

City of Estacada Transportation System Plan

Estacada, Oregon

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Section 1

Introduction

Introduction

The City of Estacada, in conjunction with Clackamas County and the Oregon Department of Transportation (ODOT), initiated a study of the City's transportation system in the summer of 1997. The purpose of this study is two-fold: to guide the management and development of transportation facilities; and to incorporate the vision of the community into a transportation system that addresses the multimodal needs of the community.

The Estacada urban growth boundary (UGB) contains sufficient land to accommodate the growth projected to occur during the next 20-year period. Because there is an ample supply of land within the UGB, there is a potential for low-density development and inefficient development patterns, which could make it difficult to provide utilities and services cost-effectively and efficiently. How and where future development occurs will be important in terms of helping Estacada maintain its strong identity and character. Careful planning and development review will ensure accessibility to the downtown while maintaining access control and the mobility of the highway.

State of Oregon guidelines stipulate that a transportation system plan (TSP) must be based on the current comprehensive plan land use map and must provide a transportation system that accommodates the expected 20-year growth in population and employment that will result from implementation of the land use plan. Oregon Revised Statute 197.712 and the Land Conservation and Development Commission (LCDC) administrative rule known as the Transportation Planning Rule¹ (TPR) require that all jurisdictions develop the following:

- a road plan for a network of arterial and collector streets;
- a public transit plan;
- a bicycle and pedestrian plan;
- an air, rail, water, and pipeline plan;
- a transportation finance plan; and,
- policies and ordinances for implementing the transportation system plan.

The TPR requires that alternative travel modes be given equal consideration and that reasonable effort be applied to the development and enhancement of the alternative modes in providing the future transportation system. In addition, the TPR requires that local jurisdictions adopt land use and subdivision ordinance amendments to protect transportation facilities and to provide bicycle facilities between residential, commercial, and employment/institutional areas. It is further stipulated that local communities coordinate their respective plans with county and state transportation plans.

This study was prepared as part of a Transportation Growth Management Grant. Although the population of Estacada does not meet the threshold level identified by State of Oregon legislation requiring local jurisdictions to prepare a transportation system plan (TSP), the report is formatted to provide the necessary elements for the City of Estacada to be in compliance in the future. In addition, this document provides Clackamas County and ODOT with recommendations for incorporation into their respective plans.

STUDY AREA

The City of Estacada is located along Highway 211-224 in Clackamas County, Oregon, as shown in Figure 1. The city, which is bordered by the Clackamas River to the south, is home to an estimated population of 2,100 persons (1997 estimate). Incorporated in 1957, the city's economy was once primarily based on the timber industry, but recent trends have forced Estacada towards diversity, improving the future outlook of the community. Throughout the past 30 years, the downtown area has remained the heart of the community with a robust mix of commercial, residential, and public land uses.

The majority of commercial land uses within Estacada are located within the central business district north of Highway 211-224. Over the past few years, commercial development has included the redevelopment of existing buildings in the central business district. The City has recently rezoned a 200-acre parcel west of Highway 211-224 to attract additional employment to the area. Residential land uses are located throughout the city, with farmland located along the city's northern periphery. The City has an ample supply of vacant, developable residential land within the urban growth boundary.

PUBLIC INVOLVEMENT AND STUDY GOALS

The TSP planning process provided the citizens of Estacada with the opportunity to identify their priorities for future growth and development. Expressing their vision for the future in terms of goals and objectives for the TSP was a central element of the public involvement process. The goals and objectives identified by the community served as guidelines for developing and evaluating alternatives, selecting a preferred transportation plan, and prioritizing improvements.

Two committees were formed to guide the planning process: the Management Team and the Study Advisory Committee (SAC). The Management Team was comprised of representatives of the City of Estacada, Clackamas County, ODOT, and the consultant team. The Study Advisory Committee includes the members of the Streets Committee and key stakeholders in the community.

The two committees convened at several key junctures of the project including: project inception, completion of the existing conditions analysis, presentation of the future conditions and alternatives analysis findings, and presentation of the draft and final TSP. Through these meetings, the local transportation planning process evolved such that a general consensus was achieved and maintained among all parties in attendance.

Based on a review of the city documentation related to transportation and land use planning and discussions with the TSP committees, a series of project goals and objectives evolved that provided direction to the planning process. These goals and objectives are summarized on the next few pages.

