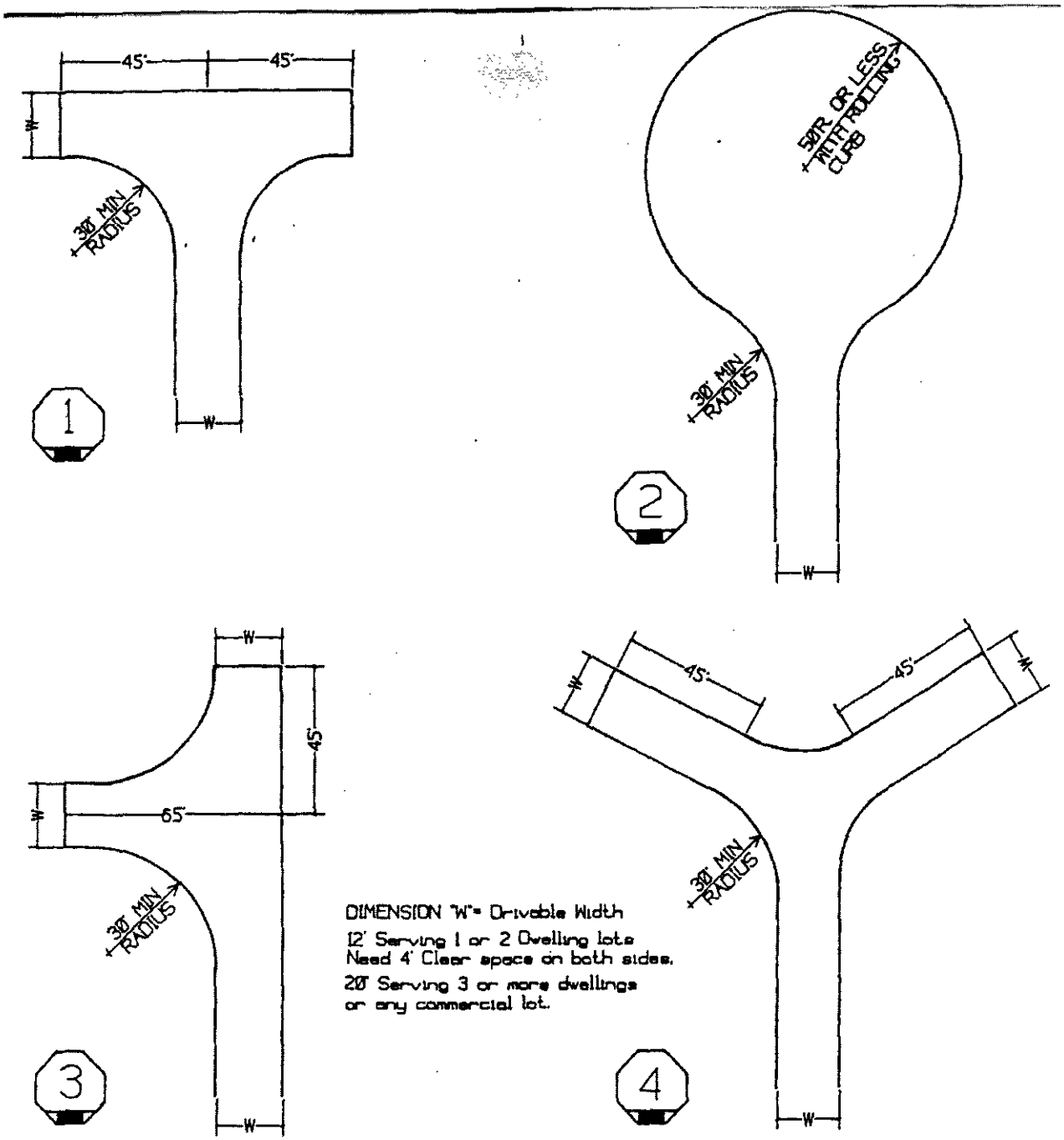
The current neighborhood traffic management plan does not address the provision of traffic calming measures on new streets. However, specific design measures may be considered when they would preserve the functional integrity of local residential streets with the approval of the City Engineer.

1.4 Other Transportation Design Standards

1.4.1 Stub Streets

Residential subdivisions providing public streets will, where appropriate, provide accommodations to extend streets to adjacent undeveloped lands by stubbing streets to the property line of adjacent lands. A barricade shall be placed at the end of the stub street as part of the project, including a sign that states that the stub street may be extended at a future date.

