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The Transportation System Plan for West Linn proposes that the City have a balanced, integrated transportation system which promotes ease of use for car drivers, pedestrians, bicyclists, and transit users. All except the street element, dealing with automotive traffic, was adopted by the City Council in 1998. The street element (Chapter 3 in the document) was adopted in 2000.

Introduction & Summary

The West Linn Transportation System Plan (TSP) has been developed to bring an earlier 1991 City Transportation Plan into compliance with the Oregon Transportation Planning Rule adopted that same year. Last year, the city adopted their TSP with all of the required elements except for Chapter 3: Street Element. This report presents the updated technical information and recommendations for that chapter.

The overall West Linn TSP is a multi-modal plan, addressing improvement to existing roadways, new pedestrian and bicycle facilities, improvement in public transit service, and transportation demand management (TDM) strategies. The plan also includes a transportation improvement program, as well as changes to West Linn codes and standards to implement the TSP recommendations. This new report was developed to integrate with the findings and recommendations from the 1998 TSP.

Street Element Development Process

The updated West Linn Street Element was prepared concurrently with the update to the city's Comprehensive Plan. A committee of citizens and local merchants was assembled by the city and given the title *West Linn Tomorrow! Task Force* to oversee the development of these two plans. The land use review process conducted during the Comprehensive Plan update was fed directly into the travel forecasts made for this street element update. The task force reviewed, on a monthly basis, the on-going work products that include goals, policies, and implementing plans and standards.

A technical advisory committee (TAC) also assisted in the development of both plans. The TAC members included representatives from the City of West Linn, Oregon City, Lake Oswego, Clackamas County, ODOT, Tri-Met, and Metro.

Findings

This transportation planning report presents **Chapter 3: Street Element** of the West Linn Transportation System Plan. The most significant findings in the report include the following:

1. Peak hour traffic conditions at intersections with traffic signals on Highway 43 operate at Level of Service D or better based on traffic volumes observed in 1998.
2. Many intersections without traffic signals have substantial delays for side street traffic during peak hours, but only two location have sufficiently high volumes to warrant traffic signal controls (the two intersections on 10th Street at the I-205 freeway ramps).
3. The majority of peak hour travel on Highway 43 is traffic with local destinations or origins. The component of "through" traffic from other jurisdictions is only about 10 percent of the total volume.

4. The highest number of reported accidents in the city between 1995 and 1997 occurred at the intersection of 10th Street and 8th Avenue.
5. Local street connectivity east of Highway 43 and in the Tanner Basin is limited because of topographic constraints and past decisions about public street connections.
6. Forecasted 2020 traffic volumes on Highway 43, Interstate 205, and 10th Street will exceed planned capacity for these facilities during peak travel periods.
7. Traffic diversion away from Interstate 205 onto parallel street facilities during congested periods will continue to increase to the point where peak hour traffic on Willamette Falls Drive will more than double relative to current volumes.
8. Widening Highway 43 to accommodate 2020 travel demands was not supported by the reviewing citizen committee. A five-lane facility also runs contrary to the goals of the pedestrian-oriented Opportunity Areas located in Robinwood and Bolton neigborhoods.

Recommendations

The recommendations of this report include the following major components:

1. Modifications to the street functional classification system to reflect current street function and development patterns, in particular, changes between the collector and neighborhood route designations for certain streets. (See Functional Classification Map)
2. Modification to the city street standards, to include a narrower local street width option, the regional street design standards, and access spacing criteria. (See Sample Street Cross-Sections)
3. Identification of signal system and intersection improvements to increase capacity in the roadway system at traffic congestion locations.
4. Additional local street connections and spacing standards to comply with Metro Title 6 requirements and to reduce out-of-direction travel, vehicle emissions, and travel time. (See Local Street Connectivity Map).
5. Expansion of the Highway 43 Access Management Plan previously begun in 1991 to specify future traffic controls, access restrictions, and signal system controls so that the corridor can be safely and efficiently operated within a three-lane road cross-section.
6. Recommendations for street performance and access spacing standards to guide periodic review of street improvement prioritization and new land development applications. Two tiers of performance standards are suggested for the city to separate out the policies for monitoring travel on Highway 43 from all other city street facilities.
7. Augment the city's development code to specify traffic impact study guidelines to be used with development applications.
8. Expand the current ad hoc Neighborhood Traffic Management practice to a formal city program to provide a documented framework for implementing neighborhood traffic controls.
9. Periodic review of the city's traffic safety conditions based on vehicle collision data provided by the Oregon Department of Transportation.
10. Provide sufficient annual funding to maintain pavement conditions on the city's arterial, collector and neighborhood route streets.

11. Further engineering study of the 10th Street Corridor to review and select a preferred design alternative to comply with the National Environmental Protection Act requirements.

The recommended street improvement program included 32 street projects to be implemented over the next 20 years, totaling about $27 million dollars. These street projects have been prioritized for implementation for the short-term and long-term time frames. The street element of the TSP is consistent with Metro's Regional Framework and Transportation Plans and the Clackamas County Transportation Plan.

Existing Conditions

This chapter summarizes existing traffic and transportation conditions in the City of West Linn. Field observations and traffic data were recorded to better understand a typical day’s activity on the city's transportation system. An inventory of traffic behavior was made during spring and summer of 1998 to establish a base line for all subsequent analysis. Much of this data provides a benchmark (basis of comparison) for assessment of transportation performance relative to desired policies.

The following sections briefly describe existing roadway functions, circulation, traffic speeds, traffic volumes and levels of service in the West Linn transportation system.

Street Network

The Transportation Planning Rule requires that classification of streets within the City be provided. The classification must be consistent with state and regional transportation plans for continuity between adjacent jurisdictions. The City of West Linn developed a street classification system as part of its 1991

Transportation Plan.

Functional Classification

Roadways have two functions, to provide mobility and to provide access. From a design perspective, these functions can be incompatible since high or continuous speeds are desirable for mobility, while low speeds are more desirable for land access. Arterials emphasize a high level of mobility for through movement; local facilities emphasize the land access function; and collectors offer a balance of both functions. The prior adopted functional classification of streets in West Linn is represented by Figure 3-1. Any street not designated as either an arterial or collector is considered a local street.

Clackamas County

roadway classifications are generally consistent with City of West Linn designations. A table summarizing functional classification of West Linn streets by other jurisdictions is shown in the appendix of this report.

ODOT

and **Metro** only classify roads that are considered to be of statewide or regional significance, respectively. These classifications are compatible with West Linn classifications, although the specific classification names may differ. ODOT and Metro classifications can be found in the *Roadway Functional Classification According to Jurisdiction* table in the appendix of this report. Metro classifications are from the Regional Motor Vehicle System map. Several roadways that West Linn and Clackamas County consider Minor Arterials Metro classifies as Collectors of Regional Significance. These were assumed to be compatible classifications (i.e. these were not called out as differing classifications).

The following table summarizes key differences between West Linn's Functional Classification System and that of Clackamas County and Metro. The only real difference is in the classification of Salamo Road. West Linn considers Salamo Road a minor arterial, while Clackamas County considers it a collector. This difference is likely due to the fact that during the development of the Tanner Basin Master Plan, both Tannler Drive or Salamo Road were considered for the key access roadway between the 10th Street area and Tanner Basin. Salamo Road was eventually chosen as the primary access route; however, the County's Functional Classification system pre-dates this decision.

Table 3-1: Functional Class Differences Between Agencies

Roadway	*West Linn*	*Clackamas County*	*Metro*
Salamo Road	Minor Arterial	Collector	Collector of Regional Significance

Figure 3-1: Current Functional Classification

Access Management

There is one major corridor in West Linn where some form of access management has been applied. This corridor is Highway 43, which has a significant portion of its frontage occupied by commercial and residential land uses. Previous work conducted for the City of West Linn identified an access management strategy for Highway 43 that included both capacity improvements and an access management policy. The city has included annual capital budget funding to implement the recommended management measures. The first stage of these improvements are under construction near Elliot Street as part of the new traffic signal installed at that location.

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Existing Travel Activity

The existing transportation activity on the city's transportation system was measured by collecting field data to review existing traffic speeds, volumes, travel times, and travel patterns during weekday peak hours. This data was analyzed and the findings are presented in the next section to determine how well the existing system meets today's travel demands.

Traffic Speeds

Speed zones within the City of West Linn are summarized in Figure 3-2. There are two ways a speed zone can be established by statute. One is in a "residence district," which is vaguely defined in the Oregon Vehicle code under 801.430, and the other is a school zone. A residence district can be posted at 25 mph and a school zone can be posted at 20 mph.

In all other cases, an engineering study is required to determine the appropriate speed zone (the basis is the 85th percentile speed). The study is typically done by the appropriate ODOT region office. The speed zone recommendation (based on the engineering study) is then forwarded from the ODOT region office to Salem to be approved by the State Traffic Engineer. If the jurisdiction requesting the speed study does not agree with the results of the engineering study and recommendation to the State Traffic Engineer, the jurisdiction can appeal the decision to the Speed Zone Review Panel. This panel only meets once a year to review appealed speed zone requests. For perspective on the magnitude of what this board does, this panel reviewed only four cases for the entire state of Oregon in 1997.

Vehicle speeds on several collector and residential streets are a concern for the community. As examples, the following streets have received numerous speeding complaints: Rosemont Road, 19th Street, Tannler Drive, and Salamo Road. In most cases, speeding becomes very noticeable when it is above 30-35 miles per hour. Speeding can usually be expected on local streets where the streets are wide and straight for long stretches or where downhill grades are extended.

Speed surveys were conducted on several roadways in West Linn for this study. Table 3-2 summarizes the results of these surveys, showing the posted speed limit and the 85th percentile speed on each route. The 85th percentile speed represents the speed at which 85 percent of the vehicles are traveling slower and 15 percent of the vehicles are traveling faster. The 85th percentile speed is typically used as the posted speed and the speed that is used for traffic engineering analysis (i.e. for sight distance calculations, etc.).

Table 3-2: Selected Traffic Speeds Surveys

Route	Location	Posted Speed Limit	85th Percentile Speed (Both Directions)
Willamette Falls Drive	West of Alderwood (outside of city limits)		50 mph
Highway 43	North of Oregon City Bridge	35	25 mph
Highway 43	North of West "A" Street	35	40 mph
Highway 43	North of Arbor	40	45 mph
10th Street	South of I-205 SB Ramps	--	38 mph
Rosemont Road	West of Hidden Springs	45	48 mph
Salamo Road	South of Ponderay	35	40 mph
Barrington Drive	East of Salamo	25	29 mph

Figure 3-2: Existing Speed Zones

Traffic Volume

A complete inventory of peak hour traffic conditions was performed in the spring of 1998. The traffic counts conducted as part of this inventory provide the basis for analyzing existing problem areas as well as establishing a base condition for future monitoring. The City of West Linn conducted morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period turning movement counts at 26 locations to determine intersection operating conditions. Typically, the traffic volumes during the evening peak period are the highest hourly volumes of the day because of commute, retail and school activities all occur during that period.

On a typical day, I-205, Highway 43, Willamette Falls Drive, 10th Street, Salamo Road, Rosemont Road, and Hidden Springs Road are the most heavily traveled streets in West Linn. Overall, based on traffic counts at gateways to the City, about 73,000 vehicles enter and exit West Linn (about half in and half out) in a given day. As a comparison, daily traffic on I-205 is about 83,000 vehicles per day near the 10th Street interchange. Figure 3-3 shows average daily traffic (ADT) and peak hour volumes on several routes in West Linn.

Traffic data collected for this study were compiled into hourly volume charts that illustrate the typical fluctuations of traffic over the course of a day (see Technical Appendix). These charts show that traffic volumes generally tend to increase over the course of the day (through the evening peak period).Typical residential and regional routes areas are shown. These streets generally tend to peak in the morning and evening peak (commute) hours.

Figure 3-3: Existing Traffic Volumes

Traffic Control

West Linn has six signalized intersections within the city limits (another signal is under construction on Highway 43 at Elliott Street). All six are located along Highway43 and they are owned and operated by the Oregon Department of Transportation. Intersection control is also accommodated by two-way, three-way or four-way stop signs. Figure 3-4 shows the signalized and all-way-stop controlled locations in the study area.

Traffic signals are valuable devices for the control of vehicle and pedestrian traffic. Properly located and operated traffic control signals can have one or more of the following advantages:

Advantages of Traffic Signal Control

- They provide for the orderly movement of traffic
- Where proper physical layouts and control measures are used, they can increase the traffic handling capacity of the intersection
- They reduce the frequency of certain types of accidents, especially right angle type
- Under favorable conditions, they can be coordinated to provide continuous or nearly continuous movement of traffic at a definite speed along a given route
- They permit minor street traffic, vehicular or pedestrian, to enter or cross continuous traffic on the major street

Improper or unwarranted signal installations may cause the following disadvantages:

Disadvantages of Traffic Signal Control At Unwarranted Locations

- Excessive delay
- Disobedience of signal indications
- Circuitous travel of alternative routes
- Increased accident frequency, particularly rear-end type

Consequently, it is important that the consideration of a signal installation and the selection of equipment be preceded by a thorough study and based on consistent criteria. The study must identify the need for left turn phasing, lanes and phase type. The justification for the installation of a traffic signal at an intersection should be based upon the warrants stated in the Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD has been adopted by the State of Oregon and is used throughout the nation.

Figure 3-4: Existing Traffic Control

The same requirements for signalized intersections hold true for installation of stop sign traffic controls. Specific warrants identify conditions that may warrant two-way or multi-way stop sign installations. A stop sign is not a cure-all and is not a substitute for other traffic control devices. Guidelines and warrants for stop sign installations are outlined in the MUTCD.

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Existing Service Levels

The following sections review the performance of various key routes in West Linn in terms of volumes, capacity, accidents, intersection level of service, arterial level of service and general observations. The information is organized to provide a description in terms of functional classification, number of lanes, existing traffic volumes, accident locations and a summary of peak hour operating conditions. The calculations are based on the *1994 Highway Capacity Manual*. Level of service calculation sheets are provided in a separate Technical Appendix.

Traffic Service Levels

Traffic volume analysis provides better understanding of the general nature of traffic in an area, but by itself indicates neither the ability of the street network to carry additional traffic nor the quality of service afforded by the street facilities. For this, the concept of *level of service* has been developed to subjectively describe traffic performance at intersections.

Levels of service categories are similar to report card ratings for intersection traffic performance. Intersections are the controlling bottlenecks of traffic flow and the ability of a roadway system to carry traffic efficiently is nearly always diminished in their vicinities.

Definition of Level of Service

. Level of service (LOS) is used as a measure of effectiveness for intersection operation. It is similar to a "report card" rating based upon average vehicle delay. Level of service A, B, and C indicate conditions where vehicles can move freely. Level of service D and E are progressively worse. Level of service F represents conditions where traffic volumes exceed the capacity of a specific movement. Level of service D or better is generally desirable for signalized intersections. Unsignalized intersections provide levels of service for major and minor street turning movements. For this reason, LOS E and even LOS F can be acceptable under conditions where traffic signal controls are not warranted or would adversely affect intersection operations. Levels of service descriptions for intersections are summarized in the appendix.

Evaluating Intersections Without Traffic Signals.

The unsignalized intersection level of service calculation evaluates each movement separately to identify problems (typically left turns from side streets). The calculation is based on the average stopped delay per vehicle for stop controlled movements. Level of service F indicates that there are insufficient gaps of suitable size to allow minor street traffic to safely enter or cross the major street. This is generally evident by long delays and queuing on the minor street. Level of service F may also result in more aggressive driving, with side street vehicles accepting shorter gaps. In such cases, some increase in conflicts and disruption to major street traffic can result. It should be noted that the major street traffic can still move effectively when LOS F is indicated for side street left turns, and that the side street volume may be only a small percentage of the total intersection volume. It is for these reasons that level of service results must be interpreted differently for signalized and unsignalized locations.

Table 3-3: 1998 Intersection Conditions

	AM Peak*			PM Peak*		
Intersection	*Delay*	*LOS*	*V/C*	*Delay*	*LOS*	*V/C*
Traffic Signal Controls (Average Condition for All Traffic Movements)						
Highway 43/Marylhurst Drive	8.5	B	0.75	8.5	B	0.75
Highway 43/Cedar Oak Drive	17.3	C	0.94	4.6	A	0.64
Highway 43/Hidden Springs Road	10.8	B	0.68	10.8	B	0.78
Highway 43/McKillican Street	12.7	B	0.78	14.0	B	0.90
Highway 43/I-205 SB Ramps	15.5	C	0.67	27.5	D	0.95
Highway 43/I-205 NB Ramps	9.2	B	0.39	8.9	B	0.35
STOP Sign Controls (Major Street/Minor Street Most Delayed Movement)						
10th Street/Blankenship-Salamo	A/D			A/D		
10th Street/I-205 NB Ramps	B/E			A/F		
10th Street/I-205 SB Ramps	B/F			A/F		
Cornwall Street/Lancaster Road	A/A			A/A		

Highway 43/Dillow Road	B/D	B/D
Highway 43/Failing Street **	B/E	B/E
Highway 43/Jolie Pointe	B/E	B/D
Highway 43/Mapleton	B/C	B/E
Highway 43/Pimlico Drive	B/D	B/F
Highway 43/West "A" Street **	B/F	B/E
Highway 43/Willamette Falls Drive	A/F	A/F
Rosemont Road/Hidden Springs Road	A/B	A/B
Willamette Falls Drive/12th Street	A/B	B/B
Willamette Falls Drive/Dollar Street	A/C	A/C
Willamette Falls Drive/Sunset Avenue	A/C	A/C
Willamette Falls Drive/West "A" Street	A/D	A/D
All-Way Stop Controlled Intersections (Average for All Movements)		
Rosemont Road/Salamo Road	A	B

Summit Street/Rosemont Road	B	A
10th Street/Willamette Falls Drive	D	C
* Intersection LOS: Delay = Average Delay per Vehicle, LOS = Level of Service, V/C = Volume-to-Capacity Ratio ** Traffic signal controls under construction at Highway 43 and Elliott Street to remedy these poor conditions.		

All signalized study intersections operate at LOS D or better in both peak hours. Field observations showed that the intersection of Highway 43/Hidden Springs intermittently generates southbound vehicle queues which extend back to the Highway 43/ Cedaroak Drive intersection, approximately 600 feet away, which creates poor operating conditions at both intersections. This queuing problem is not detectable in the intersection level of service calculation (since the calculation is based on the volume that *does pass through* the intersection), but it is included in the travel time surveys conducted along Highway 43.

Many of the study area intersections controlled by STOP signs operate at level of service D or better during the evening peak hour; however, several intersections operate at LOS E or F for the minor street left turn movement in either the AM or PM peak hour (or both).

Intersection improvements are planned in the West Linn Capital Improvement Plan (1999-2001) for the following locations:

- Highway 43/Willamette Falls Drive Signal
- Highway 43/West "A" Signal (includes realignment with Elliott Street)
- Highway 43/Pimlico Signal

Other locations controlled by STOP signs that showed substantial delays for side street traffic during peak hours were reviewed to determine if traffic controls were appropriate. The standard for this assessment is published in the *Manual on Uniform Traffic Control Devices* (MUTCD). The traffic signal warrant number 11 (Peak Hour Volume Warrants) was checked for each STOP controlled intersection that operates at LOS E or F that is not scheduled for improvements. The results summarized below show that traffic signal controls are justified in the short-term at the 10th Street interchange. Detailed studies (further warrant checks) should be conducted at each of these locations to determine whether traffic signals should be installed at either or both of these intersections. The initial indication is that traffic signal controls are justified today at these two ramp junctions.

Table 3-4: Traffic Signal Warrant Review

Intersection	Peak Hour Warrant 11
Highway 43/Mapleton	Not Met
Highway 43/Jolie Pointe	Not Met
10th Street/I-205 NB Ramps	Met
10th Street/I-205 SB Ramps	Met

Highway 43 Traffic Performance

In addition to the traffic speed and volume data collected throughout the city, supplemental data was surveyed on Highway 43 to further understand how the city's only principal arterial operates. The additional data included measurements of travel times, the mix of local and through traffic using the facility, and the number of occupants in each vehicle. These supplemental surveys were taken during peak commute periods since these are typically the most busy periods of the day for this facility.

Peak Hour Travel Speed

Vehicle travel speed information was collected as another indicator of roadway system performance on Highway 43. Travel time runs were conducted on Highway 43 between the Oregon City Bridge and Interstate 205 and the northern city limits during the PM peak period on a typical weekday. The surveys were limited to the p.m. peak hour since future travel forecasts can be made only during that period using the Metro travel demand model, and this information will be used as a baseline condition.

Arterial level of service was calculated according to the methods presented in the *1998 Highway Capacity Manual*. The arterial performance is based on the average vehicle travel speed whereas the intersection level of service, as discussed in a later section, is based on average delay per vehicle. Overall, average evening peak hour travel speed southbound on Highway 43 ranged from about 12 miles per hour north of Hidden Springs Road to 34 miles per hour between Hidden Springs Road and Failing Street. Travel speeds in the opposite direction were generally higher, especially north of Hidden Springs Road. More information on level of service descriptions and calculations (both arterial and intersections) can be found in the appendix.

Table 3-5: Highway 43 Average Travel Speeds – PM Peak Hour

Segment Boundary	*Northbound*		*Southbound*	
	Speed	*Level of Service*	*Speed*	*Level of Service*
Marylhurst to Hidden Springs	26	B	12	E
Hidden Springs to Failing	36	A	34	A
Failing to Oregon City Bridge	22	C	20	C
Overall Average	27	B	23	C
Source: Travel speeds sampled during weekdays in September 1998 during peak commute hours when schools was in session. Level of service based on *Highway Capacity Manual* methodology (Chapter 11) for Class 3 arterial facilities.				

Origin-Destination Survey

Travel patterns were monitored on Highway 43 at three observation stations to determine the mix of local versus "through" traffic using this facility. Through traffic is defined as vehicles that do not begin or end their trips within the city limits, but use the highway as a regional facility to reach outside destinations. Video cameras were used to observe vehicle license plates during the peak hour of travel in the peak direction, i.e. northbound in the AM peak hour and southbound in the PM peak hour.

Table 3-6: Highway 43 Travel Patterns

Travel Description	*AM Peak Hour*	*PM Peak Hour*
	Northbound	*Southbound*

Enters/Leaves City at Oregon City Bridge	100%	10%
Accesses onto I-205	78%	24%
Local Destination between I-205 and North City Limit	9%	66%
Leaves/Enters City at North City Limits	13%	100%
Travel Stream Components		
Local Traffic (trip ends within the city)	9%	66%
Through Traffic (to/from Oregon City)	13%	10%
Through Traffic using I-205	78%	24%
Source: Traffic surveys taken in September 1998.		

The findings summarized in the above table show that nearly 80 percent of the traffic crossing the Oregon City Bridge turned onto Interstate 205. Approximately 9 percent continued north on Highway 43 and made local stops, and the remaining 13 percent continued through to the northern city limit. In the opposite travel direction, 66 percent of the southbound traffic entering the corridor across the north city limit had local destinations during the p. m. peak hour. Approximately 24 percent traveled the length of Highway 43 than turned onto Interstate 205. The remaining 10 percent continued south all the way through the city to the Oregon City Bridge. In the morning peak hour, the reverse pattern did not occur. This data clearly shows that through traffic along the length of Highway 43 between Oregon City and Lake Oswego is a relatively small proportion of the total travel during peak hours. The majority of vehicles on Highway 43 have either local origins or destinations.

Average Vehicle Occupancy

Average vehicle occupancy (AVO) was measured on Highway 43 north of Hidden Springs Road during both the morning and evening peak periods. Overall AVO measured at this location (in both directions, over both time periods) was 1.20. This rate is somewhat lower than observed typical ranges for auto occupancy in other suburban locations that range from about 1.31 to 1.54. A breakdown by time and direction is shown in the table on the next page.

Table 3-7: Highway 43 Average Vehicle Occupancy

Time Period	Northbound	Southbound	Overall
6:45-8:45 (AM Peak)	1.13	1.19	1.15
4:00-6:00 (PM Peak)	1.23	1.25	1.24
Overall	1.17	1.23	1.20
Source: Surveys taken June 1998.			

Traffic Collision History

Reported vehicle collision data was obtained from the Oregon Department of Transportation Accident Data Unit for the period between January 1, 1995 and December 31, 1997. The table below summarizes collision severity, type, and frequency over this period within the City of West Linn. No fatal collisions were reported during the study period. Injury collisions have remained relatively constant, ranging from 57 to 66 occurrences each year. Property damage only collisions have actually dropped in the last reported year to 46 collisions, down from a high of 68 in 1995.