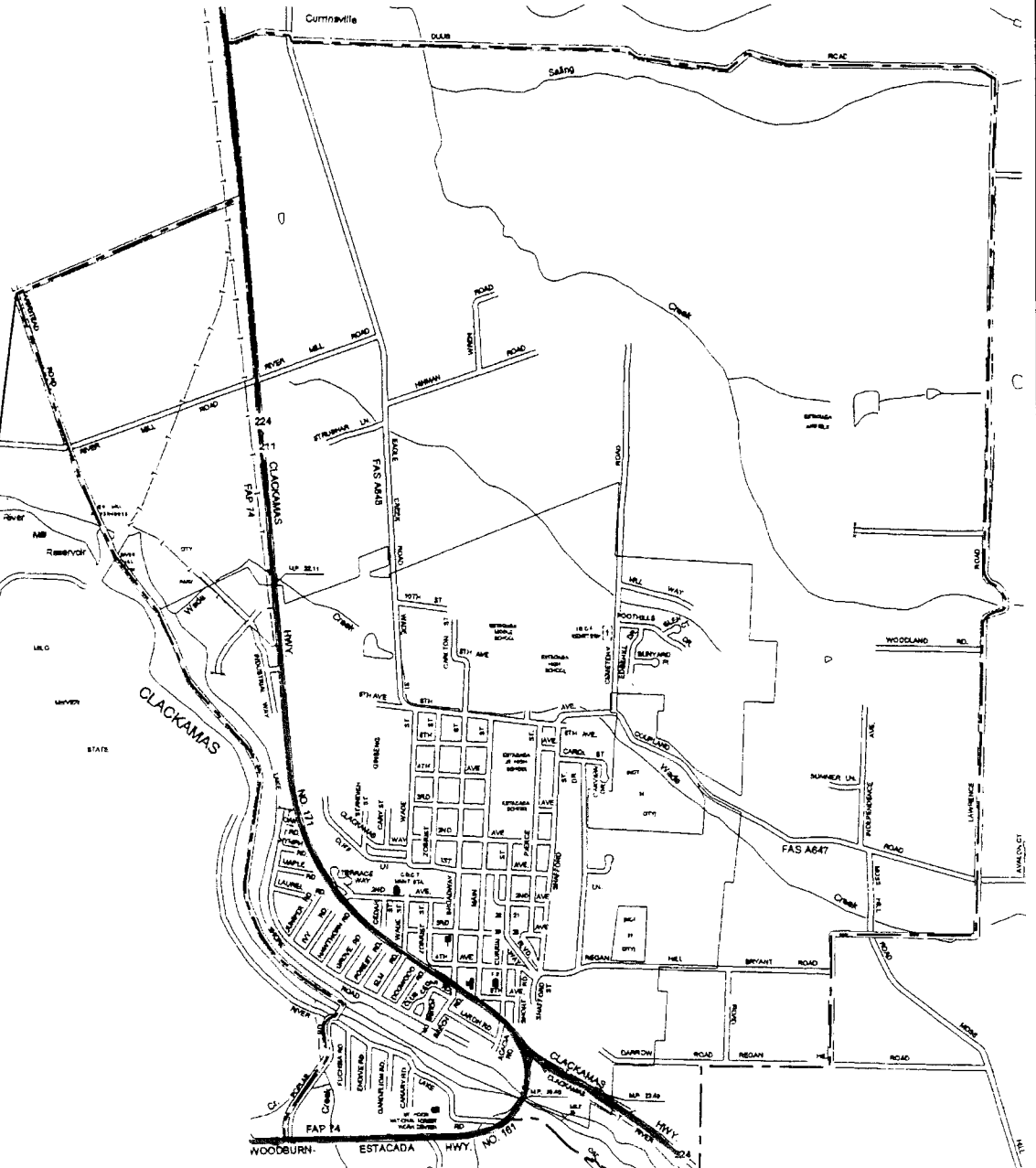
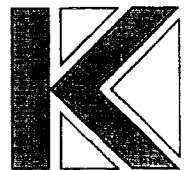


FIGURE 1
STUDY AREA MAP
Estacada Transportation System Plan



Goal 1 :

Promote a balanced, safe, and efficient transportation system.

Objectives

1. Develop a multi-modal transportation system that avoids reliance upon one form of transportation as well as minimizes energy consumption and air quality impacts.
2. Protect the qualities of neighborhoods and the community.
3. Provide for adequate street capacity and optimum efficiency.
4. Promote adequate transportation linkages between residential, commercial, public, and industrial land uses.

Goal 2 :

Ensure the adequacy of the roadway network in terms of function, capacity, level of service, and safety.

Objectives

1. Develop a functional classification system that addresses all roadways within the study area.
2. In conjunction with the functional classification system, identify corresponding street standards that recognize the unique attributes of the local area.
3. Identify existing and potential future capacity constraints and develop strategies to address those constraints, including potential intersection improvements, future roadway needs, and future street connections.
4. Evaluate the need for modifications to and/or the addition of traffic control devices.
5. Identify access spacing standards.
6. Provide an acceptable level of service at all intersections in the city, recognizing the rural character of the area.
7. Identify existing and potential future safety concerns as well as strategies to address those concerns.

Goal 3 :

Promote alternative modes of transportation.

Objectives

1. Develop a comprehensive system of pedestrian and bicycle routes that link major activity centers within the study area.
2. Encourage the use of alternative modes of transportation by providing a system that insures mobility for all users.
3. Encourage the continued use of public transportation services and identify improvements to further promote transit in the community.

Goal 4

Identify and prioritize transportation improvement needs in the City of Estacada, and identify a set of reliable funding sources that can be applied to these improvements.

Objectives

1. Develop a prioritized list of transportation improvement needs in the study area.
2. Develop construction cost estimates for the identified projects.

3. Evaluate the adequacy of existing funding sources to serve projected improvement needs.
4. Evaluate new, innovative funding sources for transportation improvements.
5. Develop a transportation system development charge for the city to enhance current funding mechanisms.

TSP STUDY PROCESS

Development of the city of Estacada's Transportation System Plan began with an inventory of the existing transportation system. The inventory included documentation of all transportation-related facilities within the study area and allowed for an objective assessment of the current system's physical characteristics, operational performance, safety, deficiencies, and general function. A description of the inventory process, as well as documentation of the existing conditions analyses and their implications, is presented in **Section 2, Existing Conditions** of this plan. The advisory committees provided significant input into this portion of the report because of their familiarity with the city and the transportation system.