Design for cul-de-sac, turnarounds and hammerhead street ends shall be according to the requirements for fire vehicle access (Figure 7).



Not to Scale Drawn: Pierce Date: 3/12/97	Examples are minimum standard Local Fire Marshal approval of construction plans required prior to construction	FIRE VEHICLE ACCESS TURN AROUND OPTIONS AHJ:

Figure 7
Turnaround Options

1.4.2 Parking

On-street parking shall be restricted as follows:

1. Arterials – On-street parking should not be allowed within the distance back from the cross street equal the 95% percentile queue of existing and future traffic (based upon forecasts from the current Transportation System Plan).

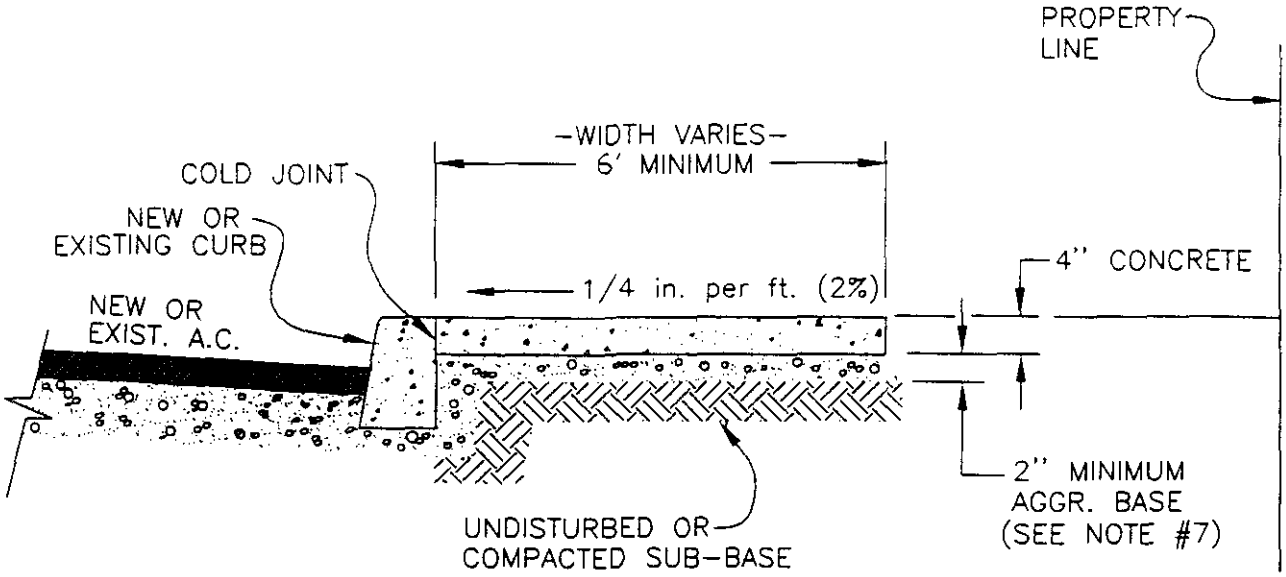
2. Collector - No parking within 40' of the point of curb return.

3. Local - No parking within 20' of the point of curb return.

4. Cul-de-sac - No parking allowed within the radius of the cul-de-sac turnaround.

1.4.3 Sidewalks

Sidewalks with curbs shall be provided along the frontage to new developments and street projects per the provisions of Milwaukie Municipal Code Chapter 19.1400. Residential sidewalk design standards are shown in Figure 10.

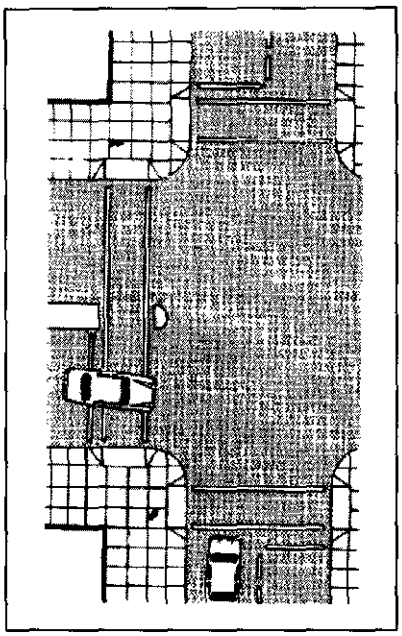


NOTES:

1. CONCRETE SHALL BE 3500 P.S.I. @ 28 DAYS (MINIMUM) I.E., CLASS 3500–1 1/2 PER A.P.W.A. SEC. 212.1 THRU 212.4, SLUMP RANGE 2" TO 4" (MAX.).
2. MINIMUM SIDEWALK THICKNESS SHALL BE 4".
3. 1/4" TO FT. CROSS SLOPE (2%).
4. BROOM FINISH WITH TOOLED EDGES (SHINERS NOT REQUIRED)
5. SIDEWALK PANELS SIDES SHALL BE EQUAL TO WIDTH (4x4, 5x5, etc.).
6. EXPANSION JOINTS AT EACH SIDE OF DRIVEWAY APPROACHES, AT UTILITY VAULTS, WATER METER BOXES AND EVERY 45 FEET.
7. CONTRACTION JOINTS EVERY 15 FEET MAXIMUM.
8. AGGREGATE BASE SHALL BE 3/4" OR 1" MINUS CRUSHED ROCK CONFORMING TO A.P.W.A. SECTION 207.2.05, COMPACTED TO 95% DENSITY PER A.P.W.A. SECTION 207.3.04B.

ATTENTION: ALL CONCRETE WORK IN THE CITY RIGHT–OF–WAY REQUIRES FORM AND SUB–GRADE INSPECTION AND APPROVAL BY PUBLIC WORKS PERSONNEL PRIOR TO POURING CONCRETE.

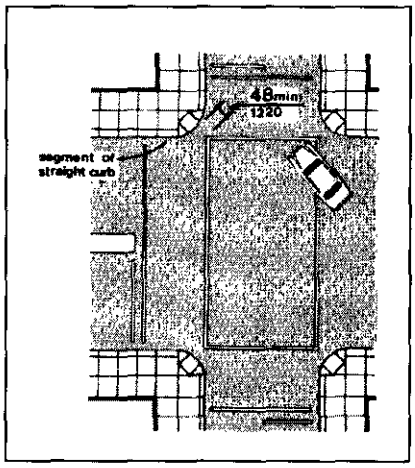
CITY OF MILWAUKIE	CITY OF MILWAUKIE, OREGON – PUBLIC WORKS DEPT.					
	RESIDENTIAL SIDEWALK (CURBTIGHT W/TYPE "C" CURB)					DRAWING NO. Figure 8
APPROVED		NO.	REVISIONS	DATE	BY	
CITY ENGINEER DATE						



Sidewalk design shall meet the requirements of the American Disabilities Act (ADA). The following sections summarize key elements of design to address ADA needs.

Slope and clearance: Sidewalks shall have a maximum slope equal to the slope of the roadway and a cross slope no greater than 1:50 where possible. Where steeply sloped roadways and constrained right-of-way result in steep slopes, the least possible slope shall be provided. All utilities with facilities the in the sidewalk area shall locate their facilities to be in conformance with the 36 inch minimum horizontal clearance. A seven foot vertical clearance above the sidewalk shall be maintained.

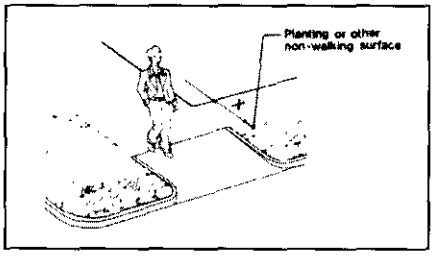
Sidewalk Ramps. All intersections shall contain sidewalk ramps (for access) located within the curb return. Two (2) ramps per curb return are preferred. Locations of sidewalk ramps shall be designed with regard to storm water flows, street grades, and pole locations. Other factors may also dictate sidewalk ramp location.



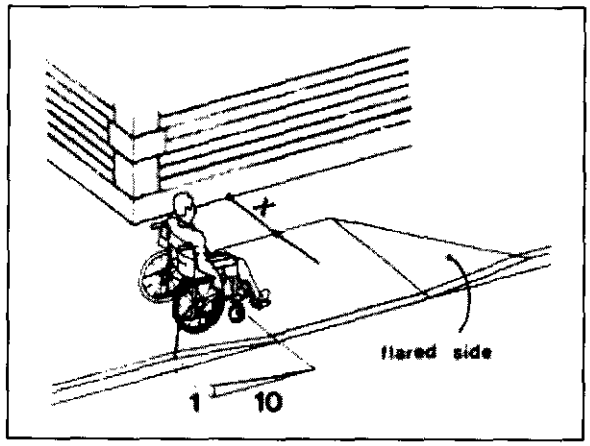
The minimum width of a curb ramp shall be three feet exclusive of flared sides.