Table 3-8: West Linn Vehicle Collision Summary (1995-1997)

Year	*Fatalities*	*Major/Minor Injury*	*Property Damage Only*	**Total**
1995	0	57	68	125
1996	0	66	61	127
1997	0	66	46	112
Total	0			

Source: Oregon Department of Transportation, Accident Data Unit. Refer to Figure 3-5 for locations of collisions at intersections.

Figure 3-5 shows the locations for recorded collisions within 150 feet of an intersection. Only locations with more than one reported collision between 1995 and 1997 are shown. The top ten intersections with the highest total number of collisions are:

Top Ten Vehicle Collision Intersections

Highway 43 at Interstate 205 (2 intersections)

- 10th Street at 8th Avenue
- West "A" Street at Skyline Drive
- West "A" Street at McKillican Street
- Willamette Falls Drive at 12th Street
- Highway 43 at Cedaroak Drive
- Highway 43 at Arbor Drive
- Highway 43 at Hidden Springs Road
- Highway 43 at McKillican-Hood

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Street System Summary

West Linn major street facilities are described in the following section as to their functional classification, connectivity, volumes and speeds under existing conditions. Table 3-9 provides a summary matrix for reference.

Interstate Facilities

Interstate 205

is classified by ODOT as a State Highway with Interstate Level of Importance (LOI). It is classified as a Principal Arterial (Freeway) by Metro, as a Freeway/Expressway by Clackamas County and as a Principal Route by West Linn. I-205 provides a by-pass route to I-5 through the Portland Metropolitan region and provides access to areas east of Portland and Vancouver proper. It connects between Tualatin and Vancouver. Near West Linn, it is two lanes in each direction. I-205 provides access between West Linn, the rest of the Portland region and other interstate routes. I-205 carries about 83,300 vehicles daily just east of the 10th Street interchange.

Arterial Facilities

Highway 43 (ORE 43)

is classified by ODOT as a District Level State Highway. It is posted and known locally as Willamette Drive but has been shown on old or non-local maps by various names to include Pacific Highway, Oswego Highway, and Portland Avenue. It is classified by Metro, Clackamas County and West Linn as a Major Arterial. Highway 43 provides access from West Linn to destinations north of town including Lake Oswego, the John’s Landing area of Portland, the Sellwood Bridge and downtown Portland. It is a two-lane, two-way street with bike lanes and sidewalks along most of its frontage and a posted speed of 45 miles per hour north of Cedaroak Drive and 35 miles per hour south of Cedaroak Drive. It carries approximately 21,000 ADT (Average Daily Traffic) at the northern city limit line, with about 1,650 vehicles (two-way) during the evening peak hour. Just north of the Oregon City/West Linn Bridge, Highway 43 carries about 13,500 ADT, with about 1,200 during the evening peak hour.

Hidden Springs Road

is classified as a Minor Arterial by both Clackamas County and West Linn. It is a two-lane, two-way roadway, with left turn lanes at key locations. Its frontage is primarily residential. It has a posted speed of 25 miles per hour and generally has sidewalks on both sides. It carries about 2,450 vehicles daily near Rosemont Road and about 6,300 near Highway 43, with about 250 and 650 vehicles (two-way) during the evening peak hour, respectively.

Pimlico Drive

is classified by Clackamas County as a Minor Arterial between Summit Street and Highway 43 and as a Collector for the remainder of its length. It is classified as a Collector by West Linn. Pimlico Drive has a posted speed of 25 miles per hour. Pimlico Drive is generally fronted by residential development. It carries about 3,250 vehicles daily near Highway 43, with about 325 vehicles (two-way) during the evening peak hour.

West "A" Street

is classified as a Minor Arterial by both Clackamas County and West Linn. It is a two-lane, two-way roadway with a posted speed of 25 miles per hour. This roadway provides access to West Linn High School and residential areas in West Linn. It carries about 2,350 vehicles daily near Highway 43 (to the south) and about 1,000 vehicles daily near Highway 43 (to the north), with about 235 and 100 vehicles (two-way) during the evening peak hour, respectively.

Willamette Falls Drive

is classified by Metro, Clackamas County and West Linn as a Minor Arterial. This route provides access to West Linn from Oregon City and provides access between disjointed parts of West Linn. It is a two-lane, two-way roadway with no shoulders, no bike lanes and only intermittent sidewalks along its frontage. Willamette Falls Drive parallels the Willamette River and is the most direct local street connection between the west and east halves of the city. Posted speeds vary from 25 to 35 miles per hour in the Willamette Area to 35 and 45 miles per hour near the east end . It carries approximately 10,000 vehicles daily near Highway 43, with about 1,000 vehicles (two-way) during the evening peak hour. Pavement conditions are generally fair to poor along most segments of the roadway.

10th Street

is classified by Metro as a Collector of Regional Significance and is classified by Clackamas County and West Linn as a Minor Arterial. 10th Street provides access between areas north and south of I-205 within West Linn. It is primarily a two-lane, two-way roadway with left turn lanes at key locations and shoulders which serve as bike lanes. There is no posted speed limit on 10th Street. It has shoulders and sidewalks adjacent to the shopping centers, but no continuous sidewalks from one side of the freeway to the other. There is a wide paved shoulder on either side of the undercrossing. Tenth Street carries approximately 13,300 vehicles daily south of I-205, with about 1,100 vehicles (two-way) during the evening peak hour.

Dollar Street

is classified as a Minor Arterial (East of Ostman) and a Collector (West of Ostman) by Clackamas County and as a Minor Arterial (for its length) by West Linn. It is a two-lane, two-way roadway with a posted speed of 25 miles per hour. It provides access to residential areas in the Willamette Area of West Linn. Dollar Street carries about 1,000-2,000 vehicles daily, with about 100-200 vehicles (two-way) during the evening peak hour.

12th Street/Tualatin Avenue

is classified as a Minor Arterial by both Clackamas County and West Linn. It is a two-lane, two-way roadway which provides access to West Linn from rural areas to the southwest. It has a posted speed of 25 miles per hour (20 mph when children are present in the school zone). 12th Street carries about 3,150 vehicles daily near Willamette Falls Drive, with about 315 vehicles (two-way) during the evening peak hour.

Rosemont Road/Summit Street/Skyline Drive

– Rosemont Road is classified as a Collector of Regional Significance (west of Salamo Road) by Metro and as a Minor Arterial by Clackamas County and West Linn. Rosemont Road is a two-lane, two-way roadway with a posted speed of 45 miles per hour. South of Miles Drive the speed drops to 25 miles per hour and continues through the length of Summit Street and Skyline Drive. There are sidewalks adjacent to recently developed areas, but otherwise there are generally no sidewalks or bike lanes. Rosemont Road carries about 4,900 vehicles daily near Hidden Springs Road, with about 500 vehicles (two-way) during the evening peak hour.

Salamo Road

is classified as a Collector of Regional Significance by Metro and as a Minor Arterial by Clackamas County and West Linn. This roadway provides access to residential areas in West Linn from I-205. As of July 1, 1999, the former Day Road alignment was re-named to Salamo Road. It is typically a three-lane, two-way roadway with bike lanes and either a planted median or center left turn lane. It has a posted speed of 40 miles per hour near I-205 and 35 miles per hour near Rosemont Road. There are sidewalks in several locations (recently developed areas), but with limited connectivity. It carries about 4,800 vehicles daily near Ponderay Drive, with about 450 vehicles (two-way) during the evening peak hour.

Tannler Drive

is classified as a Minor Arterial by both Clackamas County and West Linn. It is a two-lane, two-way roadway with a posted speed of 25 miles per hour.

Blankenship Road (East of 19th)

is classified as a Minor Arterial by both Clackamas County and West Linn. It is generally a two-lane, two-way roadway with left turn lanes at key locations. It has a posted speed of 25 miles per hour. There are sidewalks adjacent to recently developed areas. Blankenship Road carries about 7,600 vehicles daily near 10th Street, with about 760 vehicles (two-way) during the evening peak hour.

Santa Anita Drive

is classified as a Minor Arterial by both Clackamas County and West Linn. It is a two-lane, two-way roadway, with left turn lanes at key locations. Its frontage is primarily residential. It has a posted speed of 25 miles per hour and generally has sidewalks on the west side. There are no bike lanes along Santa Anita Drive. It carries about 3,600 vehicles daily near Rosemont Road, with about 350 vehicles (two-way) during the evening peak hour.

Table 3-9: West Linn Street System Summary

Street	Existing Classification	Lanes	ADT	PM Peak**	Posted Speed

	West Linn	Clackamas County	Metro*				
I-205	Principal Route	Freeway/ Expressway	Principal Arterial (Freeway)	4	83,300		65/55 mph
Highway 43	Major Arterial	Major Arterial	Major Arterial	2/3	21,000	1,650	40/35 mph
Willamette Falls Drive	Minor Arterial	Minor Arterial	Minor Arterial (west of 10th Street)	2/3	10,500	1,050	25/35/45 mph
10th Street	Minor Arterial	Minor Arterial (north of I-205)	Collector (Regional)	2/3	13,300	1,060	25 mph
Salamo Road (formerly Day Road)	Minor Arterial	Minor Arterial	Collector (Regional)	2	5,600	560	35 mph
Rosemont Road/ Summit Street/ Skyline Drive	Minor Arterial	Minor Arterial	Collector (Regional)	2	5,000	500	25/45 mph
Salamo Road	Minor Arterial	Collector	Collector (Regional)	2/3	4,800	450	35/40 mph
Tannler Drive	Minor Arterial	Minor Arterial		2	N/A	N/A	25 mph
Blankenship Road (East of 19th)	Minor Arterial	Minor Arterial		2/3	7,600	760	25 mph
12th St/Tualatin Ave	Minor Arterial	Minor Arterial		2	3,150	315	25 mph

Hidden Springs Road	Minor Arterial	Minor Arterial		2/3	6,300	630	25 mph
Santa Anita Drive	Minor Arterial	Minor Arterial		2/3	3,600	360	25 mph
West "A" Street	Minor Arterial	Minor Arterial		2	2,350	235	25 mph
Dollar Street	Minor Arterial	Minor Arterial (east of Ostman)		2	1,500	150	25 mph
Pimlico Drive	Collector	Minor Arterial (Santa Anita to Highway 43)		2	3,250	325	25 mph

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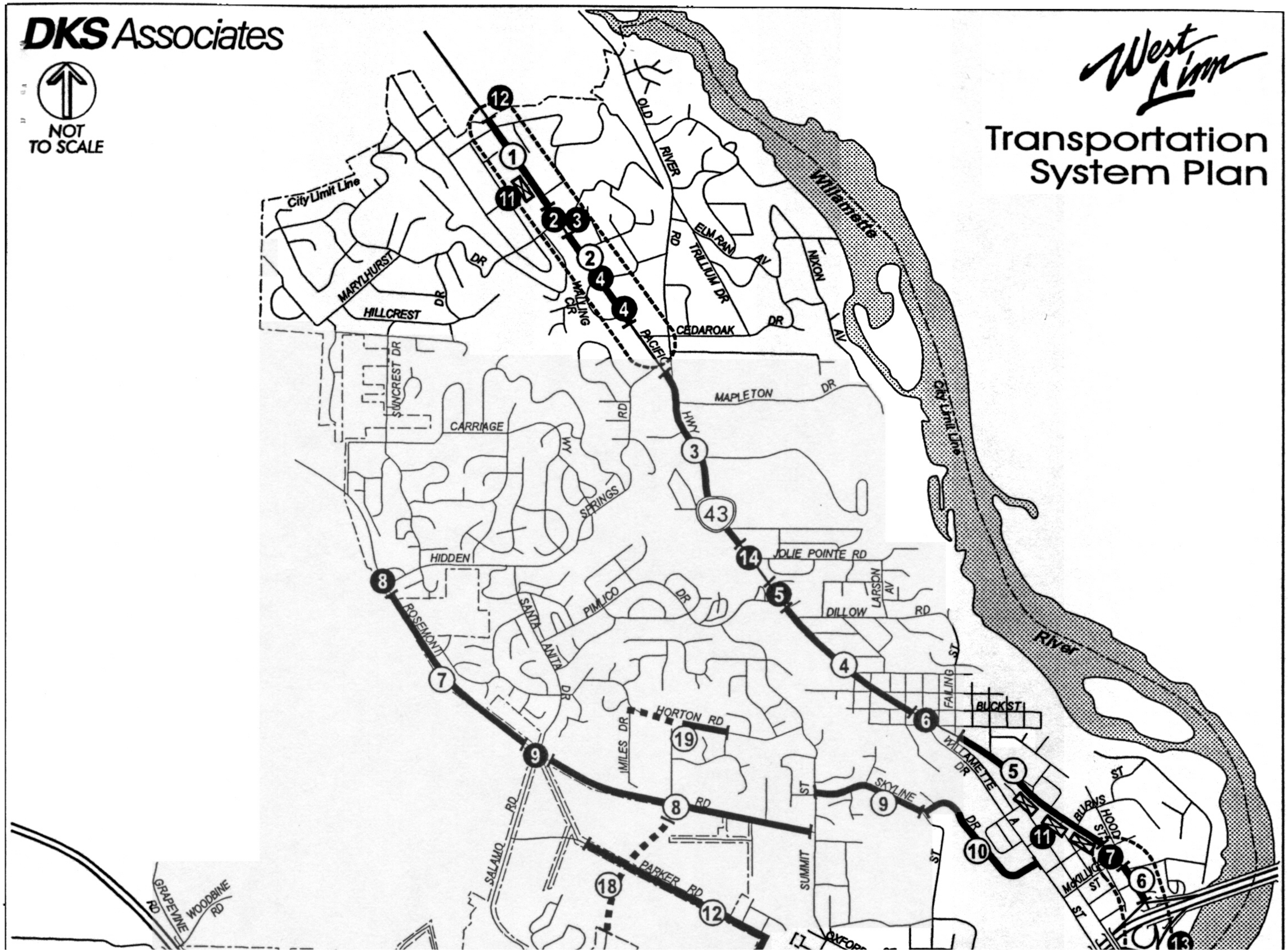
DKS Associates
NOT TO SCALE
West Linn
Transportation System Plan
City Limit Line
Willamette River
OLD RIVER RD
ELM RAN
TRILLIUM DR
NIXON AV
MARYLHURST DR
HILLCREST DR
WALLING CIR
CEDAROAK DR
PACIFIC HWY
MAPLETON DR
SUNCREST DR
CARRIAGE WY
SPRINGS
HIDDEN
JOLIE POINTE RD
LARSON AV
DILLOW RD
PIMLICO DR
SANTA ANITA DR
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HORTON RD
MILES DR
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GRAPEVINE RD
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HOOD ST
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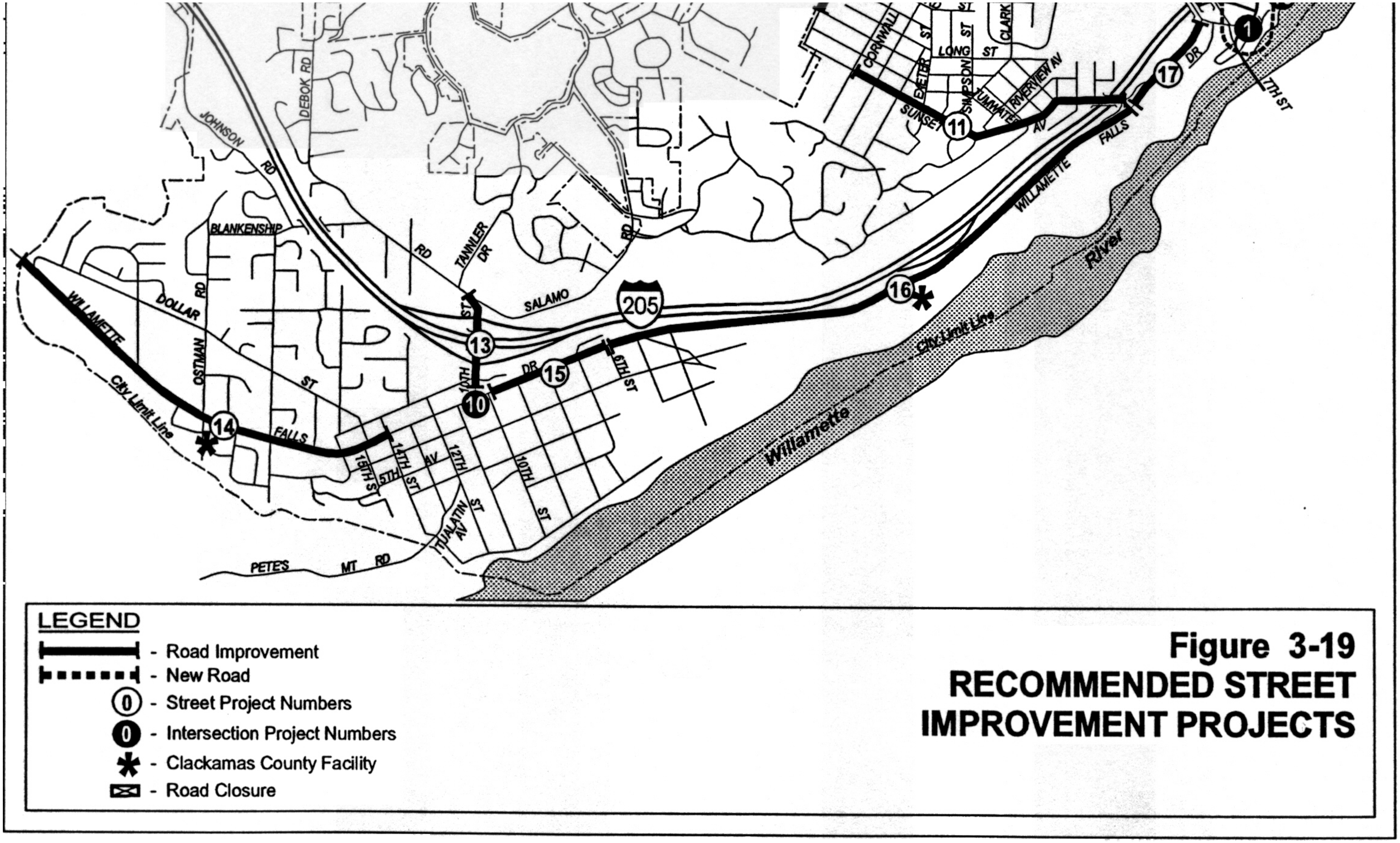

Figure 3-19
RECOMMENDED STREET IMPROVEMENT PROJECTS

Travel Demand Forecast

This chapter summarizes the methodology used to obtain future year travel forecasts in the City of West Linn. The plan for street improvements within West Linn depends on determining existing needs and needs of future growth. As a first step in assessing future needs, Metro's urban area traffic forecast model was identified as a source for determining future traffic volumes in West Linn. This traffic forecast model translates land uses into roadway volume projections. These traffic volume projections form the basis for identifying potential roadway deficiencies and for evaluating alternative circulation improvements. This section describes the forecasting process, including key assumptions and the analysis of the land use scenario developed from the current Comprehensive Plan development designations and allowed densities. Future change of these variables could significantly change the future travel forecast.

Projected Land Uses

Land use is an essential component in how the transportation system operates. The demands on the transportation system vary depending on the amount of land developed, the type of uses and their location relative to other uses. Understanding the amount and type of land use is critical to maintain or enhance transportation system operation.

Projected land uses were developed for all areas within the urban growth boundary reflecting the comprehensive plan 1999 update and the city's land use assumptions for year 2020. Complete land use data sets were developed for the following years consistent with the latest Metro travel demand model study years:

- Existing 1994 Conditions
- Year 2020

Metro’s base year model is updated every few years. For this study effort, the available base model provided by Metro was for 1994. For the horizon year planning, land uses were inventoried throughout West Linn (and the adjacent jurisdictions) by the city Planning Department as part of the Comprehensive Plan update process. It was found that the total allocations were very similar to the Metro allocations for each land use category, but the location of growth within the city was modified to better account for available vacant and re-developable lands.

The land use data applied for travel demand forecasting includes the number of dwelling units, number of retail employees and number of other employees. The city forecast was for 2017, and this essentially represents build-out of the city within its Urban Growth Boundary. This refined city forecast data was input into Metro’s 2020 travel demand model that includes 2020 land use forecasts for all other jurisdictions in the region. Table3-12 summarizes the land uses for base year conditions and the horizon year scenario in the West Linn area. A detailed summary of the land uses for each Transportation Analysis Zone (for both the 1994 and 2020 model years) is listed in Table 3-13. These data are updated regionally providing information that is more detailed. As the land use data is updated in the future, TSP updates can reflect current conditions and new forecasts.

Urban Reserve Areas

It is appropriate to note that these land use forecasts do not include potential development in the designated urban reserve areas. Urban reserves 30 through 34 along the Rosemont Road or pending Stafford Basin reserve area lie outside of the current urban growth boundary and are not included in the land use forecasts used in the traffic projections. To fully understand the implications of adding these lands into the urban growth boundary, a separate transportation analysis will be required.

Future Travel Patterns

If land uses are significantly changed in proportion to each other (i.e. there is a significant increase in retail employment relative to households), there will be a shift in the overall operation of the transportation system. Retail land uses generate significantly higher numbers of trips than do households and other land uses. The location and design of retail land uses in a community can greatly affect transportation system operation. Additionally, if a community is homogeneous in land use character (i.e. all employment, all residential), the system must support export of trip making. Typically, there should be both residential type land uses as well as employment type land uses so that some residents may work locally, reducing the need for residents to commute long distances to work. West Linn has a mix of land uses; however, many residents must travel outside the city for employment opportunities. The current balance of land uses in West Linn is predominantly residential (92 percent) with commercial uses (8 percent) in selected neighborhoods. Also, the amount of employment based land uses such as offices buildings and industrial areas are very limited within the city.

Table 3-12: West Linn Area Land Use Summary

Land Use	*1994*	*2017*	*Growth*	*Percent Increase*
Households	6,907	9,792	2,885	+42%
Retail Employees	484	932	448	+192%
Other Employees	2,552	5,114	2,562	+200%

Source
: City of West Linn, 1999. Subsequent adjustments to the residential land use forecasts were made in the later stages of the Comprehensive Plan update to be 10,137 households by 2017. The minor difference (3 percent) applied citywide would not significantly change the travel demand forecasts.

Table 3-12 indicates that a significant amount of growth is expected in West Linn area between 1994 and 2017. Approximately 1,008 residential dwelling units were constructed in West Linn between 1994 and September 1998. These land use quantities should be monitored to make sure that West Linn is working to achieve a balance of land use that is compatible with the available transportation system. This TSP balances transportation needs with the forecasted 2020 land uses.

For traffic forecasting, land use data is stratified into geographical areas called transportation analysis zones (TAZs) which represent the sources of vehicle trip generation. Table 3-13 summarizes the land uses for base year conditions and the horizon year scenario by transportation analysis zones (TAZs). There are about 10-15 Metro TAZs which represent West Linn and its vicinity. These 10-15 TAZs were subdivided as part of this plan, into about 20-30 TAZs to more specifically represent land use in and around West Linn. The original Metro and refined model zone boundaries are shown in Figure 3-6. Metro uses EMME/2, a computer based program for transportation planning, to process the large amounts of data for the Portland Metropolitan area.

Figure 3-6: West Linn Transportation Analysis Zones

Table 3-13: West Linn Land Use Summary by Transportation Analysis Zone

	Households		*Retail Employees*		*Other Employees*	
TAZ	*1994*	*2017*	*1994*	*2017*	*1994*	*2017*
356	425	554	53	55	197	187
357	493	556	0	0	86	147
377	495	497	30	43	101	127
378	409	445	1	2	171	308

379	220	326	8	16	39	66
380	217	541	3	17	8	40
381	367	582	3	6	62	119
382	295	389	4	12	28	79
1301	12	20	2	20	36	391
1302	195	710	2	8	49	170
1303	95	632	1	13	30	262
1304	243	343	4	10	29	65
1305	251	277	2	5	17	30
1306	348	439	15	41	110	274
1307	41	41	23	58	171	412
1308	10	72	51	118	127	270
1309	423	464	11	23	27	52
1310	284	369	6	15	16	35
1311	12	22	38	55	177	241
1312	252	315	62	100	288	430
1313	286	326	63	133	293	554

1314	433	575	1	2	118	255
1315	685	716	27	46	91	129
1316	197	289	0	0	21	22
1317	195	258	29	60	114	210
1318	23	36	44	72	147	240
Total	6,907	9,792	484	932	2,552	5,114
Source: City of West Linn, Planning Department, 1999						

Metro Area Travel Demand Model

Future transportation system planning depends on accurate travel demand forecasts based on population and employment estimates. An effective transportation planning process provides city staff and decision-makers with necessary information about when and where improvements should be made in the transportation system to meet travel demands.