Upon completion of the existing conditions analysis, the focus of the project shifted to forecasting future travel demand and the corresponding long-term future transportation system needs. Development of long-term (year 2019) transportation system forecasts relied heavily on population and employment growth projections for the study area and a review of historical traffic growth in the area. Through the City's Comprehensive Plan, reasonable assumptions were drawn as to the potential for and location of future development activities. **Section 3, Future Conditions**, details the analysis of a future travel demand scenario, identifying system needs within the city.

Section 4 of this report, *Alternatives Analysis*, identifies a series of transportation system alternatives that are intended to mitigate transportation system deficiencies and provide a system that accommodates growth within the community. The impact of each of the identified alternatives was considered on the basis of individual merits, conformance with the existing land use and transportation system, as well as potential conflicts to implementation and integration with the surrounding transportation system.

Based on the alternatives developed, a preferred plan was developed that reflects a consensus as to which elements are to be incorporated into the city's long-term transportation system. These recommendations are summarized in **Section 5, Transportation System Plan**, and presented by mode as the following: Roadway Network and Functional Classification Plan, Pedestrian System Plan, Bicycle System Plan, Public Transportation Plan, and Rail/Air/Pipeline Plan.

Section 6, Funding Alternatives Analysis, provides an analysis and summary of the alternative funding sources available to finance the identified transportation system improvements.

In an effort to enhance the existing comprehensive plan and policies and ensure compliance with the TPR, several comprehensive plan and zoning ordinance modifications have been developed. The recommended language is presented in **Section 7, Policies and Land Use Ordinance Modifications**, and addresses major land use and transportation issues identified through development of the TSP and reflects the desire to enhance all modes of the transportation system.

Finally, **Section 8, Transportation Planning Rule Compliance**, lists the requirements and recommendations of the Oregon Transportation Planning Rule (OAR 660 Division 12) and identifies how the City of Estacada TSP satisfies that criterion.

Section 2

Existing Conditions

Existing Conditions

The development of this transportation system plan began with an assessment of the existing transportation system and land use conditions. This section describes the existing conditions for all transportation modes that the transportation system plan addresses including roads, bicycles, pedestrians, transit, air, and marine facilities. The purpose of this section is to provide an inventory and description of existing facilities while setting the stage for a basis of comparison to future conditions.

LAND USE

The existing heart of the city is within the central business district and the commercial buildings of the downtown. The dense grid of development north of Highway 211-224, is for the most part, compact and walkable. The streets are laid out as an interconnected network forming blocks that provide for adequate circulation for vehicles and pedestrians. The mix of land uses throughout the grid system occur in relatively close proximity and provide access to a wide variety of activities for the citizens. The building entrances front the street rather than parking lots providing a streetscape that is well-defined for pedestrians and vehicles alike.

TRANSPORTATION FACILITIES

A detailed assessment of the existing transportation system was conducted at the onset of the project. This assessment included an inventory of the existing transportation facilities and services, a summary of existing transportation operations in the urban area, and an evaluation of the existing safety conditions. A summary of the inventory of each mode of travel is described below.

Pedestrian System

Figure 2 identifies the location of the existing sidewalks within the city. As shown in Figure 2, the existing sidewalk system is extensive, although several critical links are missing. Sidewalks are provided in the downtown core and along Broadway and Main Street. Intermittent sidewalks are provided in most residential areas.