If diagonal (single corner type) curb ramps are utilized, the bottom of diagonal curb ramps shall have 48 inch minimum clear space as shown .

Where the sidewalk ramp is completely contained within a planting strip or other non-walking surface, so that pedestrians would not normally cross the sides, the curb ramp sides can have steep sides including vertical returned curbs.



Sidewalk ramps shall have flares with a maximum slope of 1:10. If the clearance for the landing at the top of the sidewalk ramp (measured from the top of the ramp to the edge of the walkway or closest obstruction is denoted as "x") is less than 48 inches, then the slope of the flared side shall not exceed 1:12.



The least possible slope shall be used for any ramp. The maximum slope of a ramp in new construction shall be 1:12. Curb ramps and ramps to be constructed on existing sites or in

existing buildings or facilities where space limitations prohibit the use of a 1:12 slope (or less), slopes and rises are permitted as follows: a) a slope between 1:10 and 1:12 is allowed for a maximum rise of 6 inches; b) a slope between 1:8 and 1:10 is allowed for a maximum rise of 3 inches. A slope steeper than 1:8 is not allowed.

Mail Boxes and Large Poles. Where large poles, clustered mail boxes or other large objects are within the proposed sidewalk space, the new sidewalk design shall be widened to provide a minimum of four foot clear space.

Crosswalks. Crosswalk pavement markings shall only be used for intersections controlled by traffic signals, stop signs, or other locations approved by the City Engineer or designee. The sidewalk curb ramps shall be located wholly within the crosswalk marking limits (not including the wing flares).

1.4.4 Bicycle Facilities

The City's Comprehensive Plan adopted the "Milwaukie Bicycle Master Plan" from the Transportation System Plan. This plan summarizes the City's policy and implementation strategies for bike facilities within the City and for connection with metropolitan bike facilities. The City's plan has adopted both AASHTO and ODOT standards and criteria as the minimum guidelines for bike facilities design, construction, and control.

The City's adopted guidelines for bikeways consist of the following:

1. AASHTO, "Guide to Development of Bicycle Facilities, 1999
2. ODOT, "Oregon Bicycle & Pedestrian Plan", 1995
3. Manual on Uniform Traffic Control Devices with Oregon supplements by Oregon Transportation Commission, 2000

Design Criteria. Bicycle lanes shall be six feet wide for new construction and five feet wide for street reconstruction projects. The required width for off-street shared bicycle/pedestrian trails shall be12 feet (8 feet is the minimum width, acceptable in constrained design circumstances due to physical, topographic or environmental features).

All bike facilities shall have a minimum cross-slope of two percent (2%) and a maximum cross-slope of five percent (5%). On curved alignments, the cross-slope shall be to the inside of the curve.

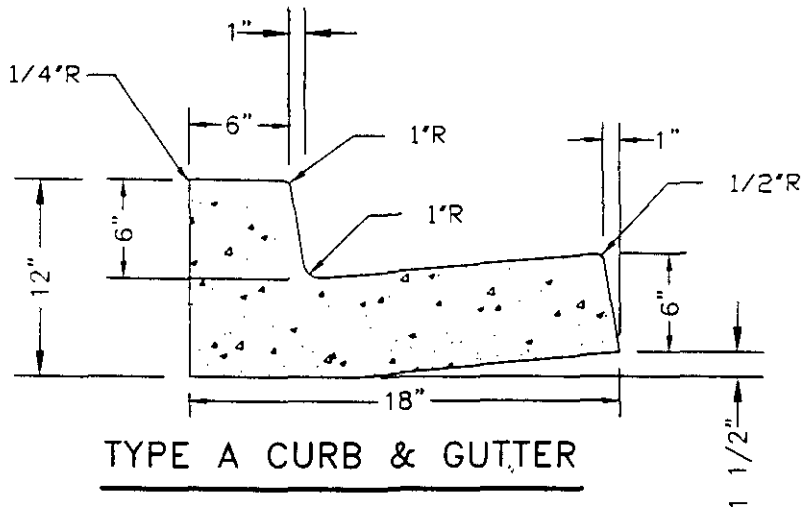
Off-street bicycle path curvature will be based on a minimum design speed of 20 MPH. Grades shall be limited to a maximum of five percent (5%) for off-street bicycle paths.