Metro has developed an urban area travel demand model as part of the Regional Transportation Plan Update process to help identify street and roadway needs. Traffic forecasting can be divided into several distinct components that represent the logical sequence of travel behavior (Figure 3-7). These components and their general order in the traffic forecasting process follow:

- Trip Generation — *the total amount of travel activity that begins or ends within a specific TAZ during a given time period.*
- Trip Distribution — *identifies the most likely beginning TAZ and ending TAZ of a particular trip. The TAZs can be inside the city or anywhere in the Metro region.*
- Mode Choice — *the preferred travel mode to complete the trip (auto, transit, pedestrian, or bicycle)*
- Traffic Assignment — *the travel route (combination of streets and highways) used to complete the trip*

The initial roadway network used in the traffic model was the existing streets and roadways. Future land use scenarios were tested and roadway improvements were added in to mitigate traffic conditions, using programmed improvements as a starting basis. Traffic forecasts during the PM peak hour traffic were produced for every major roadway segment within West Linn. Traffic volumes are projected on most arterial and collector streets. Some local streets are included in the model, but many are represented by special street connectors used in the model process.

Trip Generation

. The trip generation process translates land use quantities (in numbers of dwelling units and retail and other employment) into vehicle trip ends (number of vehicles entering or leaving a TAZ) using trip generation rates established during the model verification process. The trip rates were based on Portland regional rates developed by Metro with adjustments in the calibration process to account for local activity levels. The PM peak hour trip rates used in the Metro model are summarized in Table 3-14. Adjustments were made to reflect higher local rates based on a comparison of the average regional rates versus local generation as determined by Metro studies.

Table 3-15 shows the estimated growth in daily vehicle trips within West Linn, between 1994 and 2017. Vehicle trip generation in West Linn will grow by approximately 60 percent between 1994 and 2017 if the land develops according to the city's assumptions; this is a growth rate of about two-percent per year.

Table 3-14: Average PM Peak Hour Trip Rates Used in Metro Model

Unit	*Average Trip Rate/Unit*		
	In	*Out*	*Total*
Household	0.43	0.19	0.62
Retail Employee	0.78	0.69	1.47
Other Employee	0.07	0.29	0.36
Source: Metro			

Table 3-15: Existing and Future Trip Generation -- PM Peak Hour Vehicle Trips

Trips	*1994*	*2017*	*Growth*	*Percent Increase*
West Linn Area	6,977	10,952	3,975	+57%
Source: Metro and DKS Associates				

Figure 3-7: Traffic Forecasting Model Process

Trip Distribution.

This step estimates how many trips travel from one zone in the model to any other zone. The distribution is based on the number of trip ends generated in each zone pair, and the likelihood of travel between any two zones given the travel time between them.

In forecasting long-range future traffic volumes, it is important to consider how regional travel patterns may change as well as local patterns. The influence of growth in neighboring areas such as Lake Oswego, Tualatin, Oregon City, Portland and Washington County will affect the commute and shopping patterns in the next twenty years. Trips made outside of the city (external trips) and through trips (trips which pass through West Linn and have neither an origin nor a destination there) were estimated based on census data and traffic counts at the edge of the Metro Urban Growth Boundary.

Mode Choice.

This is the step where it is determined how many trips will be by single-occupant vehicle, transit or carpool. The 1994 mode splits were incorporated into the base model and adjustments to that mode split were made for the future scenario, depending on any expected changes in transit or carpool use. These considerations are built into the forecasts used for 2020.

Traffic Assignment.

In this process, trips from one zone to another are assigned to specific travel routes in the roadway network, and resulting trip volumes are accumulated on links of the network until all trips are assigned.

A separate travel demand model is used for auto assignment and another for transit assignment. Various techniques exist for auto assignment, such as all-or-nothing, stochastic, incremental capacity restraint and equilibrium capacity restraint. The EMME/2 package, among others, uses the equilibrium capacity restraint technique, which is considered to produce the most realistic network traffic loading of all the techniques. With this technique, the auto trips are assigned iteratively to the network in such a way that the final traffic loading will closely approximate the true network "equilibrium." Network equilibrium is defined as the condition where no traveler can achieve additional travel time savings by switching routes. Between iterations, network travel times are updated to reflect the congestion effects of the traffic assigned in the previous iteration. Congested travel times are estimated using what are called "volume-delay functions" in EMME/2. There are different forms of volume/delay functions, all of which attempt to simulate the capacity restraint effect of how travel times increase with increasing traffic volumes. The volume-delay functions take into account the specific characteristics of each roadway link, such as capacity, speed, and facility type.

Model Verification

. The base 1994 modeled traffic volumes were compared against actual traffic counts on arterial streets and at major intersections. Most arterial traffic volumes are closely replicated, even down to turn movements by the model based upon detailed calibration. Based on this performance, the model was used for future forecasting and assessment of circulation changes.

Model Application to West Linn

Intersection turn movements were extracted from the model at important intersections for both year 1994 and year 2020 scenarios. These intersection turn movements were not used directly, but the increment of the year 2020 turn movements over the year 1994 turn movements was applied (added) to existing (actual 1998) turn movement counts in West Linn. Actual turn volumes used for future intersection analyses are provided in the Technical Appendix.

The resulting peak hour volumes on selected links and freeway ramps are shown in Figure 3-8 for the greater West Linn area. The values compare the 1998 traffic count volumes with the forecasted 2020 volumes at each location.

The initial 2020 test was performed on a street network that included existing roads plus those roadway improvements that are currently programmed and would likely be implemented before the 2020 scenario is reached. Refer to Table 3-10 and 3-11 for details of the planned roadway improvements.

Alternative Travel Assumptions

Travel forecasts included the highest level of transit service given regional funding constraints (as described in the Metro Strategic Regional Transportation Plan). This includes higher frequency transit service along Highway 43 between Oregon City and downtown Portland. The forecasts also assume that Transportation Demand Management (TDM) will occur within the region and the city (see Chapter 8 of the city's Transportation System Plan for recommendations pertaining to modified parking standards and expanded park and ride lots).

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Future Needs Analysis

Circulation and Capacity Needs

The motor vehicle capacity and circulation needs in West Linn were determined for future conditions based on the travel forecasts described in the previous section. The process used for analysis is outlined below, followed by the findings and recommendations of the analysis. The extent and nature of the street improvements for West Linn are generally consistent with current transportation plans. This section outlines the type of street improvements that would be necessary as part of a long range master plan. Phasing of implementation will be necessary since improvements cannot all be done at once. This will require prioritization of projects and periodic updating to reflect current needs. Most importantly, it should be understood that the improvements outlined in the following section are a guide to managing growth in West Linn and defining the types of right-of-way and street needs that will be required as development occurs.

Future Needs

Future transportation conditions were evaluated in a similar manner to existing conditions. Improvements to intersections, roadways between intersections, and brand new or extended facilities were considered and a package of recommended improvements was determined.

Forecasts of 2020 traffic volumes were developed using the forecast model. These data were reviewed and refined to produce detailed year 2020 PM peak hour traffic forecasts at intersections. When assigned to the roadway network, this level of traffic growth is expected to create the need for improvements at several locations.

Figure 3-8: Comparative Peak Hour Traffic Volumes--1998 and 2020

Tables 3-16 and 3-17 summarize the intersection levels of service for year 2020 using two scenarios. The first is base (unmitigated) future conditions and the second is, where required, a mitigated scenario. The notes in the tables indicate the type of mitigation measure that was applied to achieve the improved service level conditions. The complete intersection calculation worksheets are listed in the Technical Appendix. These mitigation measures are in a later section of this report for the Recommended Plan.

Table 3-16: 2020 Signal Controlled Intersection Conditions (PM Peak Hour)

	2020 Base			***2020 Mitigated***		
Intersection Mitigation*	*Delay*	*LOS*	*V/C*	*Delay*	*LOS*	*V/C*

Highway 43/Marylhurst Dr	>60	F	>1.0	>60	F	>1.0
Highway 43/Cedaroak Dr (2)	>60	F	>1.0	29.3	D	0.99
Highway 43/Hidden Springs Dr (2)	24.9	C	>1.0	28.0	D	0.99
Highway 43/Elliott Street	>60	F	>1.0	>60	F	>1.0
Highway 43/McKillican St (2)	>60	F	>1.0	22.0	C	0.99
Highway 43/I-205 SB Ramps (2,3)	>60	F	>1.0	23.0	C	0.95
Highway 43/I-205 NB Ramps	19.7	C	0.95	19.7	C	0.95
Highway 43/Willamette Falls Drive (2,3)	>60	F	>1.0	47.2	E	>1.0
10th Street/Blankenship-Salamo** (4)	17.0	C	0.71	34.4	D	0.99
10th Street/I-205 SB Ramps** (2,4)	>60	F	>1.0	--	--	--
10th Street/I-205 NB Ramps (2)	>60	F	>1.0	20.4	C	0.85

Notes: Delay = Average Delay per Vehicle, LOS = Level of Service, V/C = Volume-to-Capacity Ratio

* Mitigation Measures = (1) Access Restrictions, (2) Upgrade or Install Traffic Signal Controls; (3) Add Turn Lane Channelization; (4) Road Re-alignment or Extension

** Salamo Road/Blankenship Road/10th Street intersection combined with I-205 SB Ramp intersection to form one intersection. This calculation assumes traffic signal controls, but a roundabout design is a viable alternative for this location.

The Highway 43 intersections generally exceed planned capacity for three lanes throughout the length of the city by 2020. All but two of the monitored intersections will drop to Level of ServiceF conditions. Other minor street intersections not included in this analysis will also have severe delays for the side streets entering the highway during peak hours (see Table 3-17). Table 3-16 also shows that the 10th Street interchange ramps will exceed their capacity.

Table 3-17: 2020 Non-Signal Controlled Intersection Conditions (PM Peak Hour)

	2020 Base	***2020 Mitigated***		
Intersection Mitigation*	*Level of Service*	*Delay*	*LOS*	*V/C*
STOP Sign Controls (Major Street/Minor Street Most Delayed Movement)				
Cornwall /Lancaster	A/A	A/A		
Highway 43/Dillow St. (1)	C/F	C/C		
Highway 43/Failing St. (1)	C/F	C/C		
Highway 43/Jolie Pointe	B/F	B/F		
Highway 43/Mapleton	C/F	C/F		
Highway 43/Pimlico Dr. (2,3)	F/F	>60	F	>1.0
Rosemont Road/Hidden Springs	A/C	A/C		
Willamette Falls/12th St.	D/F	D/F		

Willamette Falls/Dollar St.	B/D	B/D		
Willamette Falls/Sunset Av. (2,3)	F/F	17.5	C	0.91
Willamette Falls/West "A" St. (2,3)	B/F	>60	F	>1.0
All-Way-Stop Controlled Intersections (Average for All Movements)				
Rosemont Rd/Salamo Rd. (2,3)	F	16.1	C	0.75
Summit St./Rosemont Rd.	A	A		
10th St./Willamette Falls (2,3)	F	36.1	D	0.98
Notes: Delay = Average Delay per Vehicle, LOS = Level of Service, V/C = Volume-to-Capacity Ratio * Mitigation Measures = (1) Access Restrictions, (2) Upgrade or Install Traffic Signal Controls; (3) Add Turn Lane Channelization; (4) Road Re-alignment or Extension				

Referring to Table 3-17, the street improvement measures on Highway 43 were limited to an ultimate 3-lane street cross-section. The forecasted peak hour volumes on Highway 43 cannot be adequately served at several locations, even with the addition of traffic signal controls (e.g., Elliott Street and Pimlico Drive). Moreover, intersections without traffic signals will have severe delays (LOS F) for left-turning movements onto the highway during this period.

Traffic Signal Guidelines

Traffic signal warrant analyses were performed for all unsignalized intersections operating at LOS E or worse under future base (2020) conditions. The results listed in Table 3-18 show that all of these intersections will exceed the minimum traffic volume warrants by 2020. Traffic signal warrants were based on the *Manual on Uniform Traffic Control Device*'s (MUTCD) Warrant 11 (Peak Hour Volume). All traffic control devices should meet MUTCD standards prior to their installation. On arterial streets, signals should generally be spaced at least 1,000 feet apart for efficient operation. A detailed traffic engineering evaluation shall be conducted before the installation of any traffic signal. ODOT signal design and signal phasing guidelines should be followed for all traffic signal installations.

Table 3-18: Traffic Signal Warrants – MUTCD Peak Hour Volume Warrant

Intersection	*Warrant Met 1998?*	*Warrant Met 2020?*
10^{th} Street/I-205 NB Ramps	Yes	Yes
10^{th} Street/I-205 SB Ramps	Yes	Yes
10^{th} Street/Willamette Falls Drive	No	Yes
Highway 43/Pimlico Drive	No	Yes
Highway 43/Willamette Falls Drive	Yes	Yes
Rosemont Road/Salamo Road	No	Yes
Willamette Falls Drive/Sunset	No	Yes
Note: Traffic volumes should be monitored on a periodic basis to determine when the minimum warrant levels will be reached. Traffic signals should not be installed at any location until traffic volumes meet or exceed these levels.		

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Assessment of Need

Based upon the evaluation of intersection level of service, a total of 12 of the study intersections operate below level of service D in the 2020 evening peak hour with planned improvements. Another six intersections will have severe delays for side street approaches to major roads and highways. Today, none of the major intersections operated below LOS D and four intersections controlled by STOP signs have severely delayed minor street approaches. The future growth caused by nearly 4,000 additional trips in the evening peak hour in 2020 as compared to today plus a substantial diversion of regional traffic onto city street facilities combines to cause heavy congestion at many locations. Specific issues to be addressed in developing the street plan include the following.

Highway 43

The heavy forecasted travel demand for this corridor (up to 1,800 vehicles in the peak travel direction) is consistent with the capacity of a five-lane facility. A five-lane facility was previously recommended in the city’s 1991 Transportation Plan although sufficient street right-of-way for the full five-lane road cross-section is not available through the corridor. The city’s current Capital Improvement Program allows for widening of Highway 43 up to five lanes. The Regional Transportation Plan indicates boulevard street improvements between Pimlico Street and the Willamette River.

However, the West Linn Tomorrow Task Force that reviewed the street element update directed the consultant to seek other means to serve this growth in travel demand rather than widening the roadway. The pending Comprehensive Plan update includes two Opportunity Areas for redevelopment along Highway 43, one in the Robinwood area near Hidden Springs Road and the other in the Bolton area near McKillican Street. Features of these Opportunity Areas include a higher level of pedestrian accessibility, possible on-street parking opportunities, and a general "main street" type of environment. The task force considered that these types of features could not be achieved effectively along a five-lane highway facility.

The Transportation Planning Rule requires that a local street master plan be designed to adequately serve horizon year growth. The alternative approach to sizing the street system to meet travel demands is to accept a higher level of vehicle congestion during peak periods as defined by the city’s street performance measures. More specifically, this approach involves selecting more congested performance measures that tolerate longer delays and lower travel speeds on this Principal Arterial during peak travel periods. Highway 43 is a unique roadway facility in the city in this regard. Other city streets will be held to higher performance standards. In addition to the alternative performance measures, limited capacity improvements are recommended at selected Highway 43 intersections and an expanded access management plan is presented later in this report.

Interstate 205 Traffic Diversion

Forecasts for I-205 show a 70 percent increase in traffic volumes during the peak afternoon hour compared to today's volumes. This growth cannot be adequately served by planned freeway improvements because they add less than 50 percent capacity compared to the existing system. It is expected that substantial diversions will occur onto parallel local street facilities during commute hours. This phenomena occurs periodically today, and it is expected to increase in magnitude and frequency in the future as travel demands on I-205 outstrip capacity improvements. This traffic diversion is most evident along Borland Road and Willamette Falls Drive, where this added regional diversion traffic impacts many of the intervening intersections.

In determining the needs for these travel routes, it will be important to balance the need for local access and circulation with the enhanced attractiveness of an alternative commuter route. One element of the I-205 diversion problem may be mitigated by implementation of freeway ramp meters at the two local interchanges. These ramp meters effectively create a time penalty for regional commuters that "ramp jump" from one interchange to another along parallel local facilities. The extra time incurred by these travelers at the on-ramp meter may discourage some of this diversion activity. ODOT plans to implement ramp meters at all of the freeway ramps along I-205.

10th Street Corridor

The present configuration of the 10th Street interchange has closely spaced local street intersections that cannot adequately serve future traffic volumes. The freeway ramp terminals are forecast to operate at LOS F during peak hours, even with traffic signal controls. The close spacing of intersections will cause vehicle queues to extend into adjoining intersections, creating "gridlock" during the busiest travel hours. These types of "gridlock" condition near freeway interchanges can be observed today in other areas of Clackamas County at Sunnyside Road near I-205 and on Boones Ferry Road near I-5.

The latest plan for the corridor as developed by a consultant for the city had a preferred solution that relocated the existing ramp terminals closer to the freeway mainline. This relocation would provide better separation to adjoining city street intersections. Unfortunately, it required a six-lane street cross section under the freeway overpass. This $2.1 million improvement is included in the city's Capital Improvement Plan, but it is not shown in Metro's RTP or the State Transportation Improvement Plan.

An alternative plan was investigated in this study to meet future demands with a lesser street improvement investment. This alternative plan for the 10th Street freeway interchange involved relocating the southbound off-ramp to connect directly to Salamo Road instead of 10th Street. As shown in Alternative "A" in Figure 3-9 and in the attached visual simulation in the appendix, this concept has three primary benefits:

- It eliminates one of the two intersections north of I-205,
- Removes the high volume of traffic exiting the freeway that is bound for uphill Salamo Road from the immediate interchange area, and it

- Requires only four travel lanes under I-205 between the ramp junctions.

Figure 3-9: 10th Street/I-205 Interchange Alternatives

The south side of the interchange need not be modified in this concept. It was further considered that the intersections on 10th Street could be controlled by a roundabout design rather than installing traffic signal controls. The roundabout concept was tested with the 2020 volumes and it was found to comply with the parameters established by ODOT for these applications. The advantages of roundabouts compared to traffic signals include the followings:

- Overall less delay for traffic using the intersection
- Less frequent and less severe traffic collisions, and
- Less on-going maintenance costs.

However, the application of a roundabout design should also consider that these solutions are relatively new to this area and they are not familiar to most of the motoring public. They also do not have pedestrian signals for crossing street legs, so pedestrian traffic must cross similar to the existing unsignalized intersection condition.

Futher Engineering Study Required

– Further study will be required to comply with the National Environmental Protection Act (NEPA) guidelines for transportation facility planning prior to its adoption into the regional, state and federal plans. This study would be initiated by the City of West Linn and could involve either a complete Environmental Impact Statement, an Environmental Assessment, or a Categorical Exemption, depending on the scope of possible issues.

Highway 43 at Willamette Falls Drive

A similar intersection spacing problem was identified on Highway 43 near I-205. Plans include adding traffic signal controls along with widening for turn lanes at the Willamette Falls Drive intersection with Highway 43 (the existing traffic volumes exceed minimum level required for traffic signals). This improvement project is in the city's Capital Improvement Plan and in Metro's RTP. However, ODOT has deferred this improvement because the intersection is so close to the northbound freeway ramp junction that vehicle queues are likely to overlap between the two intersections if traffic signals are installed. The traffic queues on Willamette Falls Drive during peak hours have been observed to be several hundred feet long under today's peak hour conditions. Traffic signal controls would help reduce these delays, but it would have significant secondary impacts to traffic on Highway 43.

Lack of Intersection Turning Lane Capacity.

Several intersections along Highway 43 and Willamette Falls Drive will have lower Levels of Service in the year 2020 that would be best served by turn lane channelization rather than added through capacity. These improvements are identified in a later section of this report.

Alternative Performance Measures

Several of the Highway 43 intersections will still operate below LOS D during the peak hour even with mitigation measures for a 3-lane facility. These improvements include traffic signal controls and separate right or left-turn lanes. Several other intersections are expected to be very close to the LOS D threshold. Rather than recommend additional corridor capacity improvements, alternative performance measures for this corridor were evaluated to augment the general Level of Service standards; these performance measures will apply only to the Principal Arterial route of Highway 43.

Arterial Level of Service

The first alternative performance measure considers the average travel speeds along the length of the corridor, rather than the congestion level of a specific intersection. This approach builds from the baseline travel surveys that were conducted on this corridor to measure average speeds in 1998. The forecasted 2020 volumes were re-evaluated to determine the expected travel speeds as summarized below in Table 3-19.

The southbound speeds drop sharply overall compared to recent surveys, while the northbound flows are generally similar to today's speeds. The slowest speeds are expected in the north section between Marylhurst Avenue and Hidden Springs Road in the southbound direction. The resulting Level of Service based on *Highway Capacity Manual* is shown in the last row of the table. The northbound direction operates at LOS C overall. The southbound direction functions at LOS F with no improvements, and LOS E with appropriate turn lanes and traffic signal control improvements.

The criteria for the corridor would be to maintain LOS E or better during the peak commute hour. The determination of average travel speeds would be done according to the *Highway Capacity Manual* methodology and standard engineering practice for data collection.

Table 3-19: Highway 43 Arterial Average Speeds (2020 PM Peak Hour)

Section	*Average Speed (No Improvements)*		*Average Speed (Mitigated)*	
	NB	*SB*	*NB*	*SB*

Marylhurst to Hidden Springs	13	5	15	17
Hidden Springs to Failing	30	13	29	11
Failing to Oregon City Bridge	17	6	20	9
Overall Average Speed	20	8	22	11
Overall Level of Service	C	F	C	E
Note: Baseline travel surveys in 1998 showed overall average travel speeds on Highway 43 within city limits of 23 mph in the NB and 20 mph in the SB directions.				

Two-Hour Peak Period

The second alternative measure considers a broader commute period than the standard single peak hour. The method compares the two-hour volume for each road link with the planned link capacity. The acceptable operating standard is LOS F during the 1st peak hour and LOSE during the second peak hour. Metro has applied this measure in developing the latest round of RTP improvements to capture temporal travel shifts in response to recurring congestion as provided in Policy 13.0 – Regional Motor Vehicle System. The new Metro standard applies to designated Regional Center, Town Center and Station Area. This measure of performance is also reflected in the *1999 Oregon Highway Plan* for state facilities.

The principal drawback for this measure applied on a local basis is that it is most appropriate for large scale planning efforts and requires access to the Metro travel demand forecast model. Also, the forecasted 2020 volumes on Highway 43 exceed the thresholds identified by Metro and by the Oregon Highway Plan. The two-hour volume-to-capacity ratio is expected to be over 1.00 within the next 20 years on Highway 43.

Recommended Highway 43 Performance Measure

For principal arterial facilities (Highway 43), the corridor level of service based on the arterial level of service methodology described in the *Highway Capacity Manual* will apply when individual intersections fall below the city street performance standards. Arterial level of service will be determined according to the methods presented in the *Highway Capacity Manual*, Chapter 11, 1998 (or current version) with a minimum Level of Service E. This performance standard applies only to Principal Arterial streets. Standards for other city streets are discussed in the next section.

Recommended Plan

This section summarizes needs for the recommended street element plan and operating criteria for the motor vehicle system in the City of West Linn. The needs and criteria were identified in working with the City's West Linn Tomorrow! Task Force. This group explored automobile needs in the City of West Linn and provided input about how they would like to see the transportation system in their city develop. The Motor Vehicle modal plan is intended to be consistent with other jurisdictional plans including Metro's *Draft Regional Transportation Plan (RTP)*, Clackamas County's *Transportation Plan*, and ODOT's *Oregon Highway Plan (OHP)*.

The motor vehicle element of the TSP involves several elements as shown in **Figure 3-10.** This chapter is separated into the following sections:

- Functional Classification
- Circulation and Capacity Needs
- Alternatives
- Safety
- Maintenance
- Neighborhood Traffic Management
- Parking
- Access Management
- Transportation System Management/Intelligent Transportation Systems

Functional Classification

Roadways have two functions, to provide mobility and to provide access as shown in **Figure 3-11.** From a design perspective, these functions can be incompatible since high or continuous speeds are desirable for mobility while low speeds are more desirable for land access. Arterial facilities emphasize a high level of mobility for through movement; local facilities emphasize the land access function; and collectors offer a balance of both functions.