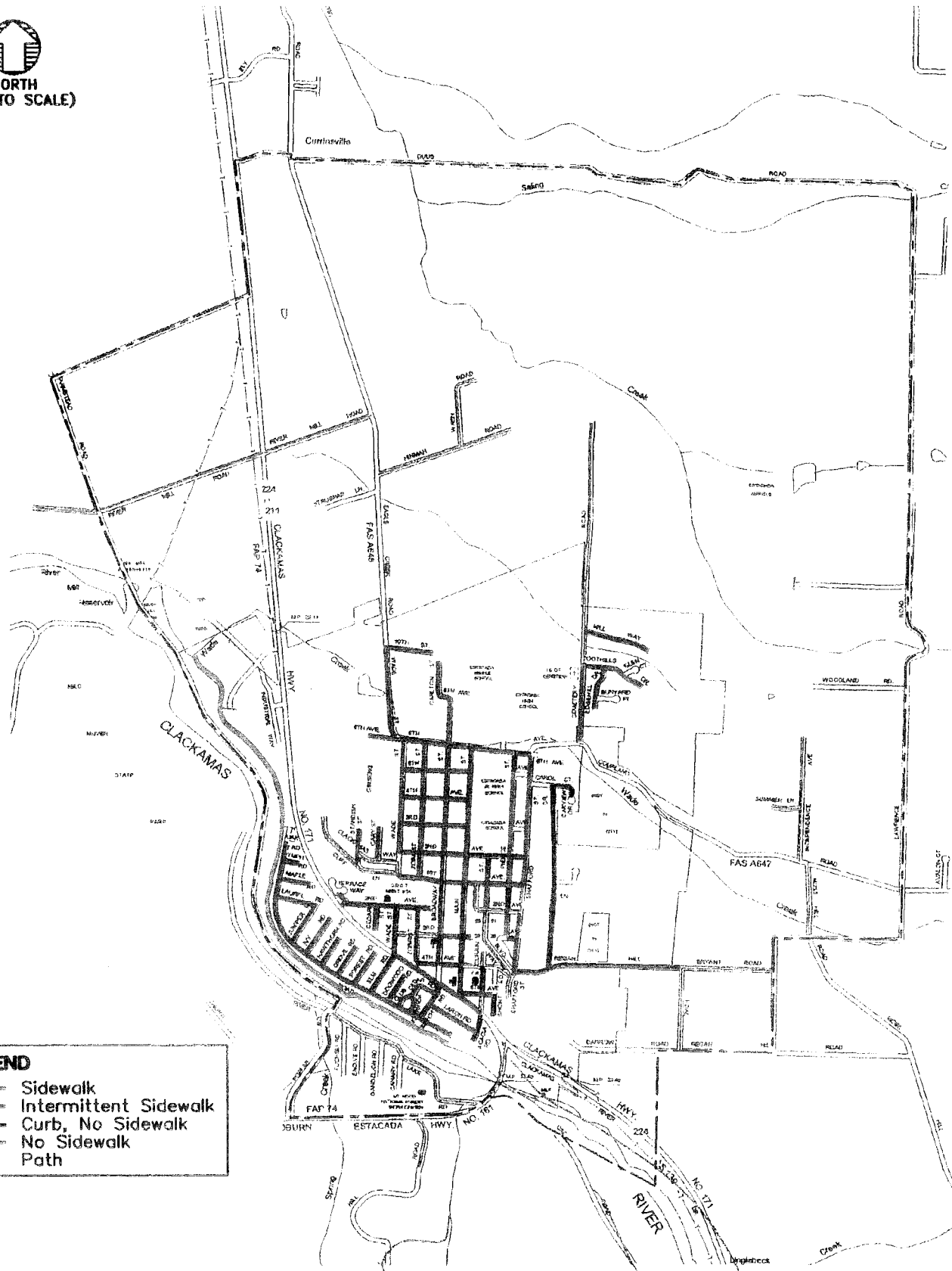
In order to evaluate the adequacy of the pedestrian system and sidewalk network, an inventory was conducted of existing connections between the pedestrian generators and the arterial- and collector-level roadways. Pedestrian generators were defined to be existing facilities that typically attract high levels of pedestrian activity on a regular basis. Typical generators include: schools, churches, parks, open spaces, shopping centers, cemeteries, libraries, community centers, government offices, museums, historical landmarks, and urban downtown core districts.

Ideally, at least one sidewalk connection should be provided between each of these generators and the existing arterial- and collector-level roadways, in order to enhance the safety and attractiveness of pedestrian and bicycle travel throughout the city. Based on the field survey, adequate sidewalk connections are currently unavailable on the arterial and collector street system at the following generators: Lakeshore Drive park/picnic area (privately maintained); Estacada Timber Park; Milo McIver State Park; IOOF Cemetery; and, Estacada High School, Junior High, Grade School and Rivermill School (especially for residents east of Pierce Street).

A developed path exists along the Clackamas River. This multi-use path follows the abandoned Oregon Electric Railroad right-of-way and is approximately eight feet wide. This path links Timber Park with downtown and runs northwest of town, adjacent to Highway 224.



NORTH
(NOT TO SCALE)



LEGEND






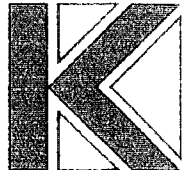
-  Sidewalk
-  Intermittent Sidewalk
-  Curb, No Sidewalk
-  No Sidewalk
-  Path



FIGURE 2
PEDESTRIAN FACILITIES
Estacada Transportation System Plan



Bicycle System

The City of Estacada does not currently offer designated on-street bicycle facilities. The city has completed construction of a multi-use path as a part of their *Parks, Open Spaces, and Recreation Master Plan*². In order to evaluate the adequacy of the street system to accommodate bicycle traffic, the inventory of the existing street system was used to analyze the traffic conditions surrounding areas where bicycle traffic is likely. Bicycle generators were defined to be places that typically attract high levels of activity. Generators considered within the City of Estacada include the schools, parks, the City Library, and the downtown.

Based on the field survey, adequate connections for bicyclists are currently unavailable on several streets within the city. As traffic volume on the streets increase, bicycle lanes may be warranted to maintain the safety of cyclists. Allowing bicycle traffic to mix with automobile traffic is acceptable where speeds are low and traffic volumes are below 3,000 vehicles per day³. On many streets in Estacada, however, traffic speeds are low enough that cycling is safe even though the traffic volume exceeds this threshold.

Public Transportation System

The backbone of the City of Estacada's public transportation system is the intra-city bus network that connects Estacada with the Portland metropolitan area. Tri-Met, the primary transit provider for the Portland metropolitan area, provides service between Estacada and Portland via Route 31.

Route 31, *Estacada*, provides bus service between Estacada and downtown Portland via the Carver Community Center, the Clackamas Town Center, and the Milwaukie Transit Center during the weekday a.m. and p.m. peak hours at 25-60 minute headways. Average travel times from the Highway 224/Main Street stop include: 42 minutes to the Clackamas Town Center, 58 minutes to the Milwaukie Transit Center, and 84 minutes to downtown. During the midday and on Saturdays, direct transit service via Route 31, is only provided between Estacada and the Milwaukie Transit Center. No transit service is available on Sunday.⁴ Figure 3 shows the existing Tri-Met bus route and bus stop locations. Also shown in Figure 3, are the existing school bus routes.