Where topography dictates, grades over five percent (5%) are acceptable when a higher design speed is used and additional width is provided.

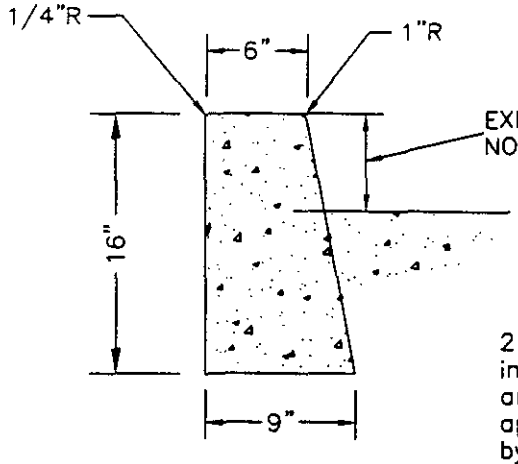
When culverts cross off-street bicycle paths or lanes, the ends of the pipe shall be no closer than five feet from the edge of the bike facility.

1.4.5 Curbs

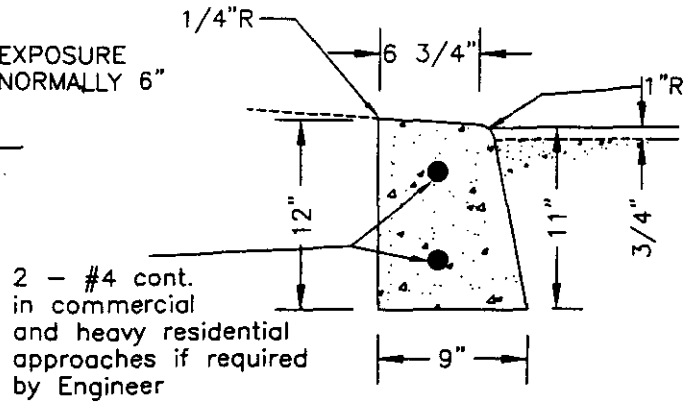
Details for standard curbs are shown in Figure 9.



TYPE A CURB & GUTTER



TYPE C CURB



CURB AT DRIVEWAY

NOTES:

1. Curbs and gutters shown may be used with either A.C. or P.C.C. pavements.
2. Transitions from one type curb to another will be detailed on project plans as necessary.
3. Contraction joint to be installed every 15' of curb and shall extend at least 50% through the curb or curb and gutter. Felt expansion joint to be installed every 45' of curb.
4. 3500 p.s.i. concrete to be used for all curbs, 2"–4" slump

CURB QUANTITIES CU. YD. PER LIN. FT.	
TYPE	QUANTITY
A	0.04942
C	0.03085

CITY OF MILWAUKIE

CITY OF MILWAUKIE, OREGON – PUBLIC WORKS DEPT.

CURB, TYPE A AND TYPE C

DRAWING NO. Figure 9

APPROVED

CITY ENGINEER DATE

NO.	REVISIONS	DATE	BY

Chapter 2
Transportation Impact Study Guidelines

2.1 PURPOSE

A Transportation Impact Study documents the adequacy of the transportation system to serve a proposed land use or development proposal and the expected impacts of the proposal on the surrounding transportation system. The transportation impact study guidelines establish uniform guidelines for conducting transportation impact studies for proposed development activities, whether new or existing, which require access or modification of access to the City's street system. These guidelines are used to ensure consistent and proper planning and engineering practices in conjunction with land use actions being considered in the City.

2.2 DETERMINING WHEN A TRANSPORTATION STUDY IS REQUIRED

A threshold scoring approach will be utilized to assist in the determination of when a transportation impact study is required. The purpose of this approach is to:

- Assess the likelihood of potential adverse traffic and safety impacts of development based upon trip generation and conditions of the site and project impact area;
- Identify known traffic and transportation facility deficiencies in the impact area of the project;
- Identify transportation plans and projects anticipated in the project area; and
- Ensure traffic and transportation issues are identified and addressed prior to submission of a land use application.

2.2.1 Timing

Traffic and transportation issues will be identified in a pre-application conference to be held prior to submission of a land use application. The City Engineer will review project information, city records and other information as appropriate when applying the threshold scoring method. Vehicle trip generation rates are subject to approval by the City Engineer.