Functional classification has commonly been mistaken as a determinant for traffic volume, road size, urban design, land use and various other features which collectively are the elements of a roadway, but not its function. For example, the traffic on a roadway can be more directly related to adjoining land uses and is not necessarily determined by how much traffic it carries. The traffic volume, design (including access standards) and size of the roadway are outcomes of function, but do not define function.

Function can be best defined by connectivity. Without connectivity, neither mobility nor access can be served. Roadways that provide the greatest reach of connectivity are the highest level facilities. Arterials can be defined by regional level connectivity. These routes go beyond the city limits in providing connectivity and can be defined into two groups: principal arterials (typically state routes) and arterials. The movement of persons, goods and services depends on an efficient arterial system. Collectors can be defined by citywide or district wide connectivity. These routes span large areas of the city but typically do not extend significantly into adjacent jurisdictions. They are important to city circulation. The past textbooks on functional classification then define all other routes as local streets, providing the highest level of access to adjoining land uses. These routes do not connect at any significant regional, citywide or district level.

Recent work in the area of neighborhoods and their specific street needs provides a fourth level of functional classification, neighborhood route. In many past plans, agencies defined a minor collector or a neighborhood collector; however, use of the term collector is not appropriate. Collectors provide citywide or large district connectivity and circulation. There is a level between collector and local streets that is unique due to its level of connectivity. Local streets can be cul-de-sacs or short streets that do not connect to anything. Neighborhood routes are commonly used by residents to circulate into or out of their neighborhood. They have connections within the neighborhood and between neighborhoods. These routes have neighborhood connectivity, but do not serve as citywide streets. They have been the most sensitive routes to through, speeding traffic due to their residential frontages. Because they do provide some level of connectivity, they can commonly be used as cut-through routes in lieu of congested or less direct arterial or collector streets that are not performing adequately. Cut-through traffic has the highest propensity to speed, creating negative impacts on these neighborhood. By designating these routes, a more systematic citywide program of neighborhood traffic management can be undertaken to protect these sensitive routes.

Figure 3-11: Street Function Relationship

In the past, traffic volume and roadway sizes were linked to functional classification. More recently, urban design and land uses have also been tied to functional classification. Discussions of neo-traditional street grids that eliminate the need for functional classification adds another commentary. The planning effort to identify connectivity of routes in West Linn is essential to preserve and protect future mobility and access, by all modes of travel. In West Linn, it is not possible to have a citywide neo-traditional grid layout. Past land use decisions, topography and environmental features make it difficult to adopt a traditional network scheme. Without defining the varying levels of connectivity now in the TSP, the future impact of the adopted Comprehensive Plan land uses will result in a degraded ability to move goods and people (existing and new) in West Linn. The outcome would be intolerable delays and much greater costs to address solutions later rather than sooner. By planning an effective functional classification of West Linn streets, the City can manage public facilities pragmatically and cost effectively.

These classifications do not mean that because a route is an arterial it is large and has lots of traffic. Nor do the definitions dictate that a local street should only be small with little traffic. Identification of connectivity does not dictate land use or demand for facilities. The demand for streets is directly related to the land use. The highest level connected streets have the greatest potential for higher traffic volumes, but do not necessarily have to have high volumes as an outcome, depending upon land uses in the area. Typically, a significant reason for high traffic volumes on surface streets at any point can be related to the level of land use intensity within a mile or two. Many arterials with the highest level of connectivity have only 33 to 67 percent "through traffic". Without the connectivity provided by arterials and collectors, the impact of traffic intruding into neighborhoods and local streets goes up substantially.

If land use is a primary determinant of traffic volumes on streets, then how is it established? In Oregon, land use planning laws require the designation of land uses in the Comprehensive Plan. West Linn's Comprehensive Plan has designated land uses for over two decades. These land use designations are very important not only to the City for planning purposes, but also to the people that own land in West Linn. The adopted land uses in West Linn have been used in this study, working with the Metro regional forecasts for growth in the region for the next 20 years. A regional effort, coordinated by Metro and local agencies, has been undertaken to allocate the determined overall land use in the most beneficial manner for transportation. Without this allocation, greater transportation impacts would occur (wider and more roads than identified in this plan). If the outcome of this TSP is either too many streets or solutions that are viewed to be too expensive, it is possible to reconsider the core assumptions regarding West Linn's livability - its adopted land uses or its service standards related to congestion. The State mandated element of the TSP is to develop a set of multi-modal transportation improvements to support the Comprehensive Plan land uses. A major component of this planning task is the functional classification of streets.

Functional Classification Definitions

The proposed functional classification of streets in West Linn is represented by **Figure 3-12.** Any street not designated as a freeway, arterial, collector or neighborhood route is considered a local street.

Freeways

are state or interstate facilities that provide regional travel connections. These routes have the highest carrying capacity and the most restrictive access requirements. Two local freeway interchanges at 10th Street and at Highway 43 serve the entire city of West Linn. Interchanges are grade-separated facilities with arterial or principal arterial streets. No intermediate vehicular or pedestrian access is allowed.

Principal Arterials

are typically state highways that provide the high level roadway capacity to local land uses. These routes connect over the longest distance (sometimes miles long) and are less frequent than other arterial or collectors. These highways generally span several jurisdictions and many times have statewide importance (as defined in the ODOT State Highway Classification).

Arterial streets

serve to interconnect and support the principal arterial highway system. These streets link major commercial, residential, industrial and institutional areas. Arterial streets are typically spaced about one mile apart to assure accessibility and reduce the incidence of traffic using collectors or local streets in lieu of a well placed arterial street. Many of these routes connect to cities surrounding West Linn. This designation represents a change from the city's previous function classification system that had a major and minor arterial designation. The new naming convention will combine them into one category, arterial streets

Collector streets

provide both access and circulation within residential and commercial/industrial areas. Collectors differ from arterials in that they provide more of a citywide circulation function, do not require as extensive control of access and penetrate residential neighborhoods, distributing trips from the neighborhood and local street system.

Neighborhood routes

are usually long relative to local streets and provide connectivity to collectors or arterials. Because neighborhood routes have greater connectivity, they generally have more traffic than local streets and are used by residents in the area to get into and out of the neighborhood, but do not serve citywide/large area circulation. They are typically about a quarter to a half mile in total length. Traffic from cul-de-sacs and other local streets may drain onto neighborhood routes to gain access to collectors or arterials. Because traffic needs are greater than a local street, certain measures should be considered to retain the neighborhood character and livability of these routes. Neighborhood traffic management measures are often appropriate (including devices such as speed humps, traffic circles and other devices to be referred to in a later section in this chapter). However, it should **not** be construed that neighborhood routes automatically get speed humps or any other measures. While these routes have special needs, neighborhood traffic management is only one means of retaining neighborhood character and vitality.

Local Streets

have the sole function of providing access to immediate adjacent land. Service to "through traffic movement" on local streets is deliberately discouraged by design.

Functional Classification Changes

The proposed functional classification differs from the existing approved functional classification. Neighborhood routes were not defined in the existing functional classification. The proposed functional classification was developed following a detailed review of West Linn's, Clackamas County's and Metro's current proposals for functional classification. Table 3-20 summarizes the major differences between the proposed functional classification and the existing designations for streets in West Linn. Table 3-21 outlines the streets that were previously designated collectors that are now identified as neighborhood routes.

Table 3-1: Proposed Changes to Existing Roadway Classification

	Roadway Classification According to Jurisdiction			*Proposed*
Roadway	*West Linn*	*Clackamas Co.*	*Metro*	*New TSP*
Bland Circle	Local	Not Classified	Not Classified	Collector
Blankenship Road	Minor Arterial	Minor Arterial	Not Classified	Collector
Dollar Street	Minor Arterial	Minor Arterial	Not Classified	Collector
Interstate 205	Principal Arterial	Freeway	Freeway	Freeway
Tannler Drive	Minor Arterial	Minor Arterial	Not Classified	Collector

Criteria for Determining Changes to Functional Classification

The criteria used to assess connectivity have two components: the extent of connectivity (as defined above) and the frequency of the facility type. Maps can be used to determine regional, city/district and neighborhood connections. The frequency or need for facilities of certain classifications is not routine or easy to package into a single criterion. While planning textbooks call for arterial spacing of a mile, collector spacing of a quarter to a half mile, and neighborhood connections at an eighth to a sixteenth of a mile, this does not form the only basis for defining functional classification. Changes in land use, environmental issues or barriers, topographic constraints, and demand for facilities can change the frequency for routes of certain functional classifications. While spacing standards can be a guide, they must consider other features and potential long term uses in the area (some areas would not experience significant changes in demand, where others will). Linkages to regional centers and town centers are another consideration for addressing frequency of routes of a certain functional classification. Connectivity to these areas is important, whereas linkages that do not connect any of these centers could be classified as lower levels in the functional classification.

Table 3-2: Collector or Local Street Changed to Neighborhood Route

Street Name	*Current Designation*
19th Street (Blankenship to Willamette Falls Drive)	Local
Barrington Drive (Salamo to Riverknoll)	Local
Beacon Hill Drive (Riverknoll to Imperial)	Local
Broadway Street (McKillican to Willamette Falls)	Local
Cedaroak Drive	Collector
Dillow Road	Collector
Exeter Street (Oxford to Long)	Collector
Greene Street	Local
Horton Road	Collector
Imperial Drive	Local

Killarney Drive	Local
Long Street (Exeter to Simpson)	Collector
Oxford Street	Collector
Ponderay Drive	Local
Riverknoll Way	Local
Shannon Lane	Local
Suncrest Drive (Carriage Way to Hidden Springs)	Local

Characteristics of Streets for each Functional Classification

The design characteristics of streets in West Linn were developed to meet the function and demand for each facility type. The actual design of a roadway can vary from segment to segment due to adjacent land uses and demands. The street system definition should allow standardization of key characteristics to provide consistency, but it should also provide criteria for application that provides some flexibility, while meeting standards. Figures 3-13 through 3-16 depict sample street cross-sections and design criteria for arterial, collector, neighborhood routes and local streets.

Figure 3-13: Arterial Street Sample Cross Sections

Figure 3-14: Collector Street Sample Cross Sections

Figure 3-15: Neighborhood Route Sample Cross Sections

Figure 3-16: Residential Local Street Sample Cross Sections

The analysis of capacity and circulation needs for West Linn outlines several roadway cross sections. The most common are 2 and 3 lanes wide. Where center left turn lanes are identified (3 lane sections) the actual design of the street may include sections without center turn lanes (2 lane sections) or without median treatments. This applies to Principal Arterial, Arterial and Collector streets alike. As noted on Figures 3-13, the arterial cross-sections can be narrowed to two-lanes where appropriate. This may be along areas where land access is very limited (e.g., Mary S. Young Park), or along Opportunity Areas where a center lane or median is not desirable. One such example would be the Willamette District that has limited space for an additional center lane. The actual center-lane or median treatment will be determined within the design and public process for implementation of each project. The plan outlines requirements that will be used in establishing right-of-way needs for the development review process.

Right-of-Way Requirements

Additional right-of-way should be planned to accommodate turn lanes wherever an arterial facility intersects with another arterial or a collector. The extra right-of-way should be considered within 500 feet of the intersection. **Figure 3-17** summarizes the West Linn streets that are anticipated within the TSP planning horizon to require right-of-way for more than two lanes. Planning level right-of-way needs can be determined utilizing Figure 3-11, Table 3-23 and the lane geometry outlined later in this chapter. Right-of-way needs should be monitored continuously through the development review process to reflect current needs and conditions. More specific detail may become evident in development review that requires improvements other than these outlined in this 20 year general planning assessment of street needs.

These cross sections are provided for guiding discussions that will update the City of West Linn *Standard Specifications for Public Works Construction*. There is an on-going discussion at the regional level regarding street cross sections. Metro has specified Regional Street Design designations in their draft of the RTP. These designations change over the length of the road. The City of West Linn will need to coordinate with regional agencies to assure consistency in cross section planning as the County Transportation Plan and the Metro Regional Transportation Plan move forward. The designations are summarized below.

Table 3-3: Metro Regional Street Design Designations

Roadway	*Designation*
Highway 43 (North city limits to Buck Street)	Regional Street

Highway 43 (Buck Street to Willamette Falls)	Regional Boulevard
Highway 43 (Willamette Falls to city limit)	Regional Street
Interstate 205	Freeway
Rosemont Road	Community Street
Salamo Road	Community Street
Willamette Falls Drive (West city limit to 16th Street.)	Community Street
Willamette Falls Drive (10th Street to 16th Street)	Community Boulevard
Willamette Falls Drive (10th Street to Hwy. 43)	Community Street
NOTE: Refer to Metro's RTP Policy Chapter for background on guidelines for streets, 1997.	

Connectivity/Local Street Plan

The local street network in West Linn is roughly 80 percent complete and, in many cases, well connected. Local streets account for just over 60 percent of the total road facilities in the city as measured in terms of the total length of street facilities for each functional class. Multiple access opportunities exist for entering or exiting neighborhoods; however, several locations in West Linn have a majority of neighborhood traffic funneled onto a single street. This type of street network results in out-of-direction travel for motorists and an imbalance of traffic volumes that impacts residential frontage. By providing connectivity between neighborhoods, out-of-direction travel and vehicle miles traveled (VMT) can be reduced, accessibility between various modes can be enhanced and traffic levels can be balanced out between various streets. Several transportation goals and policies in the Comprehensive Plan are intended to accomplish these objectives.

In West Linn, some of these local connections can contribute with other street improvements to mitigate capacity deficiencies by better dispersing traffic. Several roadway connections will be needed within neighborhood areas to reduce out-of-direction travel for vehicles, pedestrians and bicyclists. This is most important in the developing areas around the Tanner Basin. In addition, connectivity to neighborhoods east of Highway 43 can provide circulation to existing or future traffic signals that will result in less delay and better safety for access onto the highway. Figure 3-18 shows the proposed Local Street Connectivity Plan for West Linn. In some cases, the connector alignments are not specific and are aimed at reducing potential neighborhood traffic impacts by better balancing traffic flows on neighborhood routes. The arrows shown in the figures represent potential connections and the general direction for the placement of the connection. In each case, the specific alignments and design will be better determined upon development review.

The spacing criteria used for providing connections is as follows:

- Every 300 to 500 foot grid for pedestrians and bicycles
- Every 500 to 1,000 foot grid for automobiles

To protect existing neighborhoods from potential traffic impacts of extending stub end streets, connector roadways should incorporate neighborhood traffic management into their design and construction. Neighborhood traffic management is described later in this chapter.

The arrows in Figure 3-18 show priority connections only. Topography and environmental conditions limit the level of connectivity in West Linn. Other stub end streets in the City's road network may become cul-de-sacs, extended cul-de-sacs or provide local connections. Connections from these stub end streets could be deemed appropriate and beneficial to the public as future development occurs. The goal is to continue to improve city connectivity for all modes of transportation.

Figure 3-18 Local Street Connectivity Map

Recommended Improvement Plan

To address deficiencies noted in the previous section, a series of alternatives and strategies were considered. The range of strategies includes:

1. **Do nothing:**
   This results in severe impacts to motor vehicle and transit circulation in West Linn with delays which would not be tolerable.
2. **Assume that alternative modes can serve excess demand.**
   The transportation analysis assumed that alternative modes would be developed to their optimal levels. The order of magnitude of trips to be served in 2020 goes beyond the capacity of the alternative mode systems by themselves, even at their optimal levels.
3. **Pragmatically add capacity to all modes, developing a balanced system. Outline the long term configuration of streets to allow development to best accommodate needs.**
   This is the strategy that was pursued. It involves significant system improvements, but is the only alternative that balances performance between modes and it is consistent with regional policy.

The mitigation measures for the street system are outlined in a series of graphics and tables. **Figure 3-19** outlines the street and intersection improvements that are summarized in Table 3-23 and Table 3-24.

Road Improvements

The improvements that would mitigate 2020 conditions are described in Tables 3-23 and 3-24. Prioritization should occur in coordination with the CIP process. All improvements on arterial and collector streets shall include sidewalks, bike lanes and transit facilities. These improvement lists should be used as a starting point for inclusion in regional funding programs for streets.

Intersection Turning Capacity:

A series of intersection improvements were identified that primarily add turning movement capacity (Table 3-24 and **Figure 3-19**). These roadway improvements typically consist of left-turn and right-turn lanes and/or traffic signals. Ten of the study intersections require significant improvements. An alternative to traffic signal controls should be considered at the 10th Street interchange and at the Rosemont Road/Salamo Road intersection. These locations would be good candidates for a conventional roundabout design. The initial cost of the roundabout is similar to traffic signal controls, but the on-going maintenance costs are substantially less.

Table 3-23: Future Street Improvements

No.	*Location*	*Description*	*Estimated Cost (1998 dollars)*
1	Hwy 43 (North city limits to Marylhurst)	Widen to 3-lane principal arterial cross-section.	$1,066,000
2	Hwy 43 (Marylhurst to Cedaroak)	Widen to 3-lane principal arterial cross-section.	731,000
3	Hwy 43 (Hidden Springs to Jolie Pointe)	Construct 2-lane principal arterial cross-section with left-turn pockets as shown in Access Management Plan (Figure 3-20).	556,000
4	Hwy 43 (Pimlico to West "A" St.)	Widen to 3-lane principal arterial cross-section.	1,249,000
5	Hwy 43 (Failing to McKillican)	Widen to 3-lane principal arterial cross-section.	1,309,000
6	Hwy 43 (McKillican to Holly St.)	Widen to 5-lane principal arterial cross-section.	778,000
7	Rosemont Road (Hidden Springs to Santa Anita)	Widen to 3-lane minor arterial cross-section.	626,000
8	Rosemont Road (Santa Anita Dr Rd to Summit St)	Construct to city standard; add bike lanes and sidewalks.	1,929,000
9	Skyline Drive (Summit to Clark)	Construct to modified city standard; add bike lanes and sidewalks.	421,000
10	Skyline Drive (Clark to West "A")	Construct to modified city standard; add bike lanes and sidewalks.	1,166,000
11	Sunset Avenue	Construct to city standard. Add bike lanes and sidewalks.	1,677,000
12	Parker Road	Construct to 3-lane arterial standard.	1,555,000

13	10th Street Corridor	Alternative A: Re-Align SB Off-Ramp to Salamo Road. Construct round-abouts or traffic signals at ramp junctions. (Further study required before selecting preferred 10th Street corridor alternative.)	1,000,000 to 2,145,000
14	Willamette Falls Drive (Tualatin Bridge to 14th Street)	Upgrade to 3-lane arterial standard.	2,362,000
15-17	Willamette Falls Drive (10th Street to West "A")	Upgrade to 3-lane arterial standard.	4,111,000
18	Ponderay Drive	Extend 3-lane collector road to Parker Road opposite Shannon Lane.	1,260,000
19	Horton Rd (Miles Dr to existing Horton Rd)	Construct new 2-lane roadway to complete the collector facility.	1,502,000
Note: All Projects include sidewalks, bicycle lanes and transit accommodations as required.			

Table 3-2: City of West Linn 2020 Intersection Improvements

No.	*Intersection*	*Description**	*Estimated Cost (1998 dollars)*
1	Hwy 43/Willamette Falls Dr	Re-alignment of the intersection and installation of fully-actuated traffic signal or roundabout	$ 413,000
2	Hwy 43/Marylhurst Dr	Widen Marylhurst Drive eastbound approach to add right-turn lane	53,000
3	Hwy 43/Marylhurst Dr	Widen approaches on Highway 43 to add separate turn lanes	532,000

4	Hwy 43/Walling Circle	Align Walling Circle (N) with Walling Way, provide right turns only at Walling Circle (S). Install traffic signal at Walling Circle (N) when volumes meet warrant levels.	247,000
5	Hwy 43/Pimlico Dr	Widen approaches to add separate turn lanes. Install new traffic signal.	540,000
6	Hwy 43/Buck-Caufield	Widen Highway 43 north of Elliott Street to provide separate northbound left-turn lane.	300,000
7	Hwy 43/McKillican St	Widen approaches to add separate turn lanes.; transition from 5-lane to 3-lane section. Modify traffic signal.	779,000
8	Rosemont Rd/Hidden Springs Rd	Install Traffic Signal	359,000
9	Rosemont Road/Salamo Road	Install Traffic Signal or Rounabout	400,000
10	10th St/Willamette Falls Drive	Widen approaches to add separate turn lanes. Install new traffic signal.	281,000
11	Side Street Closures along Hwy 43	Closes existing side street access at Robinwood, Webb. Converts Willson and Easy to cul-de-sacs.	82,000
12	Traffic Signal Coordination – North	Install traffic-responsive traffic signal coordination system between Marylhurst Drive and Hidden Springs Road. (3,100 feet)	85,000
13	Traffic Signal Coordination – South	Install traffic responsive traffic signal coordination system between McKillican Street-Hood Street and Willamette Falls Drive (2,300 feet)	75,000
14	Traffic Signal Emergency Pre-Emption Equipment	Install emergency vehicle pre-emption equipment in all existing traffic signals	100,000
15	Tualatin Avenue/12th Street	Widen intersection to improve turning radius from Tualatin Avenue to southbound 12th Street.	200,000

Access Management

Access management is important, particularly on high volume roadways for maintaining traffic flow and mobility. In addition to the access management plan described in the previous section for Highway 43, access standards should be developed for other city streets including arterial, collector and local facilities. The close spacing and greater frequency of driveways or street intersections can significantly increase the number of conflicts and potential for accidents and decrease mobility and traffic flow. West Linn, as with every city, needs a balance between streets that provide access with streets that serve mobility.

Several access management strategies were identified to improve access and mobility in West Linn:

Provide left turn lanes where warranted for access onto cross streets.

Work with land use development applications to consolidate driveways where feasible.

Meet Clackamas County/ODOT access requirements on arterial facilities.

Establish City access standards for developments.

Develop city access requirements that are consistent with Metro Title 6 access guidelines.

The following recommendations are made for access management:

Incorporate a policy statement regarding prohibition of new single family residential access on arterials and collectors. A design exception process should be outlined that requires mitigation of safety and NTM impacts. This addresses a problem in West Linn where property owners consume substantial staff time on issues of residential fronting impacts.

Use ODOT standards for access onto Highway 43.

Access Spacing Standards

Access spacing standards for each street functional classification are guidelines to be applied to the location and provision access onto public streets. The standards provide a framework to ensure that the street facility will function as it is intended. A higher degree of connectivity is expected and allowed on local street whereas arterial facilities have much more restricted access. The city currently does not have standards established for street or driveway spacing. The following is recommended for use on arterial, collector and neighborhood route facilities. These standards will apply when constructing new street facilities, and in re-construction of existing streets or re-development of existing land uses. The access spacing requirements for

Highway 43, the city's only principal arterial are discussed in the next section.

Table 3-25: Proposed Street Access Spacing Guidelines

Roadway Functional Classification	*Area*	*Traffic Signals (miles)*	*Public Intersections (feet)*	*Private Driveways (feet)*	*Median Opening (feet)*
Arterial	Urban Opportunity	½ ¼	600 NA	300 NA	600 NA
Collector	All	¼	200	150	NA
Neighborhood Route	All	¼	150	100	NA
Local Residential Street	All	NA	100	50	NA
Local Commercial Street	All	NA	100	50	NA
"Urban" refers to intersections inside the West Linn urban growth boundary and outside the central business district or designated town centers. "Opportunity" refers to the designated opportunity areas located in the Robinwood, Bolton, and Willamette neighborhoods.					

Highway 43 Access Management Plan

In addition to modifying the performance standard for Highway 43, additional street improvements and access control measures are needed to maintain acceptable performance and safety conditions. The previous access management plan prepared for Highway 43 in the 1991 citywide study was updated and expanded in scope. The new plan recognizes that the 1999 *Oregon Highway Plan* requires additional access management of existing and future connections to Highway 43. One of the major additions to the new OHP is the inclusion of private driveways in considering access spacing. Previously, the spacing standards applied only to public road connections to state highway facilities. The OHP policies will be effective on January 1, 2000, and will apply to all new road construction, modernization, or requests for new public or private roadway connections. These standards do not retroactively apply to legal road approaches or private road crossings in effect prior to the OHP adoption except where new road construction or road connection is proposed as noted above.