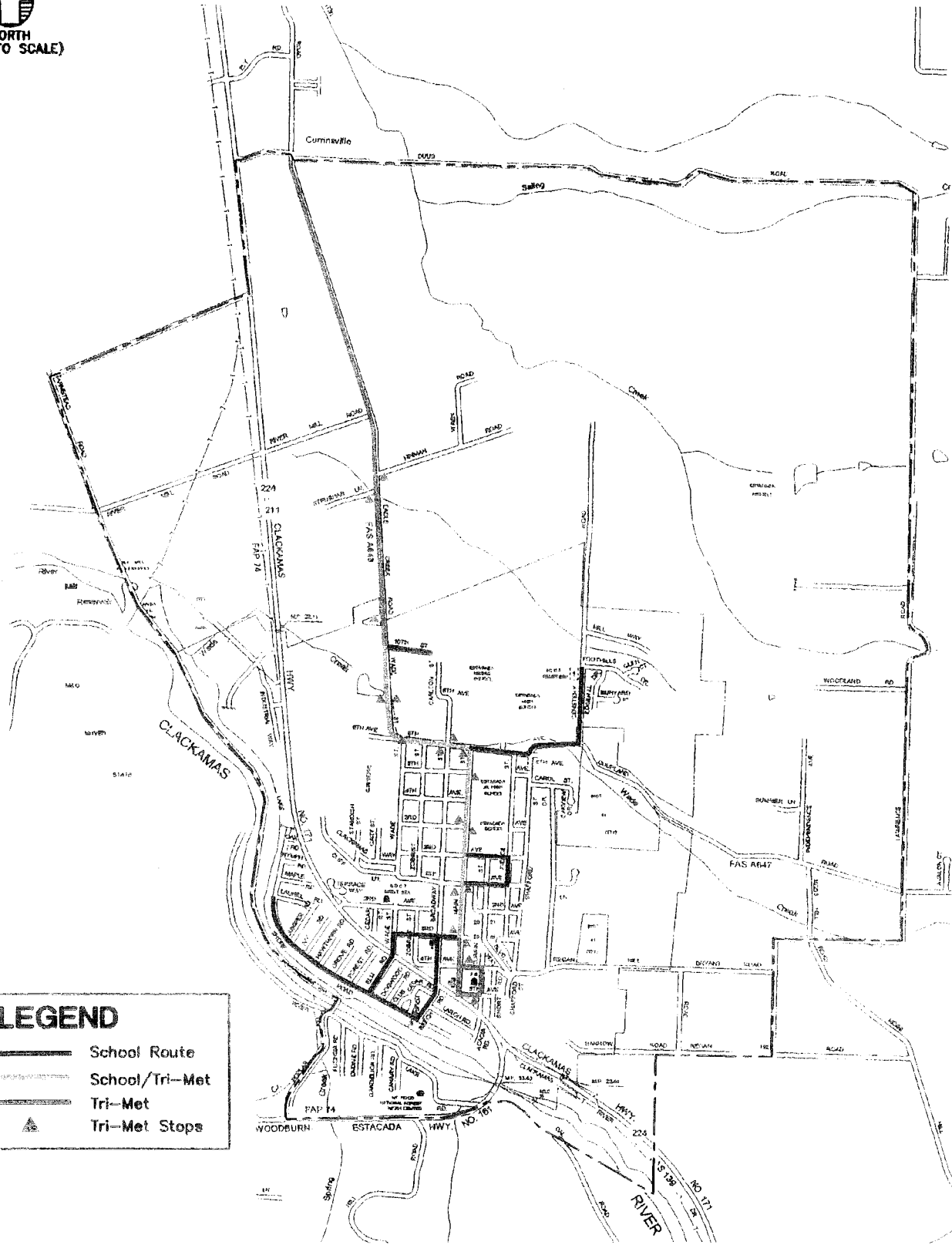
The Estacada Community Center also provides service to the transportation-disadvantaged in Estacada, Eagle Creek, and Barton. The Center operates one 14-passenger van, five days a week, on a demand-responsive basis.

Railroad Transportation System

There are no passenger or freight rail lines located within the Estacada UGB. According to the Comprehensive Plan, Portland Traction operated a rail line within the city, but the track has been vacated and is tentatively planned for use as a bicycle path. Industrial users in Estacada ship freight via truck on either Highway 224 to the Oregon Pacific rail line outside of Molalla or via Highway 211 to the Union Pacific terminals in Portland.

Passenger rail service is provided via Union Station in downtown Portland, approximately 25 miles to the northwest of Estacada. Residents of Estacada are able to access Union Station via private automobile, taxi, and Tri-Met.

No evidence was offered by the Committee or members of the community nor found by the study team to indicate that rail service to Estacada was inadequate.



LEGEND





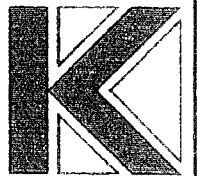
-  School Route
-  School/Tri-Met
-  Tri-Met
-  Tri-Met Stops



FIGURE 3

EXISTING TRANSIT ROUTES
Estacada Transportation System Plan



Air Transportation System

Estacada has a privately operated airport used primarily for recreational trip-making. The airport is protected under ORS 836.600 and is to be protected under the private-public airport heading. The airport was last inspected in September 1995 by State of Oregon Aeronautical personnel. Passenger and freight air service is available at the Portland International Airport (PDX). In 1996, PDX served nearly 12,600,000 passengers and 240,000 tons of air cargo. Estacada residents can travel to PDX via private auto, taxi, or Tri-Met. The existing air transportation system is considered adequate for the City of Estacada.