2.2.2 Method

Traffic and transportation parameters related to the project and the surrounding area including trip rates, land use, transportation plans and projects are assigned individual scores as shown in Table 3. These scores shall be used in determining when a traffic impact analysis is required for development and land use proposals. Scores are added

together to arrive at a total score. A traffic impact analysis is required when the total score is greater than 99 points.

Table 3
Threshold System Scoring Procedure

Parameter	Points
Any change to a land use designation, zoning district, or development standard that increases development potential, density, or intensity of use.	100
Any use over 400 vehicle trips per day (vpd)	100
Any use 200-399 vpd	75
Any use 100-199 vpd	65
Any use less than 100 vpd	45
Community Service Overlay Use or Conditional Use in any residential zone or within 500' of a residential zone.	60
More than 25 through trips on a local street.	50
Intersection below city Level of Service standard within 500' of the project site.	30
Project site within 500' of a school walking route.	20
Project site within 500' of a Capital Improvement Project or Transportation System Development Charge Project.	15
Project site within 250 feet of a Transportation System Plan (TSP) bikeway, walkway, or other TSP project.	10

2.3 SCOPE OF THE TRANSPORTATION IMPACT STUDY

The City Engineer shall approve the study area, intersections to be studied, trip rates, traffic distribution, and required content of the traffic study based on the following elements. The City Engineer may require the study to include elements not shown below when based on accepted practice or professional judgement.

2.3.1 Preparation

A neighborhood assessment, access study or transportation impact study shall be prepared and certified by staff and/or a registered Traffic or Civil Engineer in the State of Oregon. All costs for transportation studies and review shall be paid by the applicant in accordance with Milwaukie Municipal Code Chapter 19.1400.

2.3.2 Transportation Study Outline

The study area for a transportation impact study shall be defined in the pre-application meeting and scoping process. Generally, the study area will consist of a zone within a ½ mile radius, as determined by the City Engineer. Project impacts greater than 10% above the existing traffic volumes may require a study area greater than ½ mile. A Transportation Impact Study shall include the following elements, unless waived by the City Engineer (Table 4 provides the checklist that will be utilized for each project to determine study content – it will also be used to check studies for completeness):

Introduction and Summary. Include trip generation, summary of transportation operation and mitigation.

Existing Conditions. This section should include a study area description and existing study area level of service.

Impacts. This section should include a brief review of the site plan including a site plan layout, project related trip analysis, and an evaluation of the project site plan. A figure showing the assumed Future Year roadway network (number and type of lanes at each intersection) should be provided.

Mitigation. Project specific and area-wide specific mitigation measures should be recommended.

Appendix. This section should include counts, capacity calculations, warrant analysis and any information necessary to convey a complete understanding of the technical adequacy

2.3.3 Transportation Impact Study Methodology

1. Neighborhood through-traffic impact assessment as outlined in Milwaukie Municipal Code Chapter 19.1400.

2. Project description including site location map and characteristics as well as all existing and proposed land uses for the site.

3. Study area description including description of roadway (roadway classification, posted speed, ADT volumes, number of lanes, traffic control, width of road, pedestrian/bicycle facilities), transit stops and service, parking conditions, existing geometric deficiencies, collision data (vehicle, bicycle and pedestrian) at study area intersections[1], and other pertinent features. Planned roadway improvements identified in the City's Comprehensive Plan and in the Metro Regional

[1] An average of 2 collisions per year over the most recent 3 years at a particular intersection shall mandate further study of the intersection.

Table 4: TRANSPORTATION IMPACT STUDY CHECKLIST

Project Name: _____

City Reference Code: _____

Score

THRESHOLD SCORING

Transportation Impact Study Required with score of 99 or greater

❒Yes ❒ No Study Required Comment: _____ Date: _____

BACKGROUND INFORMATION ☒

❒Yes ❒ No Oregon PE Stamp and Signature

❒Yes ❒ No **INTRODUCTION AND SUMMARY ❒**

EXISTING CONDITIONS ❒

❒Yes ❒ No Roadway Network - summary of roadway classifications and description of study area

❒Yes ❒ No Analysis Periods Correct (❒ AM, ❒ Mid-day, ❒ PM ❒ Afternoon_____, ❒ Saturday_____, ❒Other_____)

❒Yes ❒ No Existing Traffic Operations (Existing Level of Service, traffic volumes (new counts ❒), speeds ❒, accident data ❒)