Highway 43 is designated by ODOT as a District level facility according to the State Classification System. The spacing standards for this type of facility require a minimum of 400 to 500 feet between successive unsignalized intersections or driveways on the same side of the highway facility. The minimum spacing for intersections controlled by traffic signals is one-half mile (2,640 feet). The OHP does provide a process for making deviations to these standards depending on posted facility speed and proximity to urban development or a designated special transportation area. The lowest allowable spacing for a private driveway is 175 feet or mid-block if the current city block spacing is less than 350 feet. The Opportunity Areas in Robinwood and Bolton neighborhoods as defined in the city’s Comprehensive Plan may be two possible candidate locations for Special Transportation Area designations on Highway 43. The recommended street cross-section allows for on-street parking along these portions of the facility.

The new access management plan identifies intersections that will have left-turn pockets on the highway, those that have turn restrictions, and locations for future traffic signal controls and signal system coordination. The new access spacing standards implemented with the 1999 OHP will require modified access plans or deviations from the standards as new street improvements are completed. This will be particularly true for the numerous private driveways to residences that currently connect directly onto Highway 43. The recommended access management plan elements are summarized in Figure 3-20 and listed below.

Street Closures at Highway 43 (pedestrian and bicycle connectivity to be retained)

Robinwood Way, Hughes Drive, Barclay Street, Buck Street east of Highway 43, Caufield Street east of Highway 43, Davenport Street, Webb Street, Willson Street, Easy Street.

Several of these closures will be completed as part of the new traffic signal installation at Elliott Street. This includes Barclay Street, Buck Street, Caufield Street, and Davenport Street.

Turn Restrictions (right-turn movements to and from cross-streets)

Walling Circle (south intersection), Barlow Street, Failing Street, Mt. Hood Trail – Bolton School entrance, Bolton Street, Hollowell Street.

Left-Turn Pocket on Highway 43

Arbor Drive, Shady Hollow, Chow Mein Lane, Dillow Drive, Buck Street-Caufield Street (northbound Highway 43 turning west), Lewis Street, Burns Street, Holly Street.

Most of these modifications to access management and supplemental traffic signal controls can be combined with other identified improvement projects on Highway 43 (see Tables 3-23 and 3-24). The others have been included in Table 3-24 along with the individual intersection improvements.

Figure 3-20: Highway 43 Access Management Plan

Traffic Signals

To guide future implementation of traffic signals to locations which have the maximum public benefit by serving arterial/collector/neighborhood routes, a framework master plan of traffic signal locations was developed (Figure 3-21). The intent of this plan is to outline potential locations where future traffic signals would be placed to avoid conflicts with other development site oriented signal placement. To maintain the best opportunity for efficient traffic signal coordination on arterials, spacing of up to 1,000 feet should be considered. The minimum spacing recommended by ODOT on the city's only principal arterial, Highway 43, is half-mile spacing (2,640 feet). No traffic signal should be installed unless it meets *Manual on Uniform Traffic Control Devices* warrants. Traffic signal controls should be addressed within the transportation policy of West Linn:

Establishing a traffic signal spacing standard of 1,000 feet and a traffic signal master plan to guide future traffic signal placements. When this standard is not met, additional evaluation should be prepared to assure signal progression can be efficiently maintained;

Traffic signals disrupt traffic flow. Their placement is important for neighborhood access, pedestrian access and traffic control. To utilize limited placement of traffic signals to serve private land holdings will expand the potential for use that will generally benefit the public, neighborhoods and pedestrian access. Limiting placement of traffic signals to locations that are public streets would minimize or eliminate the potential for traffic signals solely serving private access.

Emergency Vehicle Pre-Emption

– The existing traffic signals do not have the capability to be pre-empted by emergency vehicles. This capability is a significant asset for reducing emergency response time. This technology is readily available and includes receivers at each intersection, transmitters in emergency vehicles, and control units attached to the existing signal controllers. The existing controllers may require upgrades to enable this feature. The general cost for adding these units is $10,000 per intersection. This type of installation is recommended for every traffic signal in the city.

Traffic Signal Coordination

– The existing traffic signals along Highway 43 operate independently. Signals spaced between 600 to 1,000 feet apart can operate more effectively with interconnected service to reduce delays and vehicle stops on main highway. To upgrade this signal will require interconnect cable, traffic detectors loops and new signal timing plans. The upgrade cost may range from $15,000 to $30,000 per location depending on the state of the existing equipment and the distance to the adjoining traffic signal.

Figure 3-21: Traffic Control Master Plan

Safety

Needs

Accident data was obtained for the City of West Linn from ODOT. Several strategies are suggested for improving safety in the City of West Linn. These strategies are aimed at providing the City with priorities that meet the goals and policies of the City.

- Work with other agencies such as Clackamas County and ODOT to help prioritize and fund safety programs in a coordinated approach
- Develop a citywide safety priority system which identifies high accident locations, ranks the locations and identifies safety mitigation measures
- Address safety issues on an as needed basis

Suggested Improvements

Most high accident locations are included in future street improvements listed previously in Tables 3-23 and 3-24. In the short term, specific action plans should be prepared to address whether beneficial improvements at these high accident locations can be made without affecting future improvement plans.

A future issue with regard to safety involves providing a center turn lane on facilities designated for three-lanes. As previously mentioned, the specific design of a three-lane facility may include segments without a no center turn lane or median. This decision should consider that national research has demonstrated the benefits of providing a turning lane when daily traffic volumes exceed 15,000 vehicles per day. While widening the street can commonly be viewed as pedestrian unfriendly, the potential impact of not having a turning lane is that accident rates will increase substantially (11 to 35 percent) on two lane roads compared to three lane roads.

One safety action that can have an immediate impact is to condition all land use development projects that require access on city streets to maintain adequate sight distance. This should address all fixed or temporary objects (plants, poles, buildings, signs, etc.) that potentially obstruct sight distance. Any property owner, business, agency or utility that places or maintains fixed or temporary objects in the sight distance of vehicles, bicycles or pedestrians should be required to demonstrate that adequate sight distance is provided (per American Association of State Highway and Transportation Officials).

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Maintenance

Preservation, maintenance and operation are essential to protect the City investment in transportation facilities. The majority of current gas tax revenues are used to maintain the transportation system. With an increasing road inventory and the need for greater maintenance of older facilities, protecting and expanding funds for maintenance is critical.

A Pavement Management System (PMS) is a systematic method of organizing and analyzing information about pavement conditions to develop the most cost effective maintenance treatments and strategies. As a management tool, it aids the decision-making process by determining the magnitude of the problem, the optimum way to spend funds for the greatest return on the dollar, and the consequences of not spending money wisely. West Linn maintains an annual program of pavement management and monitors conditions in setting priorities for overlays, slurry seals and joint sealing. The city already has a PMS program in place to meet these needs. With over 90 miles of roadway to maintain, road maintenance is one of the largest transportation expenditures, requiring roughly $270,000 per year.

A pavement management program can be a major factor in improving performance in an environment of limited revenues. The City of West Linn already uses a pavement management program that enables the public works professional to determine the most cost-effective maintenance program. The concept behind a pavement management system is to identify the optimal rehabilitation time and to pinpoint the type of repair that makes the most sense. With a pavement management program, professional judgment is enhanced, not replaced.

A visual inspection of West Linn’s surface street system was conducted. This inspection, basically a "report card" of the street system rates each roadway in West Linn. Table 3-26 summarizes the roadway maintenance funding history for the last four fiscal years.

A critical concept is that pavements deteriorate 40 percent in quality in the first 75 percent of their life. There is a rapid acceleration of this deterioration later, so that in the next 12 percent of life, there is another 40 percent drop in quality. The city’s PMS can identify when pavements will begin to deteriorate before rapid deterioration starts to focus preventative maintenance efforts cost effectively. These solutions are generally one-fifth to one-tenth the cost required after a pavement is 80 percent deteriorated. Figure 3-22 illustrates the pavement life cycle. For this reason, support of gradual increases to the gas tax to support maintenance is critical.

Table 3-1: City of West Linn Street Fund Budget Summary

Street Programs	*FY 98-99*	*FY 98-99*	*FY 99-00*	

	Budget	Actual	Budget	Description
Road Surface Maintenance	$315,700	$263,000	$271,800	Maintenance/Operation of Existing Street Network
Street Cleaning	$ 44,700	$44,700	$46,700	Annual sweeping/debris disposal program
Roadway Signs, Marking & Lighting	$328,500	$308,500	$324,300	All traffic control devices and street lighting
Street Operations	$531,800	$376,800	$542,200	Administrative and overhead costs
Neighborhood Traffic Mgmt.	$20,000	$20,000	$0	Traffic calming devices
Hwy. 43 Access Mgmt. Plan	$16,600	$0	$0	
Other Capital Projects	$62,700	$31,100	$58,700	Misc. improvements
Total				

Figure 3-22: Pavement Life Cycle

Neighborhood Traffic Management

Neighborhood Traffic Management (NTM) is a term that has been used to describe traffic control devices typically used in residential neighborhoods to slow traffic or possibly reduce the volume of traffic. NTM is descriptively called traffic calming due to its ability to improve neighborhood livability.

West Linn established a traffic safety committee that oversees neighborhood traffic issues among their other responsibilities. Over the past several years, the committee has analyzed, reviewed and responded to citizen or staff complaints relative to NTM measures such as speed humps and raised pavement markings. However, the City has no formalized NTM program that provides a quantitative framework for this decision-making process to enable staff to streamline their reviews and lessen overall staff time allocated to each complaint. Setting criteria in this way helps the public understand the types of street facilities and circumstances that qualify for consideration of NTM solutions and makes it possible to solicit their assistance to collect both data and support, as appropriate. The following examples of NTM strategies may be considered in the broader formal program:

- speed wagon (reader board that displays vehicle speed)
- speed humps
- traffic circles
- medians
- landscaping
- curb extensions
- chokers (narrows roadway at spots in street)
- narrow streets
- closing streets
- photo radar
- on-street parking
- selective enforcement
- neighborhood watch

Typically, NTM can be favorably received by residents adjacent to streets where vehicles travel at speeds above 30 MPH. However, NTM can also be a very contentious issue within and between neighborhoods, being viewed as moving the problem rather than solving it, impacting emergency travel or raising liability issues. A number of streets in West Linn have been identified in the draft functional classification as neighborhood routes. These streets are typically longer than the average local street and would be appropriate locations for discussion of NTM applications. A wide range of traffic control devices is being tested throughout the region, including such devices as chokers, medians, traffic circles and speed humps. NTM traffic control devices should be tested within the confines of West Linn before guidelines are developed for implementation criteria and applicability. Also, NTM may be considered in an area wide manner to avoid shifting impacts between areas and should only be applied where a majority of neighborhood residents agree that it should be done. Strategies for NTM seek to reduce traffic speeds on neighborhood routes, thereby improving livability. Research of traffic calming measures demonstrates their effectiveness in reducing vehicle speeds. Table 3-27 summarizes nationwide research of over 120 agencies in North America.

Table 3-27: Neighborhood Traffic Management Performance

		Speed Reduction (MPH)			*Volume Change (ADT)*			
Measures	No. of Studies	Low	High	Ave.	Low	High	Ave.	Public Satisfaction
Speed Humps	262	1	11.3	7.3	0	2922	328	79%
Speed Trailer	63	1.8	5.5	4.2	-	-	-	90%
Diverters	39	-	-	.4	85	3000	1102	72%
Circles	26	2.2	15	5.7	50	2000	280	72%
Enforcement	16	0	2	2	-	-	-	71%
Traffic Watch	85	.5	8.5	3.3	-	-	-	98%
Chokers	32	2.2	4.6	3.3	45	4100	597	79%
Narrow Streets	4	5	7	4.5	-	-	-	83%

SOURCE: *Survey of Neighborhood Traffic Management Performance and Results, ITE District 6 Annual Meeting, by R S. McCourt, July 1997.*

Expand NTM Program

It is recommended that the City explore the expansion of their NTM program to include a more formalized review, approval and implementation process. This program can use regional experience and success (e.g., the Cities of Portland and Gresham) to help prioritize implementation and address issues on a systematic basis rather than a reactive basis. Criteria should be established for the appropriate application of NTM in the City. This expanded program would include:

- traffic volume and speed warrants (typical minimums are 1,000 vehicles per day and an average vehicle speed of 30 mile per hour),
- special conditions for NTM measures on street functional classes other than neighborhood routes (generally, NTM measures are restricted to neighborhood routes only)
- standards for engineering design,
- annual available funding by city and opportunities for supplemental funding by private citizens or neighborhood associations,
- project scoring and ranking criteria for implementation,
- minimum required neighborhood support from effected property owners,
- other public process issues.

In addition, the city can continue to enable concerned public to be educated about the actual speeds of vehicles by making radar equipment available through field visits with staff or on a check-out basis.

Parking

Parking has typically been a benign transportation issue in the past for West Linn. New land uses were required to provide the code designated number of parking spaces to assure there would be no impact to surrounding land uses (overflow parking). These parking ratios were developed based upon past parking demand characteristics of each land use type. Most recently, parking has become an element of transportation planning policy through two actions. The adoption of the Transportation Planning Rule (TPR) in 1991, which was updated in November 1998 (sections 660-12-020(2g) and 660-12-045(5c)) and the Metro Functional Plan of November 1996, Title 2. By adopting the minimum and maximum parking ratios outlined in Title 2, the City will be able to address the TPR required reduction in parking spaces per capita over time.

Several strategies were identified to address the desire to reduce parking needs in West Linn:

- Shared parking
- Parking pricing
- Parking needs should be reviewed by individual developments at the site plan review stage. Parking provisions should be compared to demand, as identified by ITE or DEQ.

One of the concerns with parking reduction policies is the impact to adjacent land uses should the vehicle needs of a site exceed the provision of parking.

Transportation System Management/ Intelligent Transportation Systems

Transportation System Management (TSM) focuses on low cost strategies to enhance operational performance of the transportation system. Measures that can optimize performance of the transportation system include signal improvements, intersection channelization, access management (noted in prior section), HOV lanes, ramp metering, rapid incident response, and programs that smooth transit operation. The most significant measure that can provide tangible benefits to the traveling public is traffic signal coordination and systems. Traffic signal system improvements can reduce the number of stops by 35 percent, delay by 20 to 30 percent, fuel consumption by 12.5 percent and emissions by 10 percent. This can be done without the major cost of roadway widening.

Several of the strategies are elements of an Intelligent Transportation System (ITS) plan being implemented regionally by ODOT and participating agencies. ITS focuses on a coordinated, systematic approach toward managing the region’s transportation multi-modal infrastructure. ITS is the application of new technologies with proven management techniques to reduce congestion, increase safety, reduce fuel consumption and improve air quality. One element of ITS is Advanced Traffic Management Systems (ATMS). ATMS collects, processes and disseminates real-time data on congestion to alert travelers and operating agencies of problems so that they make better transportation decisions. Examples of future ITS applications include "smart" ramp meters, automated vehicle performance (tested recently in San Diego), improved traffic signal systems, improved transit priority options and better trip information available prior to making a vehicle trip. The travel information may include condition of roads, weather, alternative mode options, a "real time" transit schedule status, and the availability/ pricing of retail goods. Most of this information will be developed by ODOT or other ITS partners (private and public). The information will be available to drivers in vehicles, people at home, at work, at events or shopping. The Portland region is just starting to implement ITS and the City of Portland and ODOT have already developed their own ITS strategic plans.

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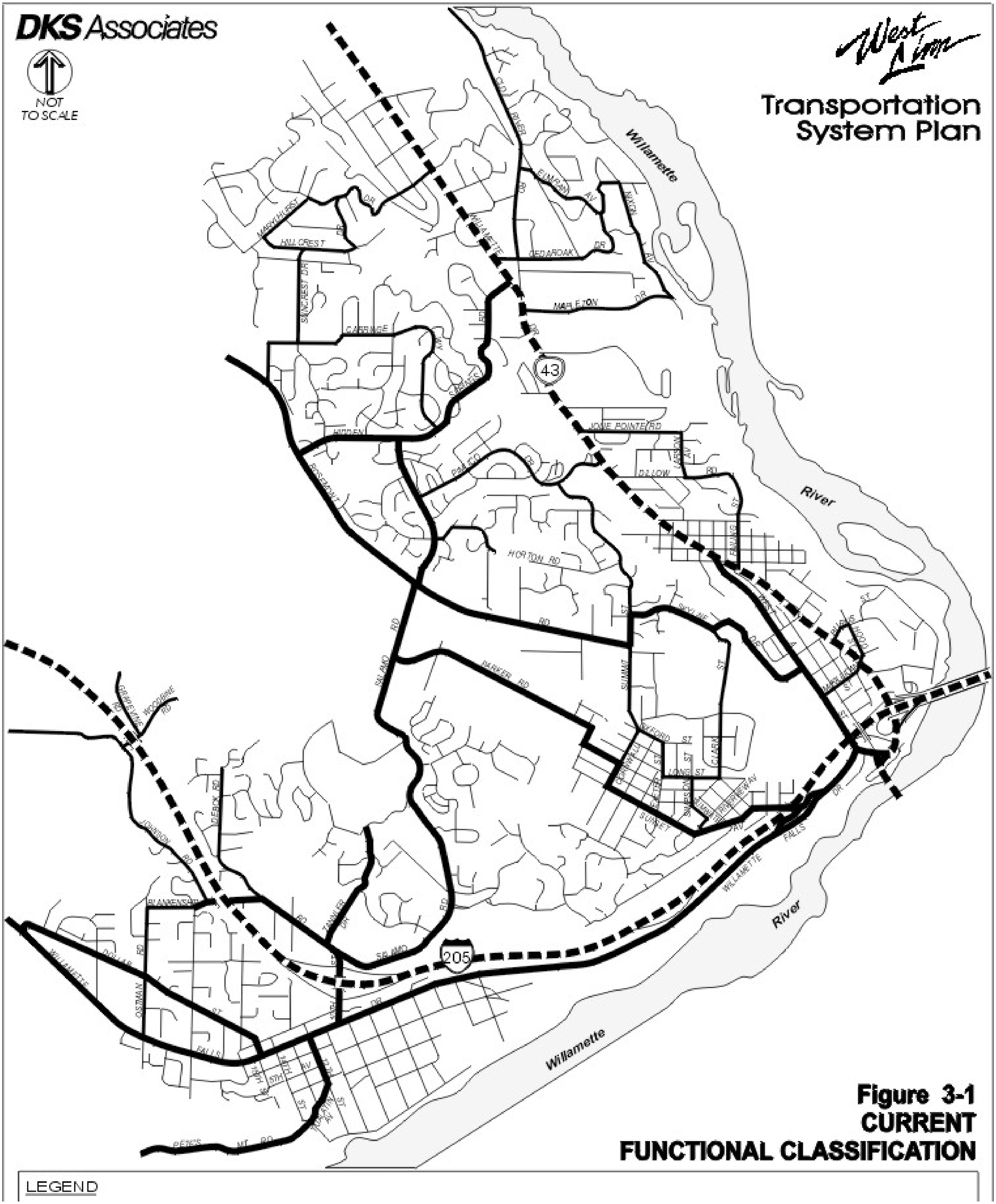


Figure 3-1
CURRENT
FUNCTIONAL CLASSIFICATION

LEGEND


LEGEND
- Major Arterial/Principal Route
- Minor Arterial
- Collector
- Local Street

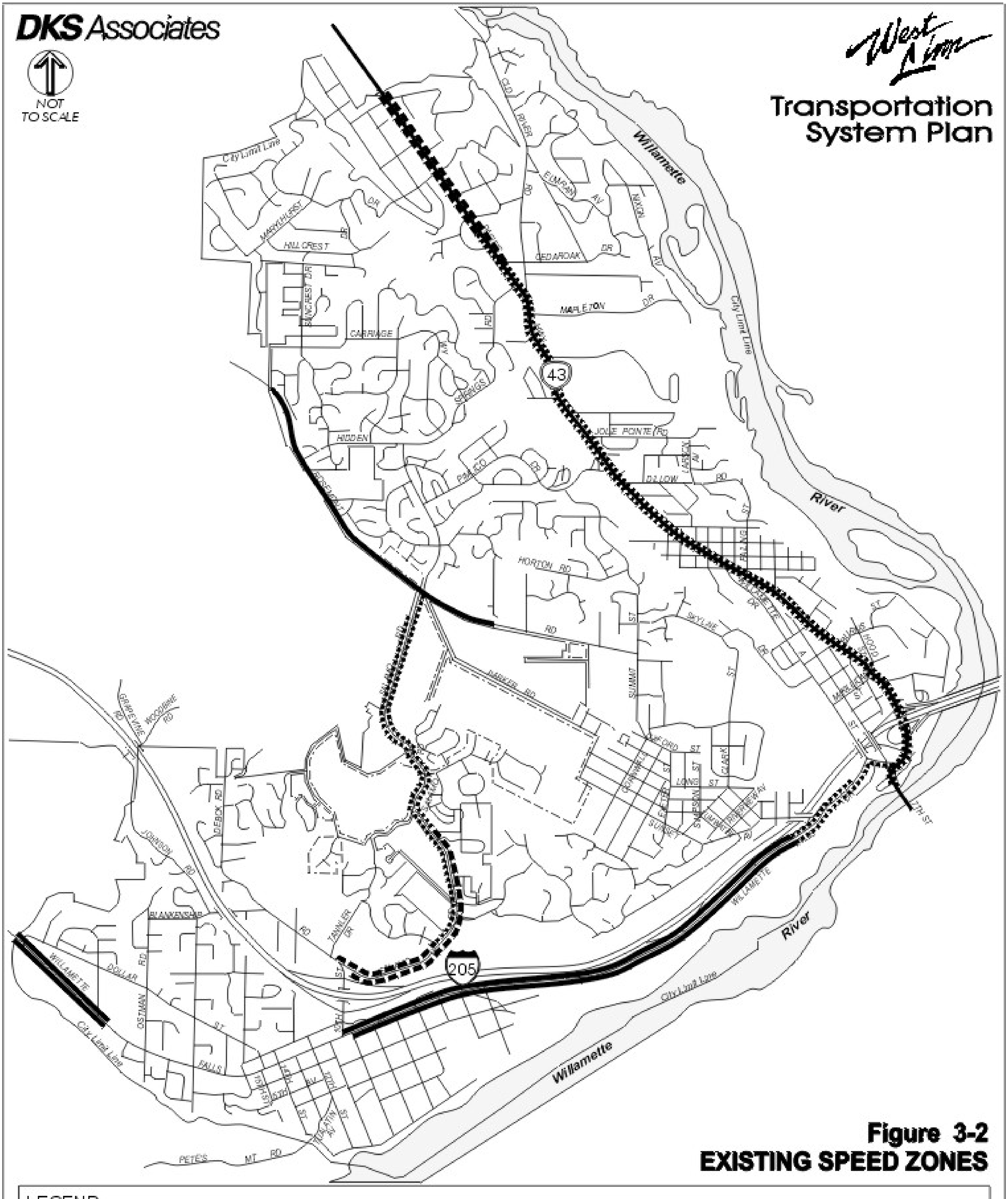
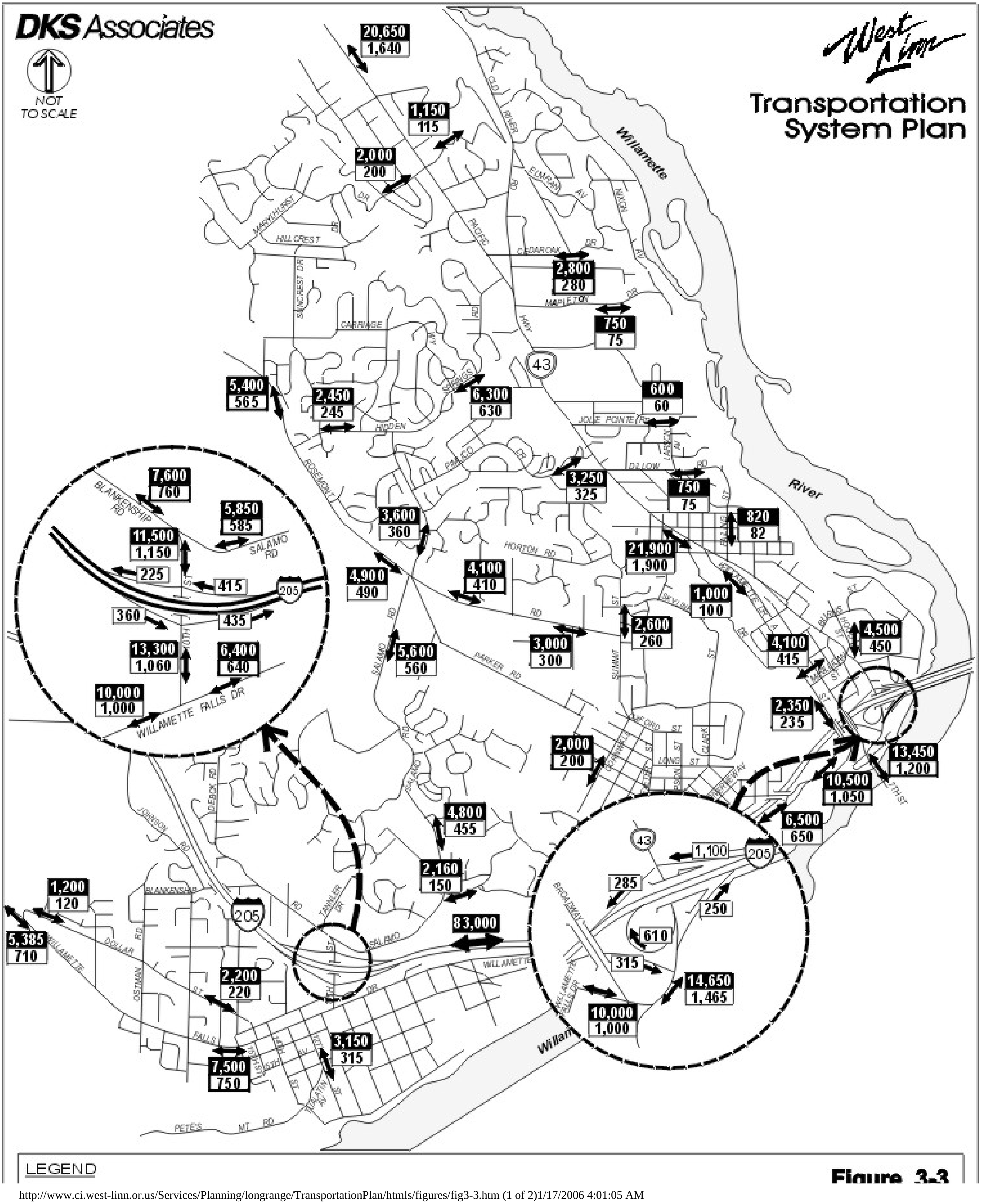