Marine Transportation System

There are no waterways within the UGB that are used for commercial transportation. The Clackamas River is used for recreational purposes only.

Pipeline and Transmission System

There are no major pipelines that cross the Estacada UGB. Portland General Electric does operate one set of high-voltage power transmission lines through Estacada. The RiverMill and Farraday Dam lines enter Estacada along Highway 211 and into a substation at the southeast corner of the Highway 211-224/Broadway intersection. Easements protect this transmission line and sufficient power is provided via this line to adequately serve the Estacada area.

Roadways

Three jurisdictions are responsible for the transportation facilities in Estacada: the Oregon Department of Transportation, Clackamas County, and the city. The characteristics of the roadway system, summarized by jurisdictional responsibility, are presented below.

ODOT Facilities

1999 → Highway 224/211 are state highways of District Level of Significance as per the Oregon Highway Plan (1991). According to the Oregon Highway Plan (OHP), the primary function of a District highway is to serve local traffic and to provide land access. In urban/urbanizing areas, the management objective of a District highway is to allow for safe and efficient, moderate to low-speed operation with moderate to high level of interruptions to flow. District highways, such as 224 and 211, serve a similar function to county and city streets. ▲

According to the OHP, Highway 224/211 is designated as a Category 5 access management facility. A Category 5 designation identifies a minimum spacing of 500 feet for public roadways, 150 feet for private drives, and 1/4 mile for traffic signals.

North of the Estacada city limits, Highway 224/211 is a two-lane roadway with a posted speed of 55 miles per hour. No bicycle lanes or sidewalks are provided along this section of the highway. At River Mill Road, the highway widens to a five-lane section and continues as such until the Highway 224/Highway 211 junction located southeast of downtown Estacada. Between River Mill Road and SW 2nd Avenue, the posted speed on the highway is 55 mph, decreasing to 40 mph south of SW 2nd Avenue and 35 mph south of Wade Street. Within the downtown area, sidewalks are provided along Highway 224/211 only at City Hall; in addition, the shoulders are wide enough to accommodate bicycle traffic.

Highway 224/211 provides Estacada residents with access to the Portland metropolitan area to the north and to recreational opportunities within the Mount Hood National Forest to the south. Access to the highway within the UGB is limited primarily to public streets and some private driveways. Within

Estacada, the average daily traffic (ADT) volumes on Highway 224/211 were approximately 7,000 - 8,500 vehicles per day in 1997. Southeast of Estacada, the ADT decreases to approximately 4,000 vehicles per day on Highway 224 and 6,000 - 8,000 vehicles per day on Highway 211.

Clackamas County Facilities

The Clackamas County Comprehensive Plan identifies the functional classification of the following streets within Estacada:

- Eagle Creek Road,
- Duus Road,
- Coupland Road, and
- Main Street.

The county's functional classification system reflects the importance, character, and carrying capacity of each identified facility. A brief description of the hierarchy and character of the County's functional classification system is listed in Table 1.

Table 1 Clackamas County Functional Classification System

Classification	Description
Freeway/Expressway	High speed, high capacity, limited or no access facility serving intra- and interregional traffic
Major Arterial	Moderate to high speed, moderate to high capacity, access limited to major generators; carries through and local traffic to/from destinations outside local community; connects cities and rural centers.
Minor Arterial	Moderate speed, moderate capacity, partial access controlled facility serving to connect collectors to higher order facilities.
Boulevard	Moderate to high speed, moderate to high capacity, major or minor arterial with improved aesthetics for the traveling public.
Collector	Low to moderate speed and capacity, principal carrier within and between neighborhoods and major activity centers, with access generally allowed.
Local	Provides direct access to abutting properties with connections to collector level and above facilities.

According to the plan, both Eagle Creek and Coupland Roads are classified as minor arterials and Duus Road is classified as a collector. In addition, the plan designates Highway 224 as a scenic roadway throughout Estacada.

City of Estacada Facilities

The City of Estacada Comprehensive Plan (1994) classifies all streets as:

- arterial/collector,
- arterial highway local,
- arterial local, or
- collector.

According to discussions with city staff, the combined (e.g., arterial local) classifications were provided to indicate the level of importance of a street within the city's transportation system differs from its designated function within the overall county/state transportation system.

For example, a street may function as an arterial within the city, but may only function as a local street when evaluating the overall county transportation system. As part of the recommendations of the TSP, the roadway classification for each street within the city was reviewed and a new set of street standards and classifications are proposed. Figure 4 shows the classification of each of the roadway facilities within the UGB. The 1998 average daily traffic volumes on the collector/arterial street system in Estacada are shown in Figure 5.

Existing Pavement Conditions

The City of Estacada has jurisdiction over most of the streets within the Urban Growth Boundary. The existing paved streets vary in condition and there are a limited number of unpaved gravel surface within the City.

An evaluation of the pavement conditions included basic observations of the street surface conditions and input from the advisory committees. The city does not have a pavement management system in place that actively identifies roads in poor condition. A Pavement Condition Category System can be used to determine the maintenance needs of the existing system. Management systems are valuable tools for capital costs planning and to determine long-term needs. Both ODOT and Clackamas County use pavement management systems to determine needs of the roadway network. An evaluation of the ODOT and Clackamas County systems identified potential systems the city could use. Discussions with the Management Team indicated that a simple pavement management system, that is easily understandable is preferred and thus, the Clackamas County system is proposed to assess pavement conditions. Table 2 describes the pavement conditions categories survey used by Clackamas County on County roadways.