IMPACTS

❒Yes ❒ No Trip Generation - Daily, peak hour trips generated by site development: ITE Trip Generation Manual ❒/Survey ❒

❒Yes ❒ No Level of Service Analysis - projected LOS with site build out, existing traffic, and background traffic growth ❒

❒Yes ❒ No Future year 20 year analysis ❒

❒Yes ❒ No Signal Warrant Analysis ❒

❒Yes ❒ No Turn Lane Warrant Analysis ❒

❒Yes ❒ No Access Spacing Standards ❒

❒Yes ❒ No Analysis of sight distance at frontage road access point(s) ❒

❒Yes ❒ No Neighborhood Traffic Analysis ❒

❒Yes ❒ No Identify safe route to school or school bus stop (Contact with school district) ❒

❒Yes ❒ No Analysis of safe pedestrian/bicycle access to nearest transit stop (if within 1/2 mile of project site) ❒

❒Yes ❒ No Identify accessibility to public transit ❒

MITIGATION

❒Yes ❒ No Identify need for right/left turn lanes, storage capacity and length ❒

❒Yes ❒ No Identify possible corrections of any LOS deficiencies ❒

❒Yes ❒ No Identify any access deficiencies (including transit/pedestrian/bicycle connections) ❒

❒Yes ❒ No Identify any TDM measures ❒

FIGURES

❒Yes ❒ No Vicinity Map ❒

❒Yes ❒ No Site Plan ❒

❒Yes ❒ No Existing peak hour turn movement volumes (counts conducted within previous 12 months) ❒

❒Yes ❒ No Trip Distribution (%) including Added Project Peak Hour Traffic Volumes (see sample) ❒

❒Yes ❒ No Approved Projects Peak Hour Traffic Volumes (see sample) ❒

❒Yes ❒ No TSP Future Year turn movement volumes comparison ❒

❒Yes ❒ No Programmed transportation improvements and transportation mitigation outlined in study ❒

TABLES ❒

❒Yes ❒ No Intersection Performance Existing Conditions

❒Yes ❒ No Project Trip Generation

❒Yes ❒ No Intersection Level of Service

OTHER ❒

❒Yes ❒ No Technical appendix - sufficient material to convey complete understanding of traffic issues (e.g. HCM analyses, trip generation calculations, signal warrant analyses, turn lane warrant analyses, etc.)

Completed By: _____

Date: _____

Transportation Plan should be identified. A figure showing the study area as well as a figure showing existing AM and PM peak hour intersection turn movement volumes should be provided along with estimates of bicycle, pedestrian and transit usage adjacent to the project site.

4. Identification and statement of compliance with applicable policies of the Transportation System Plan and Comprehensive Plan.

5. Volumes will be acceptable if collected within 12 months of acceptance of the transportation impact study.

6. Analysis Scenarios include existing conditions, existing + project and existing + project + other approved projects. For plan amendments and zone change projects or sites with non-conforming access, analysis using the currently available 20 year travel forecasts will be required.

7. Peak Hour shall include the morning and evening peaks. Additional peak hour analysis may be required by the City Engineer.

8. Trip Generation will be computed based upon the Institute of Transportation Engineers *Trip Generation (current edition).* Evaluation of the average and formula trip rates shall be provided to the City Engineer prior to commencing the study. If the City Engineer determines that the data in *Trip Generation* is not adequate or available for the proposed land use, a survey of a directly comparable site as the basis of the trip generation will be required. The trip generation rate from such surveys will be approved by the City Engineer prior to application in the Transportation Impact Study. For comprehensive plan and zoning amendments, a table comparing trip generation between the existing zoning condition and the proposed project trip generation shall be provided.

9. Intersection level of service should be determined for study area intersections for the peak hours using the *2000 Highway Capacity Manual*[2] (or current edition). The level of service results shall be shown in a table.

10. Project-related trip analysis shall include expected trip generation, trip distribution, and trip assignment. A table should be provided identifying the type and size of each proposed land use, daily and peak hour vehicle trip rates[3] and the total number of daily and peak hour vehicle trips. A figure showing Project Trip Distribution (in percent) should be provided. Trip distributions shall be based upon 1) travel forecast model results; 2) analysis of site travel patterns document in the impact study; and/or 3) actual traffic counts or surveys of comparable uses.

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2 Highway Capacity Manual, Transportation Research Board HCM 2000, 2000.