Figure 3-2
EXISTING SPEED ZONES

LEGEND


LEGEND
- 35 mph Speed Zone
- 40 mph Speed Zone
- 45 mph Speed Zone


DKS Associates
NOT TO SCALE
West Linn
Transportation System Plan
Willamette River
OLD RIVER RD
ELMRAN AV
NIXON AV
MARYLHURST DR
HILLCREST DR
SUNCREST DR
PACIFIC HWY
CEDAROAK DR
MAPLETON DR
CARRIAGE
43
HIDDEN SPRINGS
ROSEMONT
JOLIE POINTE RD
DILLOW RD
HORTON RD
SKYLINE DR
SUMMIT ST
PARKER RD
SALAMO RD
BLANKENSHIP RD
10TH ST
WILLAMETTE FALLS DR
205
JOHNSON RD
DOLLAR ST
OSTMAN RD
TANNLER DR
BROADWAY
CLARK
LONG ST
PETE'S MT RD
7TH ST
20,650
1,640
1,150
115
2,000
200
2,800
280
750
75
5,400
565
2,450
245
6,300
630
600
60
3,250
325
750
75
820
82
7,600
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585
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1,150
225
415
360
435
13,300
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6,400
640
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1,900
4,900
490
4,100
410
1,000
100
2,600
260
3,000
300
4,100
415
4,500
450
5,600
560
2,350
235
2,000
200
13,450
1,200
10,500
1,050
4,800
455
6,500
650
1,100
285
250
610
315
14,650
1,465
10,000
1,000
2,160
150
83,000
1,200
120
5,385
710
2,200
220
3,150
315
7,500
750
LEGEND
Figure 3-3

LEGEND

↔ - Approximate Location of Two-way Volume Count

7,500 - Average Dailly Traffic

750 - PM Peak Hour Volume

Figure 3-3
EXISTING TRAFFIC VOLUMES

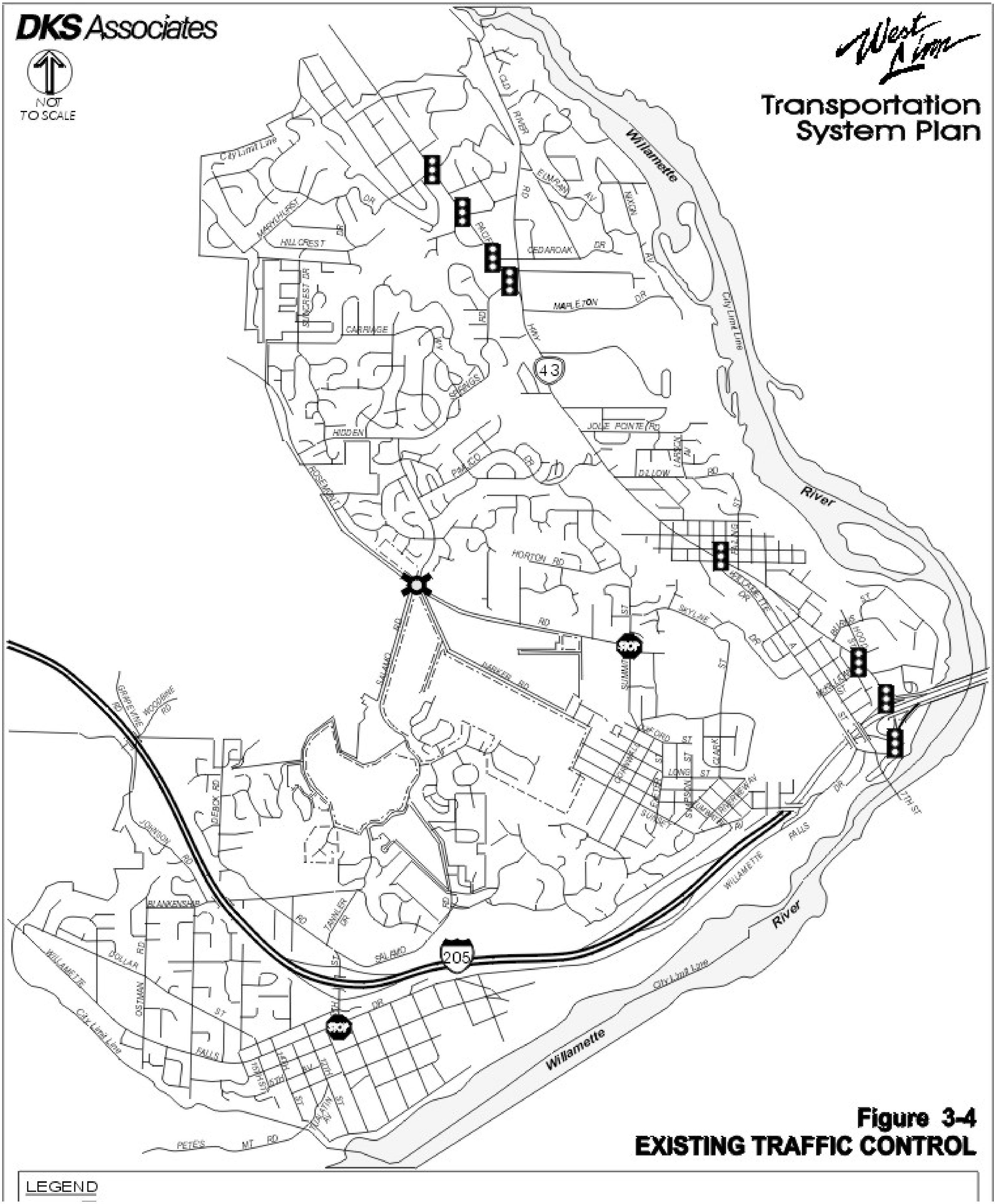
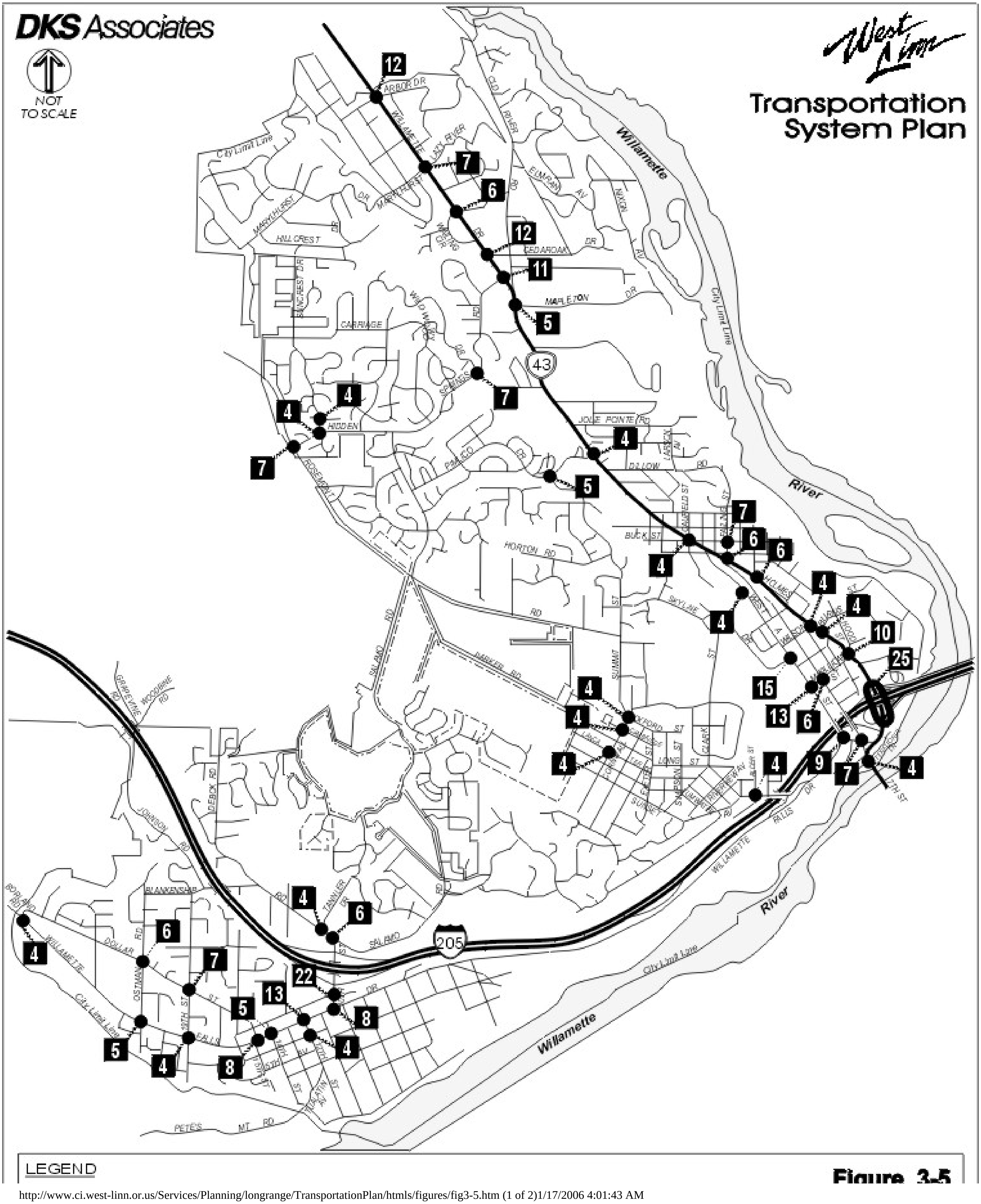


Figure 3-4
EXISTING TRAFFIC CONTROL

LEGEND

LEGEND

- Traffic Signal
- All-way-stop w/Flasher
- All-way-stop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NOT TO SCALE
West Linn
Transportation System Plan
Willamette
River
City Limit Line
43
205
LEGEND
Figure 3-5

LEGEND

● - Intersection Location

5 - Number of Intersection Accidents

NOTE: Indicated are intersections with more than *One* Accident.

Figure 3-5
ACCIDENT LOCATIONS
(1995-1997)

West Linn
Transportation Analysis Zones

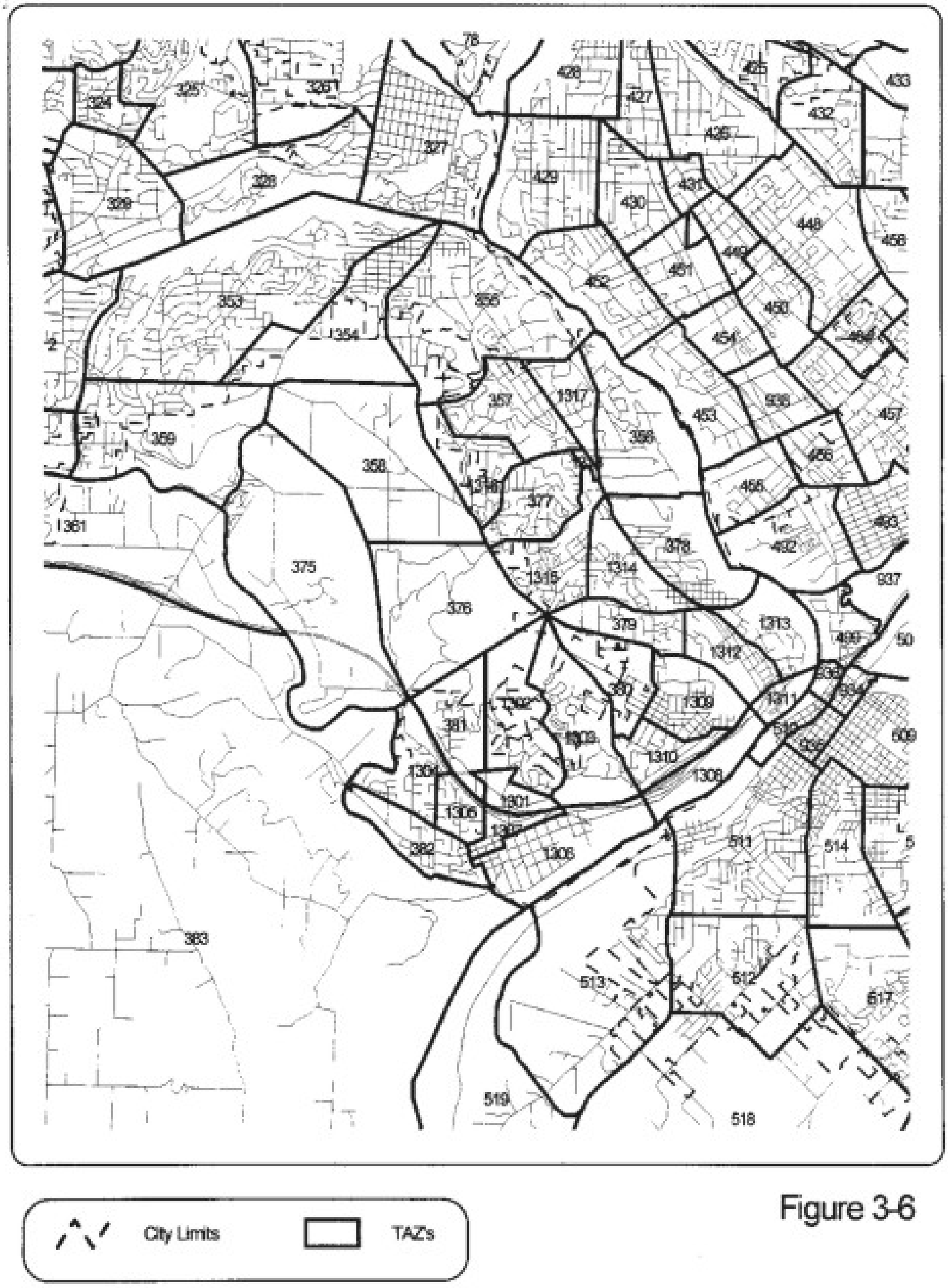


Figure 3-6

DKS Associates

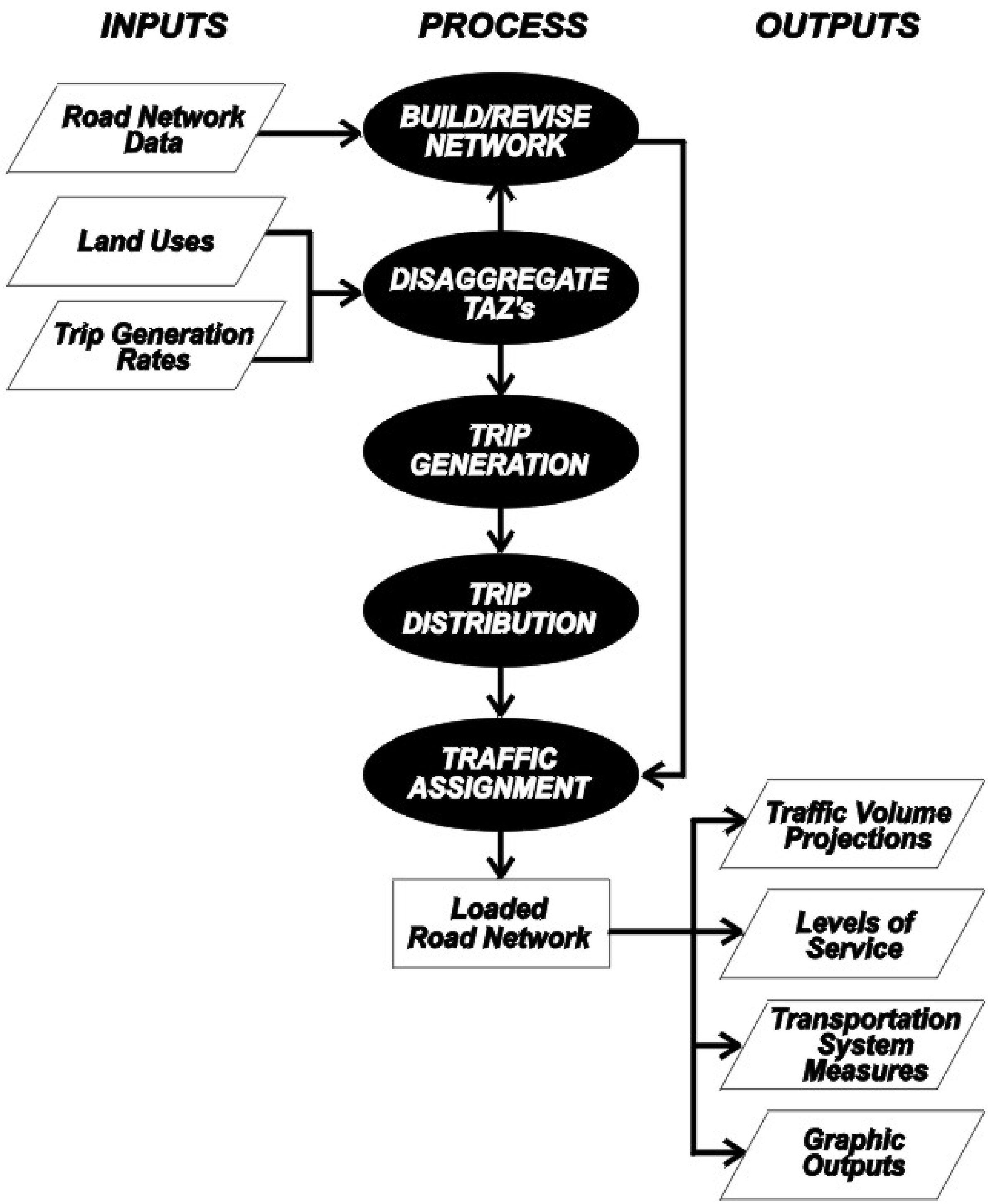
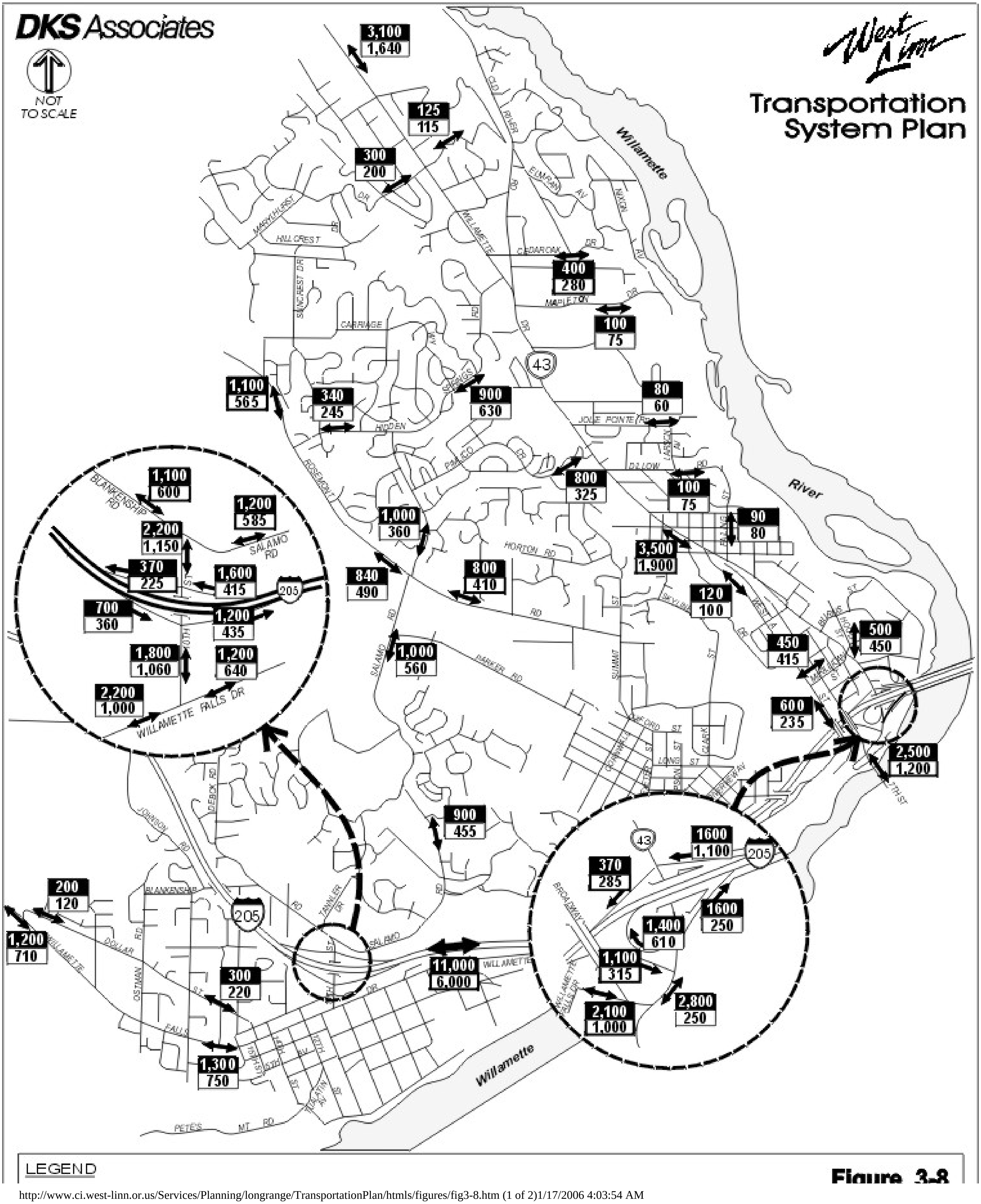


Figure 3-7
TRAFFIC FORECASTING MODEL PROCESS


DKS Associates
NOT TO SCALE
West Linn
Transportation System Plan
Willamette River
Willamette
LEGEND
Figure 3-8