Table 2 Pavement Condition Categories⁵

Category	PQI	Condition
Excellent	8-10	Pavement structure is stable, with no cracking, no patching and no deformation evident. Roadways in this category are usually fairly new. Riding qualities are excellent. Nothing would improve the roadway at this time.
Good	6-8	Pavement structure is stable, but may have surface erosion or minor cracking, minor patching, and possibly, some minor deformation. Riding qualities are very good. The pavement has a dry or light colored appearance. Some type of rejuvenation of the wearing surface is all that is required.
Fair	4-6	Pavement structure is generally stable with minor areas of structural weakness evident. Cracking is easier to detect. The pavement may be patched but not excessively. Although riding qualities are good, deformation is more pronounced and easily noticed.
Poor	2-4	Roadway has areas of instability, marked evidence of structural deficiency, areas of alligatoring, heavy and numerous patches, and very noticeable deformation. Riding qualities range from acceptable to poor. Spot repair of the pavement base may be required.
Very Poor	0-2	Costs of saving the pavement structural section would equal or exceed "complete reconstruction".

Clackamas County conducts a qualitative survey of pavement conditions on a yearly basis for arterials and collectors. Local streets are surveyed on a two to three year cycle. The acceptable standard for arterials and collectors is an average Pavement Quality Index (PQI) of 6.0. On local streets an acceptable standard is an average PQI of 5.0.

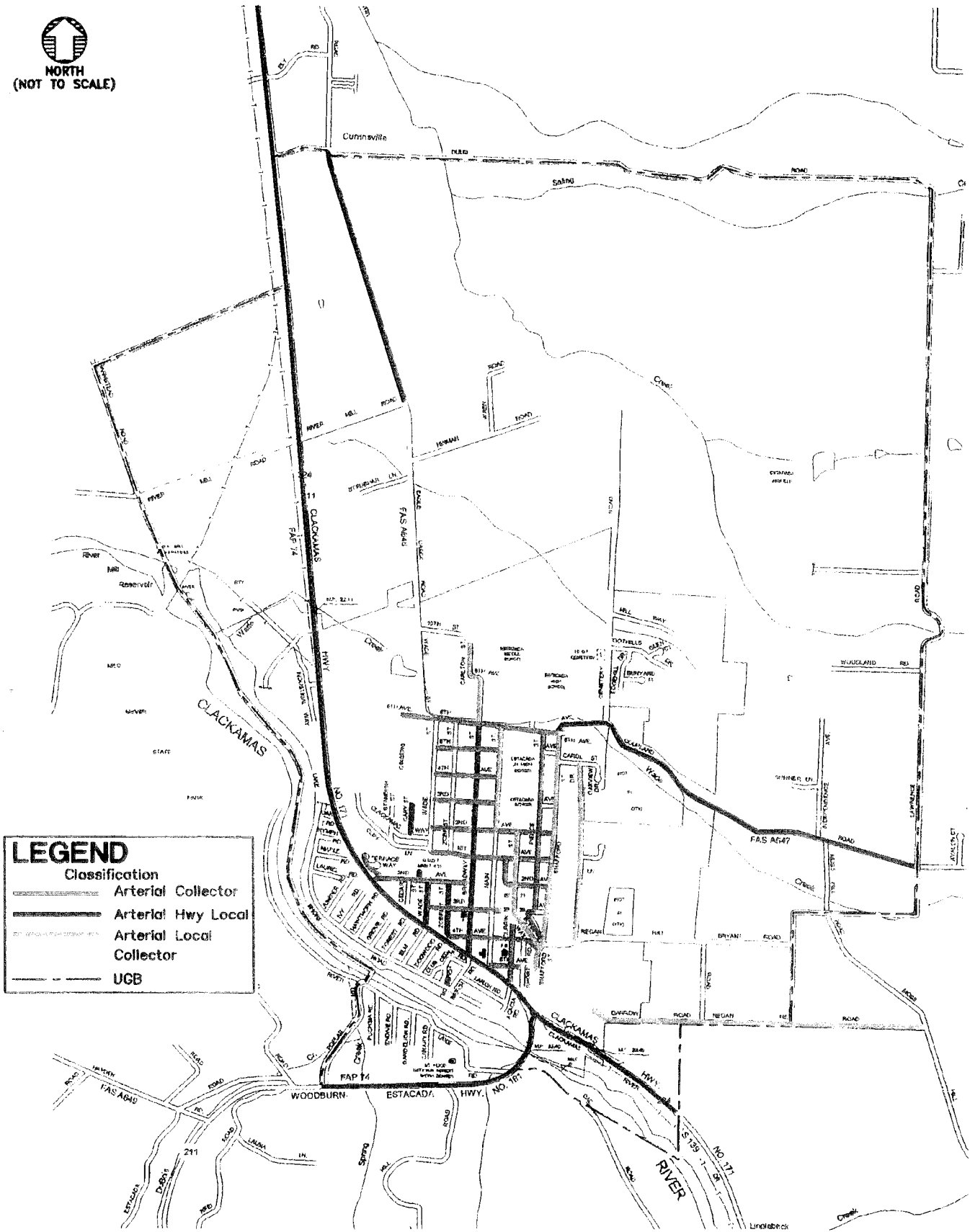
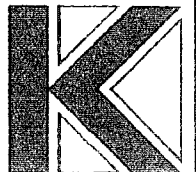