3 Based upon Trip Generation, Institute of Transportation Engineers most current edition or actual similar site surveys/counts.

11. An evaluation of the project site plan should include site access locations, vehicle queue storage, left turn/right turn lane needs, pedestrian circulation and conflicts, parking, existing deficiencies, and efficiency of proposed vehicular circulation/facilities, and recommendations for on-site channelization and traffic controls.

12. An evaluation of project impacts on street operating conditions to include:

a. An analysis of level of service and volume/capacity at study area intersections and project access points. The level of service results for study area intersections and access points should be shown in a table with the level of service calculation sheets provided in the appendix of the report. Approved projects should be those projects approved by the City yet not constructed. The City will provide a listing of approved projects (from their CIP or other funding programs).

b. Operational analysis should include turning conflicts and queue spill-back locations which may adversely affect adjacent intersections or driveways. Turn lane warrants should be evaluated for project access points and all unsignalized study area intersections.

c. Neighborhood street impacts will be assessed by estimating the number of vehicle trips that will travel to/from the proposed development through a residential local or neighborhood street. All such streets with greater than 10 vehicle trips per hour in any hour of the day will be identified and compared to existing traffic volumes on each street exceeding the threshold. Measures appropriate to minimize the impact of speeding, volume and noise to the neighborhood shall be identified.

d. Assessment of pedestrian, bicycle and transit accessibility to the site.

e. A discussion of traffic safety impacts:

    i. Signal warrant analysis and Four-way stop analysis based on the *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD) should be conducted at study area unsignalized intersections. Traffic signals are intended for crossings of public streets for all modes of transportation. Their use shall be limited to those appropriate per the guidelines in OAR 731-020-300 and 731-020-400.
    ii. Left turn lane requirements for different scenarios should utilize *A Policy on Geometric Design of Highways and Streets, (AASHTO) 1990, page 791 (or current edition).* If storage lanes are required, the study will include the length of the storage lane needed and its storage capacity. Provision of turn lanes will be consistent with policy for arterial and collector streets.

iii. Project access should be evaluated including sight distance requirements based on AASHTO (including but not limited to page 762).
iv. Access spacing to adjacent driveways/public streets (including both sides of the street) shall be documented, as required in Chapter 1)
v. Pedestrian and Bicycle safety issues. The study should address the safety of pedestrians leaving and entering the site. For residential projects it should address provision of a safe walking environment for students leaving the site and traveling to the nearest Elementary and Middle/Junior High Schools, or to the nearest school bus stop(s) serving these and High Schools. The study will also address when and where the school bus stop is provided. If school bus service is not provided, the walking path to the corresponding elementary and/or junior high schools shall be identified. The school district shall be contacted to discuss locations for bus pull-outs.[4] For all land uses, safe pedestrian and bicycle access to the nearest transit stop (if within 1/4 mile of the development) shall be identified.
vi. Bicycle access for the site should be identified indicating the closest bicycle lane (existing or comprehensive plan) and their status in terms of connectivity within the City.
vii. The transit accessibility of the project shall be described and evaluated. Planned transit system changes/modifications shall be documented including bus stop locations[5].

13. Other Issues as determined in the pre-application meeting and scoping process (provided in writing by the City). These may include citizen issues, agency issues identified in scoping letters or other transportation related concerns specific to the project site.

14. Statement of Assumptions – The transportation impact study shall clearly describe all assumptions utilized in the analysis (this material can be documented in the appendix).

2.2.4 Mitigation Requirement and Options

Mitigation measures for site access and transportation system improvements shall be required when the standard for public facilities are not met. This may include the following (subject to rough proportionality and mitigation provisions of the Milwaukie Municipal Code Chapter 19.1400):

- The location, nature, and extent of all project specific and area-wide mitigation measures to achieve acceptable operating conditions for both the short-term and long-term study year shall be identified. Mitigation of both on-site and off-site

[4] Contact North Clackamas School District Transportation Department Director.

[5] Contact Tri-Met Service Planning.

transportation deficiencies reasonably related to the impacts of the proposed development shall be identified for the safe and efficient flow of motor vehicles, bicycles, pedestrians, transit and freight. The study shall discuss whether the recommended improvements (both on-site and off-site) are reasonably related to and roughly proportional to the impacts of the development.

- Where performance standards noted above are not met, mitigation measures including but not limited to street connectivity, demand management, shared access permission, lane geometry, future streets, traffic control enhancement or other measures shall be identified to correct the deficiency.