LEGEND

↔ - Approximate Location of Two-way Volume Count

1,300 - 2020 PM Peak Hour Volume

750 - 1998 PM Peak Hour Volume

Figure 3-8
COMPARITIVE PEAK HOUR TRAFFIC VOLUMES

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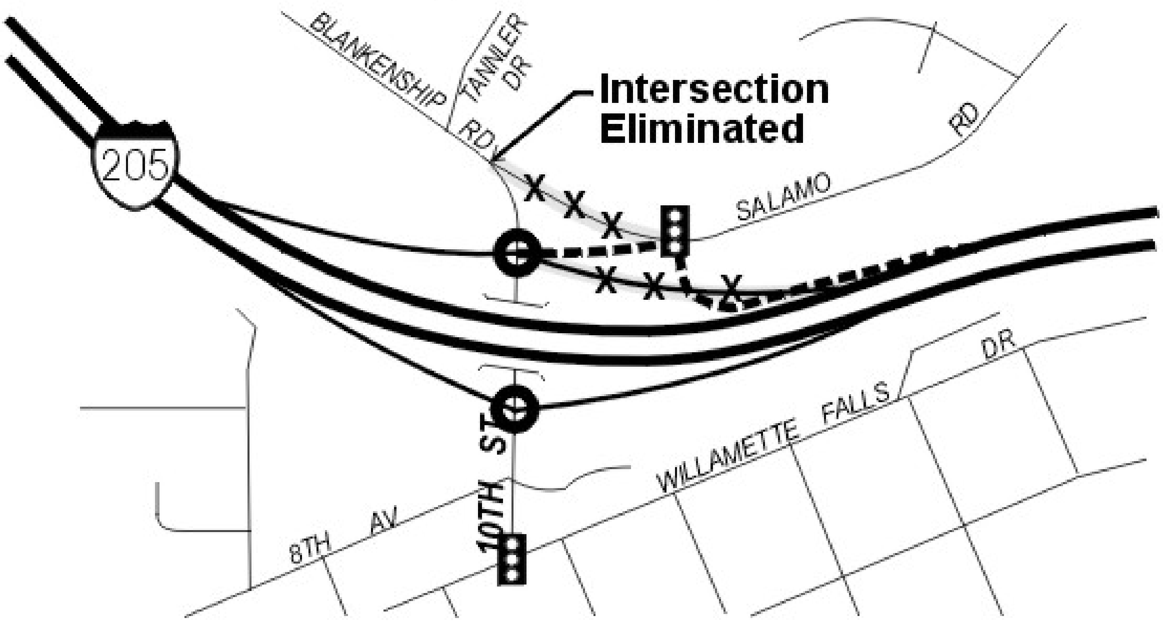
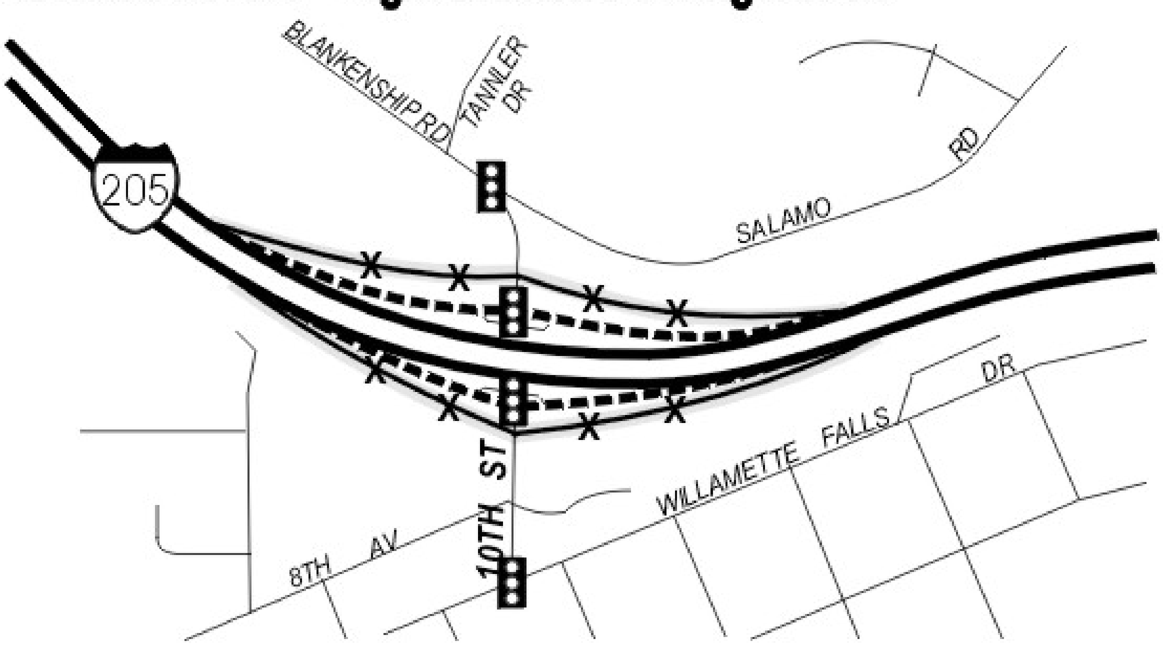
West Linn Transportation System Plan

ALTERNATIVE A - Realign SB Off-Ramp Plus Roundabouts



ALTERNATIVE B - Tight Diamond Configuration



LEGEND

Figure 3-9

LEGEND

- Planned Traffic Signal
- Planned Roundabout
- New or Re-designed Road Segment
- Existing Road Segment to be Removed

Figure 3-9
10TH STREET INTERCHANGE ALTERNATIVES

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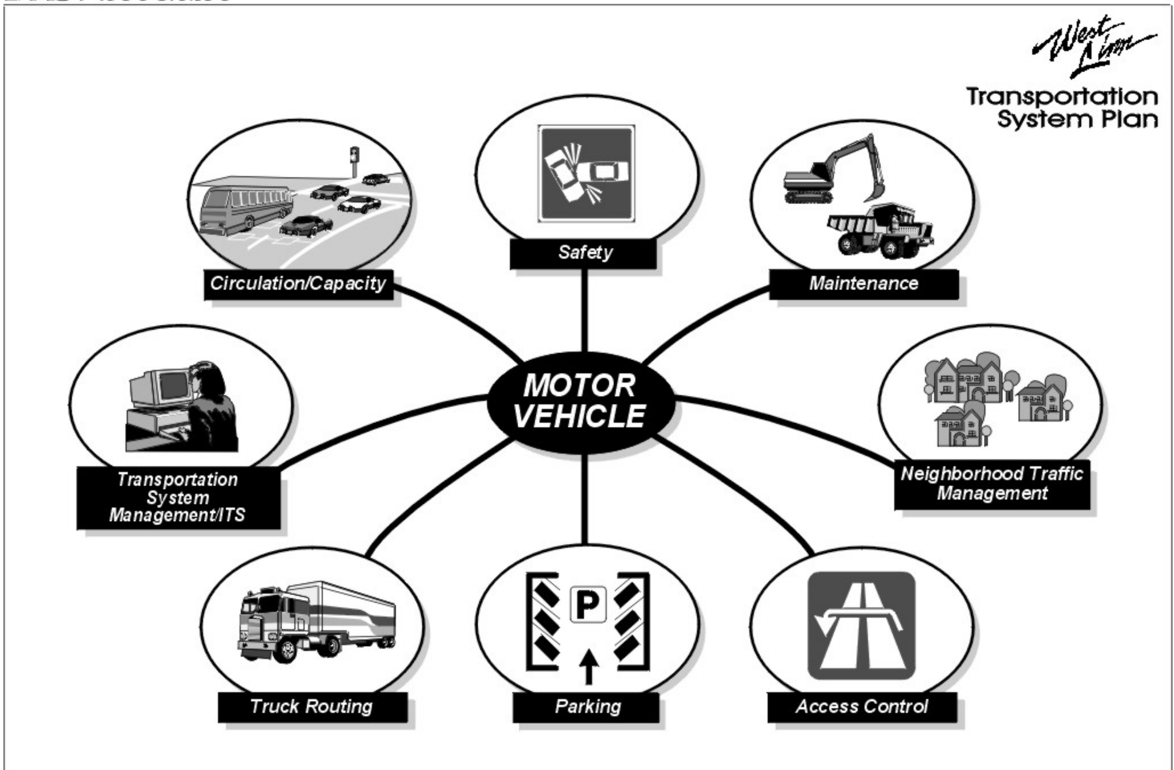

Figure 3-10
VEHICULAR ELEMENTS OF THE STREET PLAN

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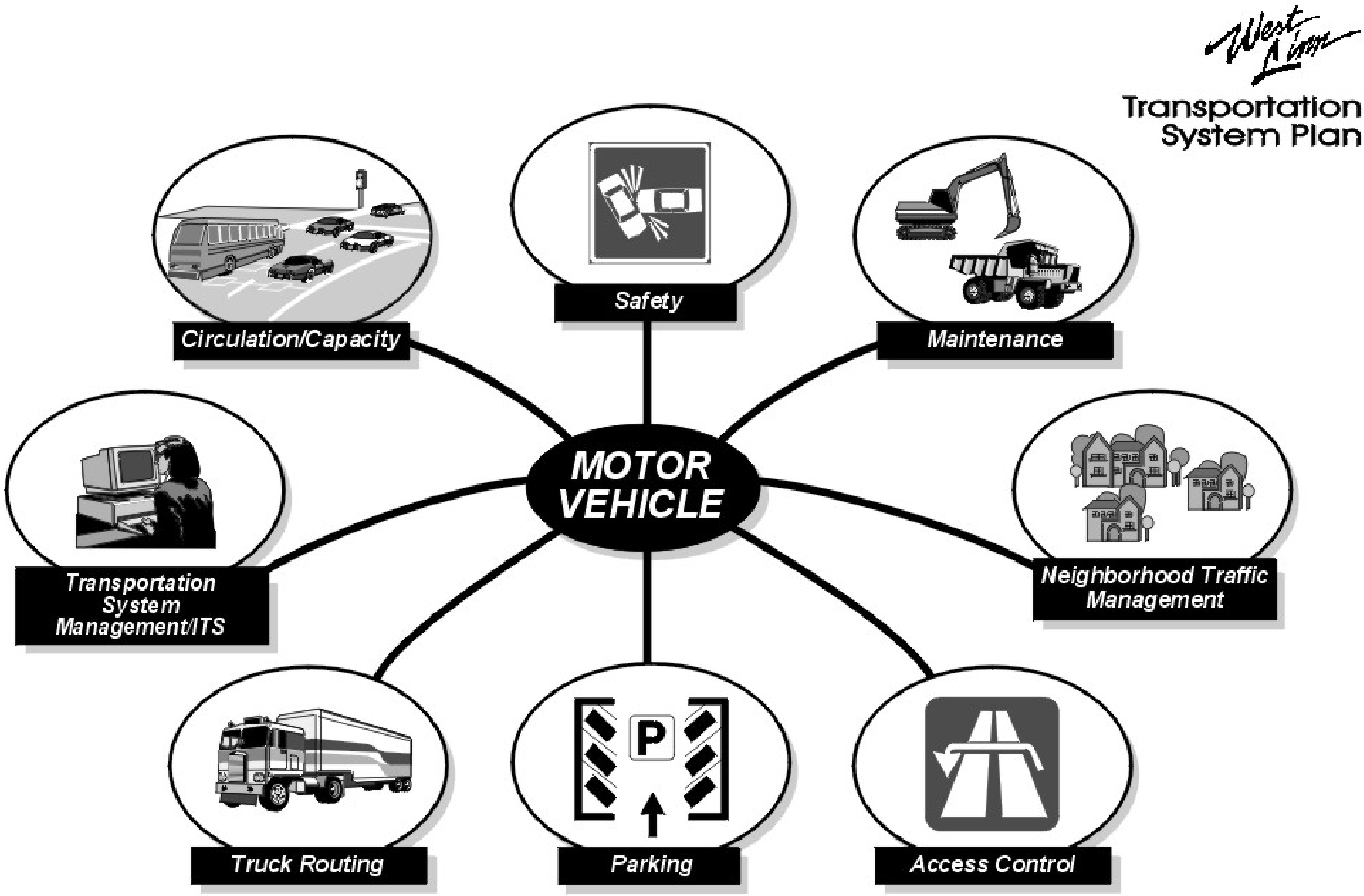


Figure 3-10
VEHICULAR ELEMENTS OF THE STREET PLAN

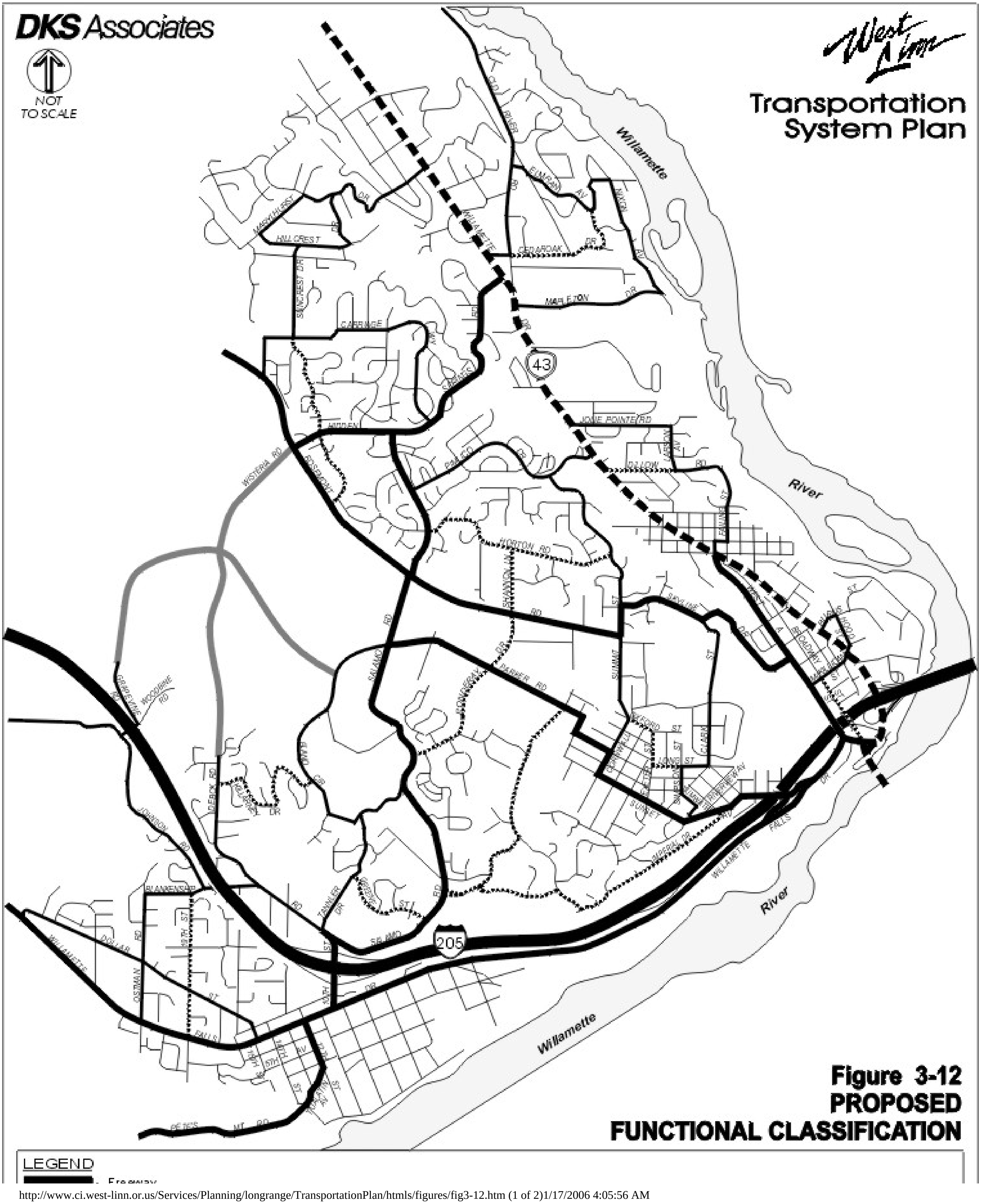
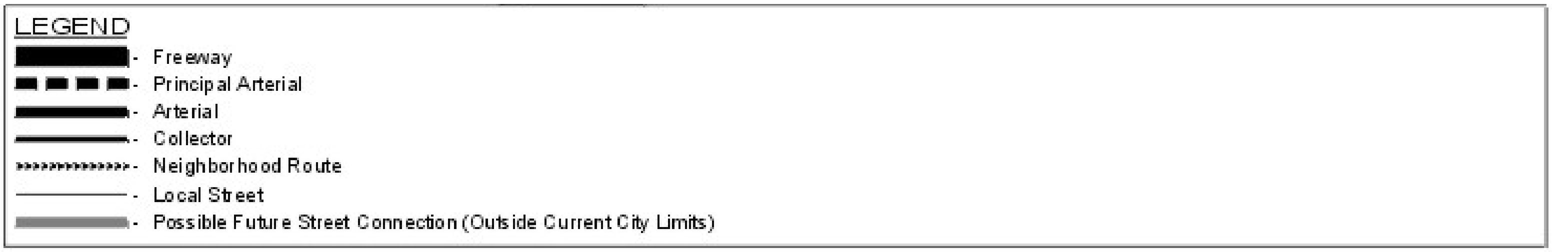


Figure 3-12
PROPOSED FUNCTIONAL CLASSIFICATION

LEGEND

Freeway


LEGEND
- Freeway
- Principal Arterial
- Arterial
- Collector
- Neighborhood Route
- Local Street
- Possible Future Street Connection (Outside Current City Limits)

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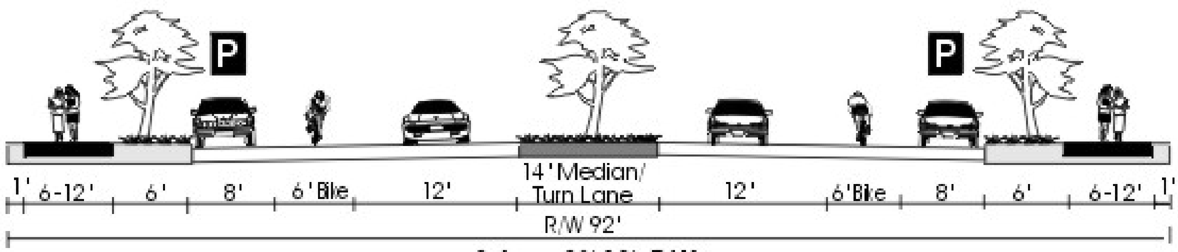
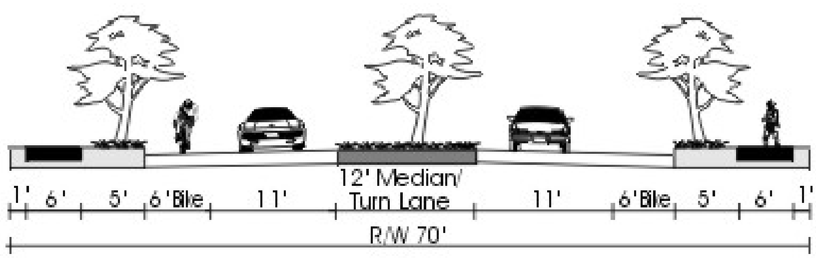
West Linn
Transportation System Plan

Principal Arterial



3 Lane 80'-92' R/W

Arterial



3 Lane 70' R/W

Criteria	Principal Arterial	Arterial
Vehicle Lane Widths:	11-14 ft.	11-12 ft.
On Street Parking:	Limited *	Limited *
Bicycle Lanes:	5-6 ft.	5-6 ft.
Sidewalks:	6-12 ft.	5-8 ft.
Landscape Strips:	0-8 ft.	0-8 ft.
Medians/Turn Lane Widths:	0-14 ft. **	0-14 ft. **
Neighborhood Traffic Management:	Not Appropriate	Not Appropriate

* Note: On-street parking allowed in designated opportunity areas.

** Note: Two-lane arterial allowed in designated opportunity areas, or where property access is limited to right-turn movement only. (No center lane)

is limited to right-turn movement only.
(No center lane)

Legend

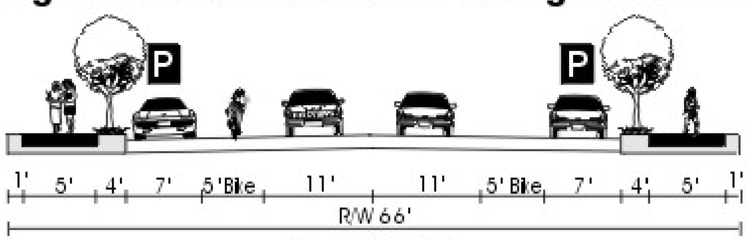
P - *On-street Parking Lane*

Figure 3-13
ARTERIAL
SAMPLE STREET CROSS SECTIONS

DKS Associates

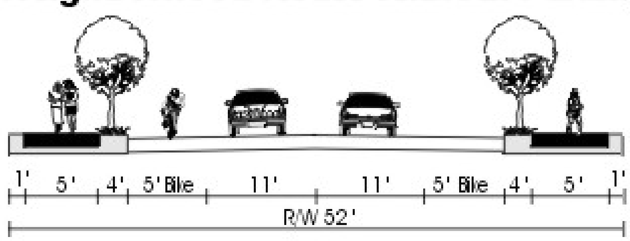
West Linn Transportation System Plan

Neighborhood Route With Parking & Bike Lane



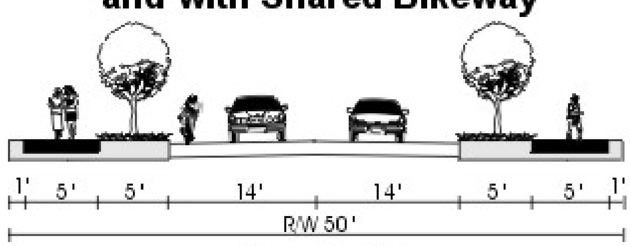
2 Lane 66' R/W

Neighborhood Route Without Parking



2 Lane 52' R/W

Neighborhood Route Without Parking and with Shared Bikeway



2 Lane 50' R/W

Criteria	Neighborhood Route
Vehicle Lane Widths:	10-12 ft.
On Street Parking:	7-8 ft.
Bicycle Lanes:	5ft.
Sidewalks:	5-6 ft.

Sidewalks:	5-6 ft.
Landscape Strips:	0-5 ft.
Medians/Turn Lane Widths:	None
Neighborhood Traffic Management:	Under Special Conditions

Legend

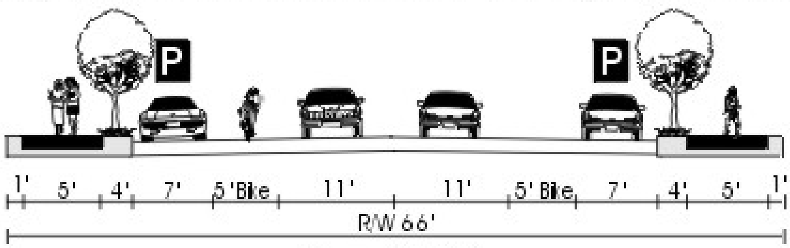
P - On-street Parking Lane

Figure 3-15
NEIGHBORHOOD ROUTE
SAMPLE STREET CROSS SECTIONS

DKS Associates

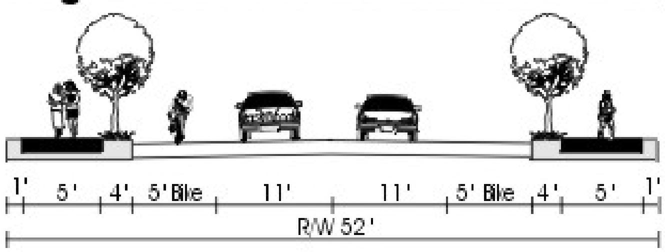
West Linn Transportation System Plan

Neighborhood Route With Parking & Bike Lane



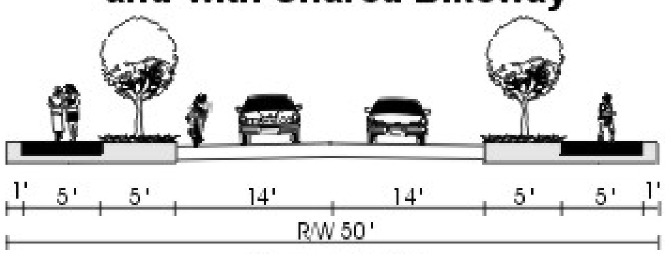
2 Lane 66' R/W

Neighborhood Route Without Parking



2 Lane 52' R/W

Neighborhood Route Without Parking and with Shared Bikeway



2 Lane 50' R/W

Criteria	Neighborhood Route
Vehicle Lane Widths:	10-12 ft.
On Street Parking:	7-8 ft.
Bicycle Lanes:	5 ft.
Sidewalks:	5-6 ft.
Landscape Strips:	0-5 ft.
Medians/Turn Lane Widths:	None
Neighborhood Traffic Management:	Under Special Conditions

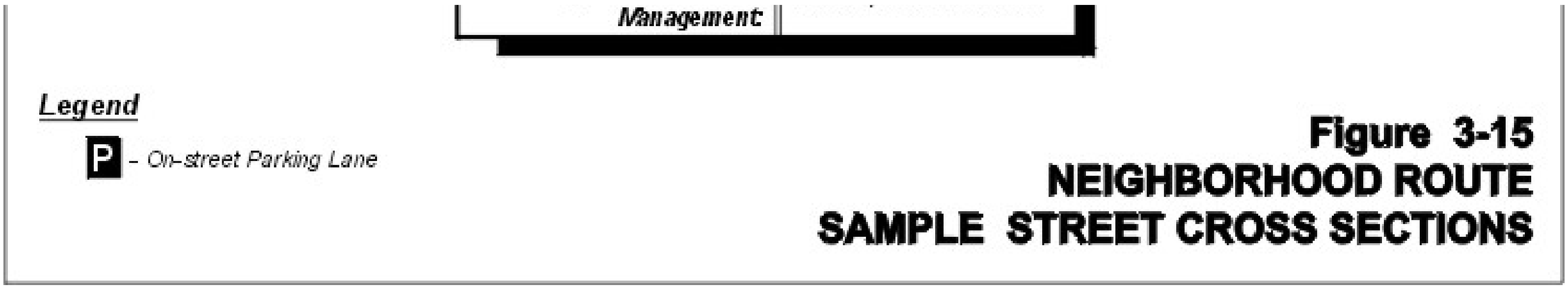
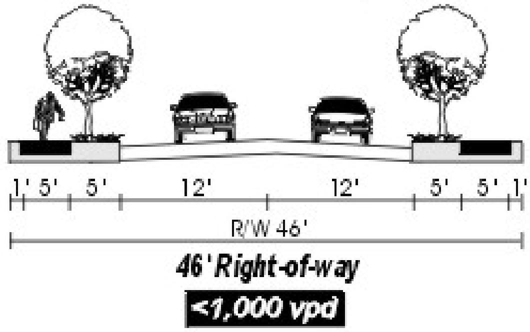


Figure 3-15
NEIGHBORHOOD ROUTE
SAMPLE STREET CROSS SECTIONS

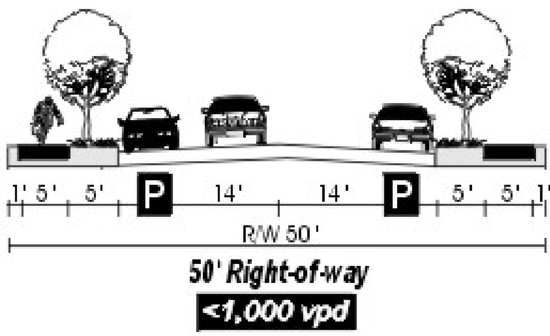
DKS Associates

West Linn Transportation System Plan

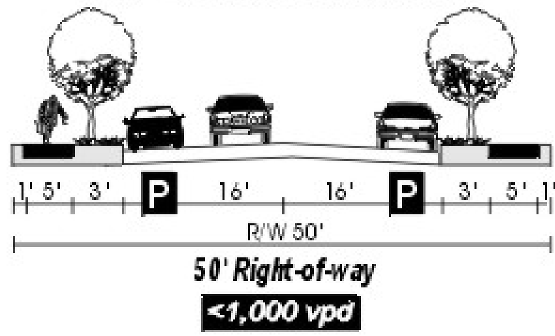
24' Local Residential (No Parking)



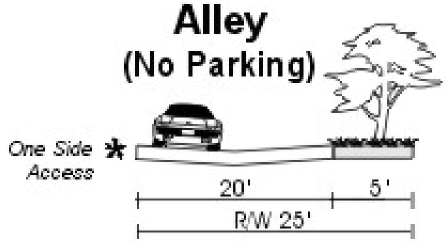
28' Local Residential



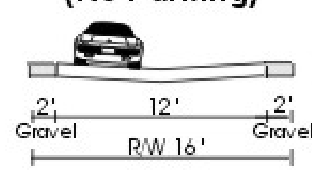
32' Local Residential



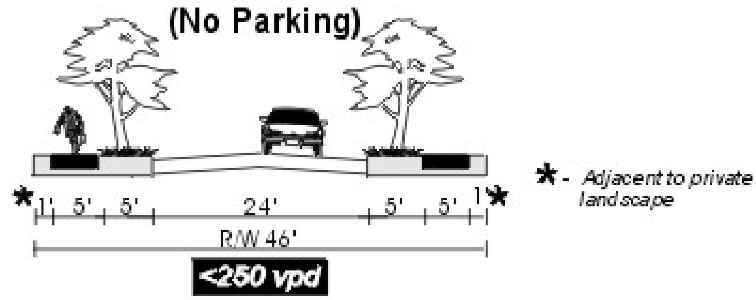
Alley
(No Parking)



Alley
(No Parking)



Cul-de-sac
(No Parking)



Legend

P - On-street Parking Lane

Note: If sidewalks are provided adjacent to curb without landscape strip the minimum sidewalk width shall be 6 feet for locals.

Figure 3-16
PROPOSED RESIDENTIAL LOCAL SAMPLE STREET CROSS SECTIONS

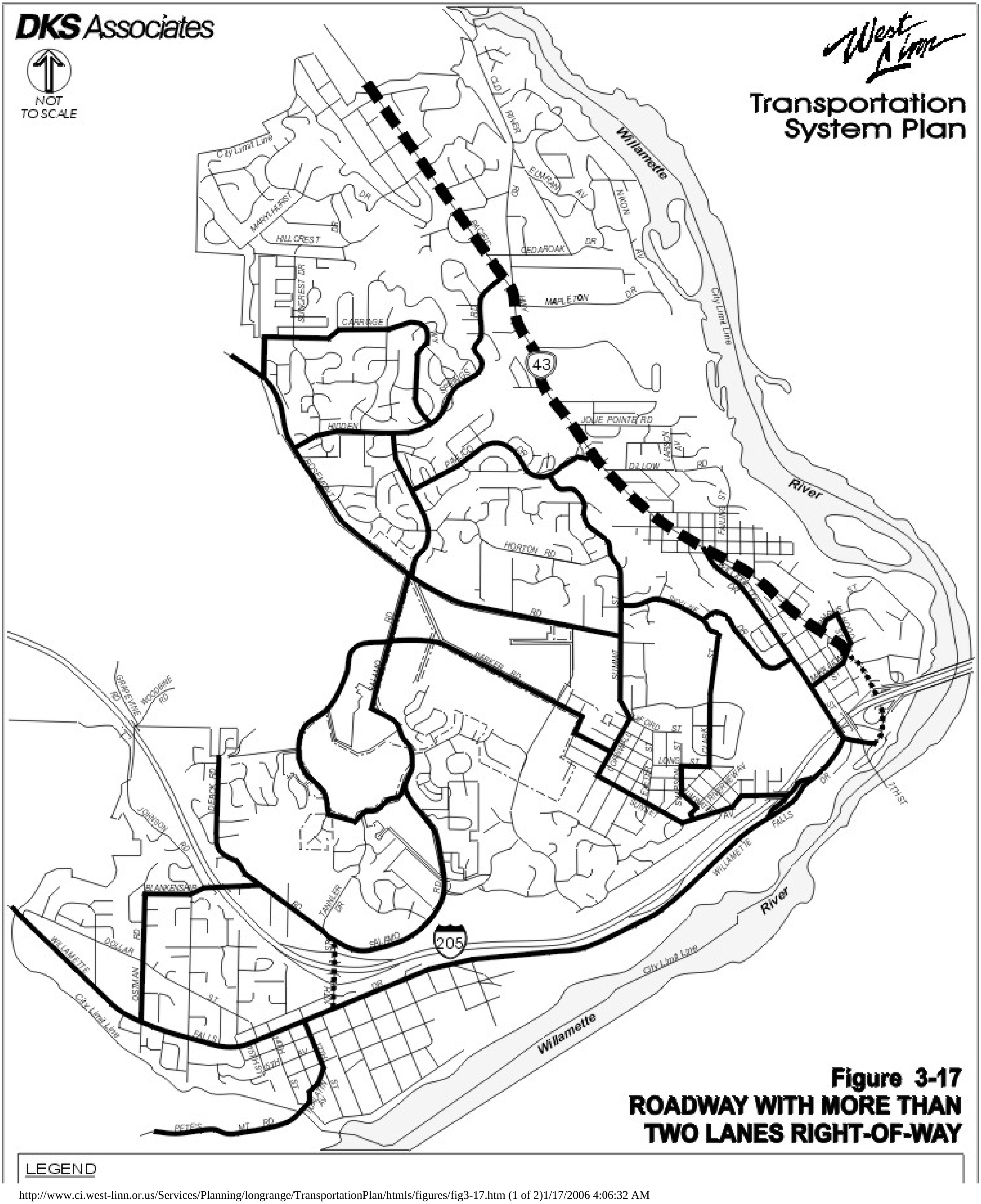


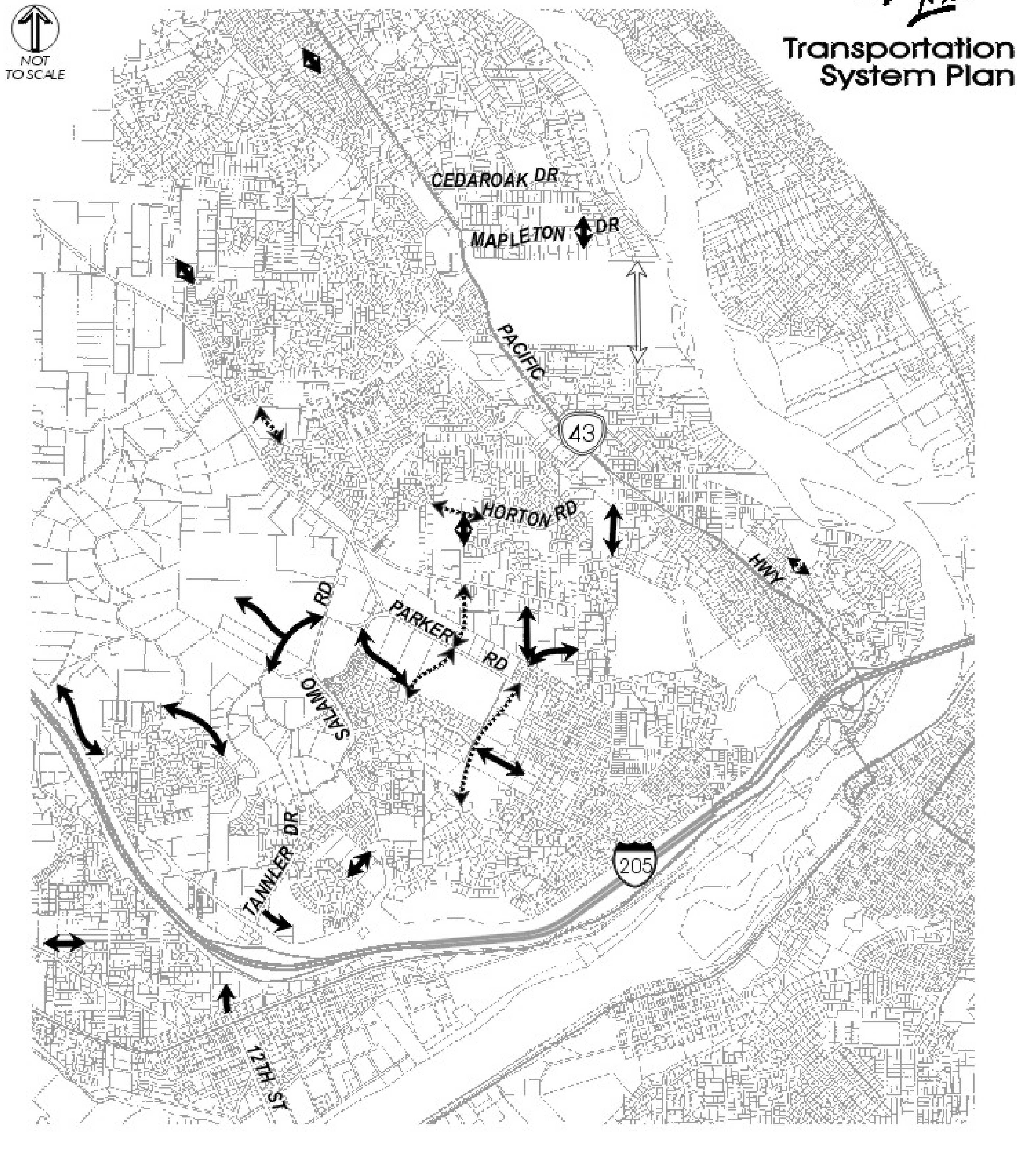
Figure 3-17
ROADWAY WITH MORE THAN TWO LANES RIGHT-OF-WAY


LEGEND
- 3 Lanes
- 4/5 Lanes
- Wide 2/3-Lane (Principal Arterial)

DKS Associates

West Linn

Transportation System Plan



LEGEND

LEGEND

- Possible Local Street Connection*
- Possible Neighborhood Route
- Possible Pedestrian/Bike Connection (No Autos)

*NOTE: General connection route indicated. Precise alignments to be determined

Figure 3-18
LOCAL STREET CONNECTIVITY MAP

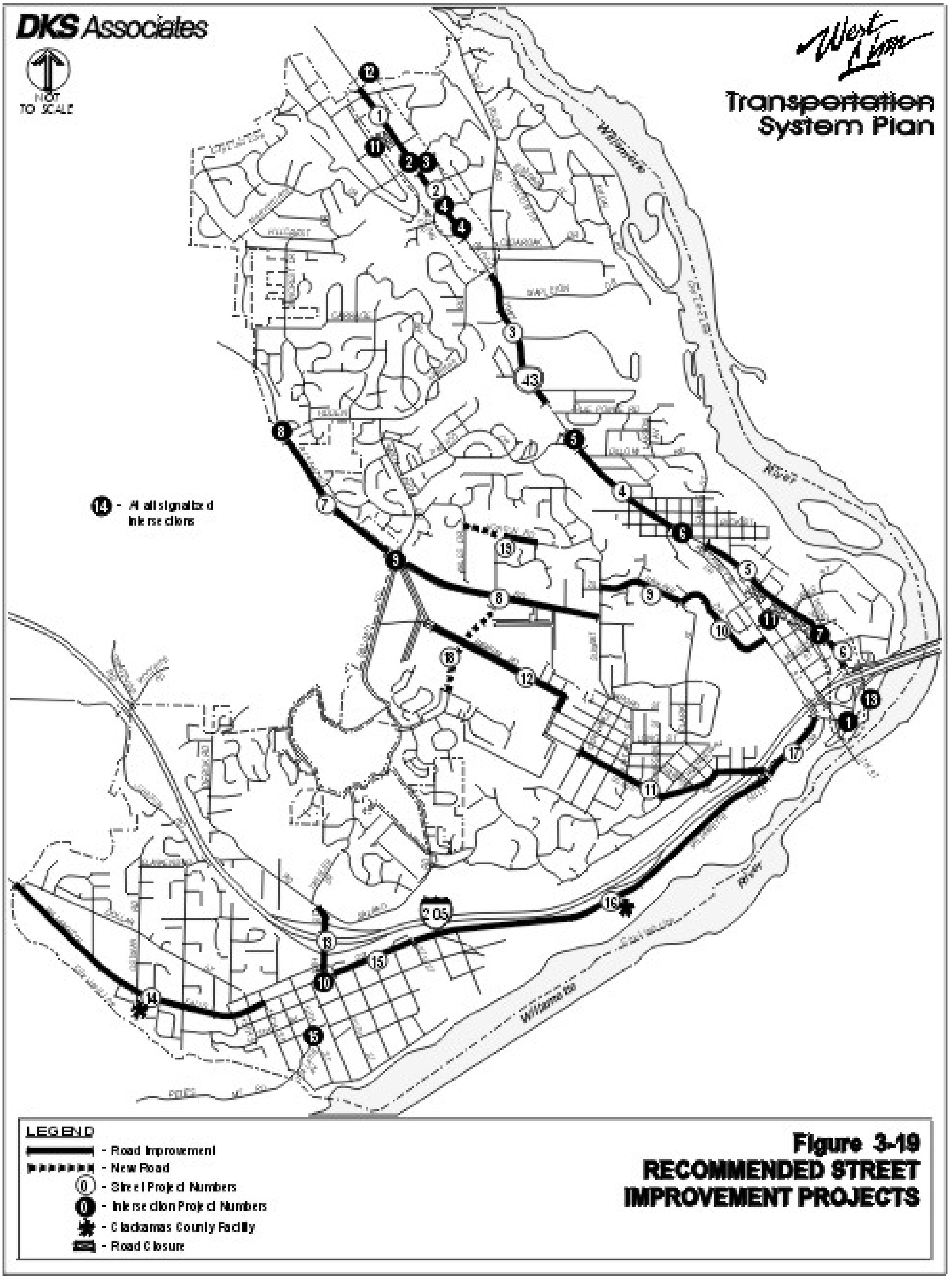
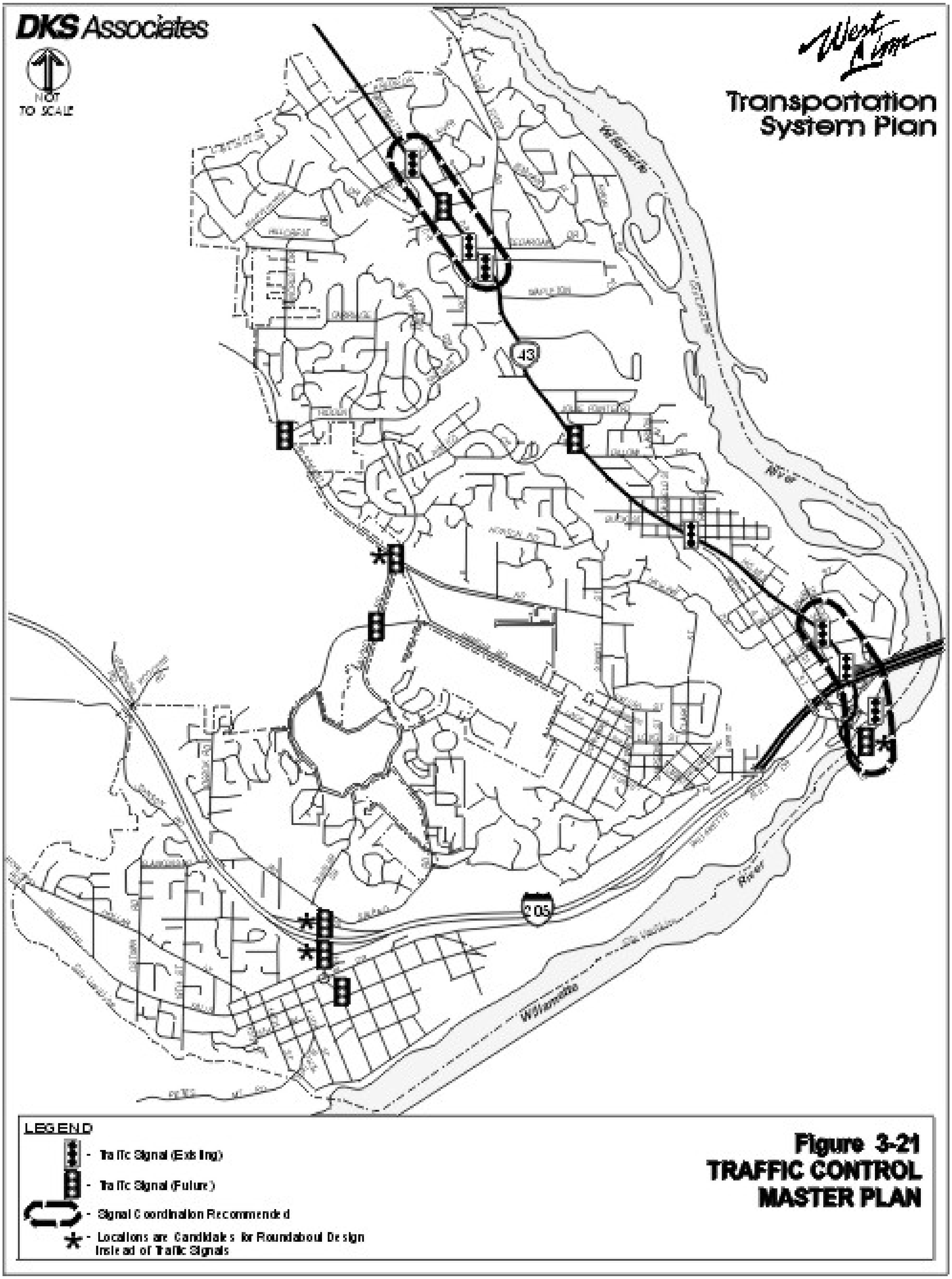


Figure 3-19
RECOMMENDED STREET IMPROVEMENT PROJECTS


West Linn
Transportation
System Plan
PACIFIC
ROSEMONT
MAPLETON DR
43
HWY
IDLE PONTE RD
DILLON DRIVE
HUGHES DRIVE
BUCK
BARCLAY ST.
205
NOT
TO SCALE
DKS Associates
LEGEND
- Traffic Signal (Existing)
- Traffic Signal (Future)
- Street Closure
- Turn Restrictions (Future)
- Left-Turn Lane (Existing)
- Left-Turn Lane (Future)
- Coordinate Traffic Signals
Figure 3-20
Highway 43
ACCESS MANAGEMENT PLAN


DKS Associates
NOT TO SCALE
West Linn
Transportation System Plan
43
205
LEGEND
Traffic Signal (Existing)
Traffic Signal (Future)
Signal Coordination Recommended
Locations are Candidates for Roundabout Design Instead of Traffic Signals
Figure 3-21
TRAFFIC CONTROL MASTER PLAN

DKS Associates

West Linn
Transportation System Plan

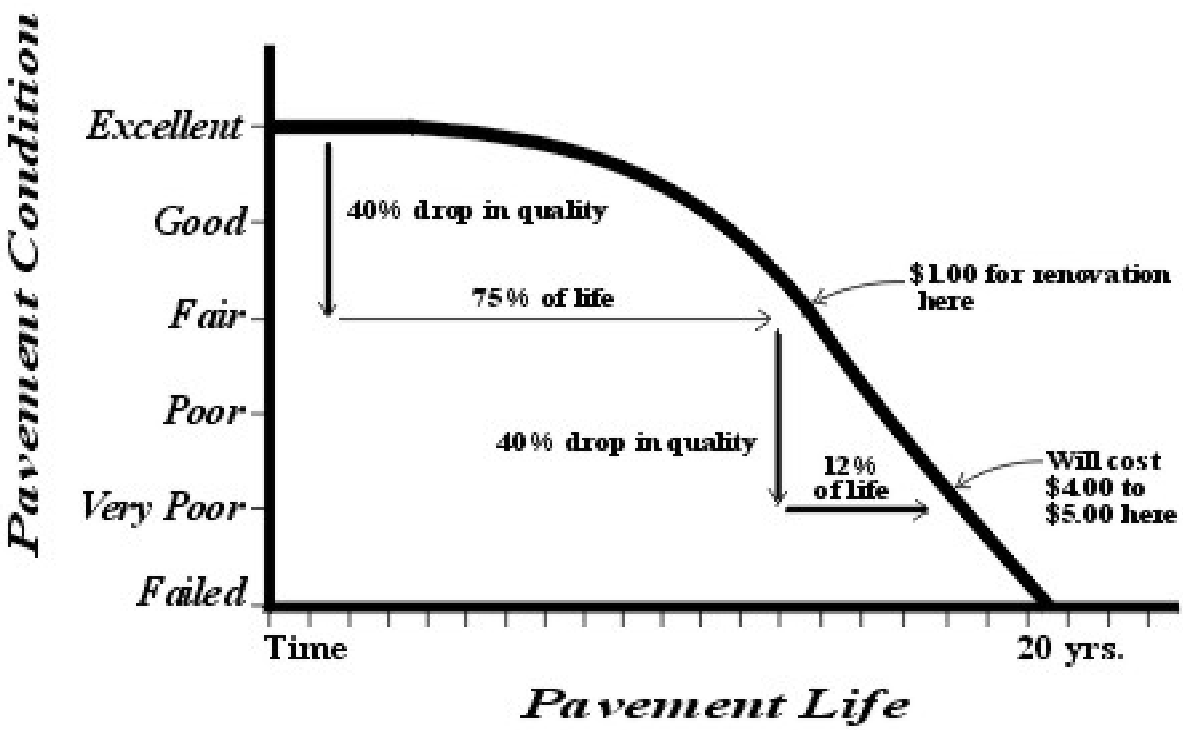


Figure 3-22
PAVEMENT LIFE CYCLE