FIGURE 4

EXISTING ROADWAY CLASSIFICATION

Estacada Transportation System Plan



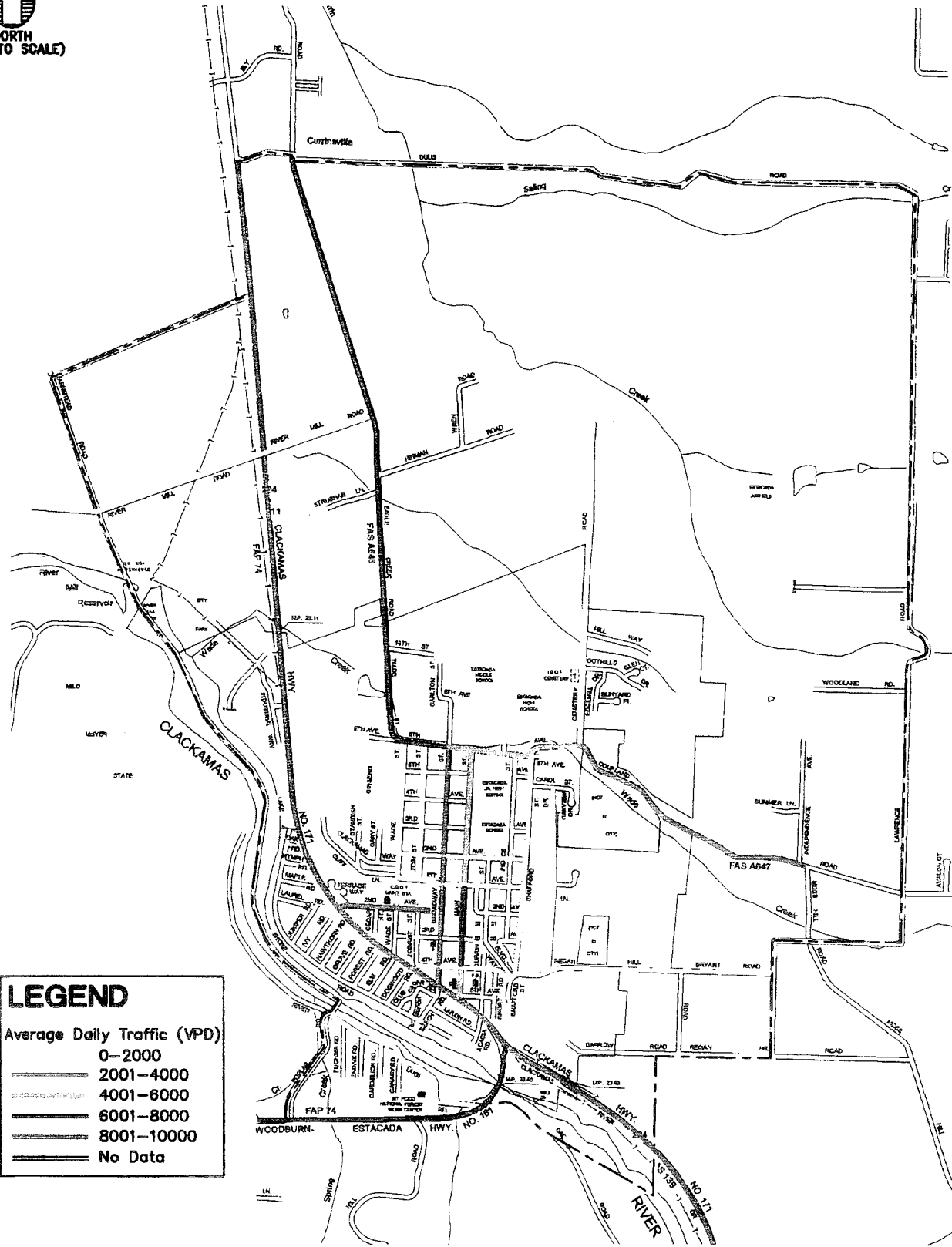
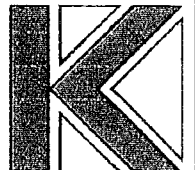


FIGURE 5

AVERAGE DAILY TRAFFIC VOLUMES
Estacada Transportation System Plan



It is recommended that the city implements the pavement management system described above to improve the existing conditions of pavement and begin implementation of preservation rather than continued short-term maintenance.

Existing Traffic Control

Traffic control takes many forms including turn restrictions, traffic signals, stop signs, and others. These traffic control devices are intended to improve the safety of the system. Within the Estacada UGB, only the Broadway/Highway 224 intersection is signalized. All-way stop-controlled intersections are located at: NE 6th Avenue/Main Street, SE 3rd Avenue/Broadway, and SE 4th Avenue/Broadway. All of the approaches, with the exception of the northbound movement at the Broadway/NE 1st Avenue intersection are stop-controlled. Sight distance constraints dictate the need for the stop-control at this intersection and the need to prohibit southbound left turns. The Shafford/Regan Hill/SE 4th Avenue intersection operates similarly, the eastbound approach is uncontrolled and the other approaches are stop-controlled. All of the remaining intersections are stop-controlled on the minor street approaches.

Intersection Analysis

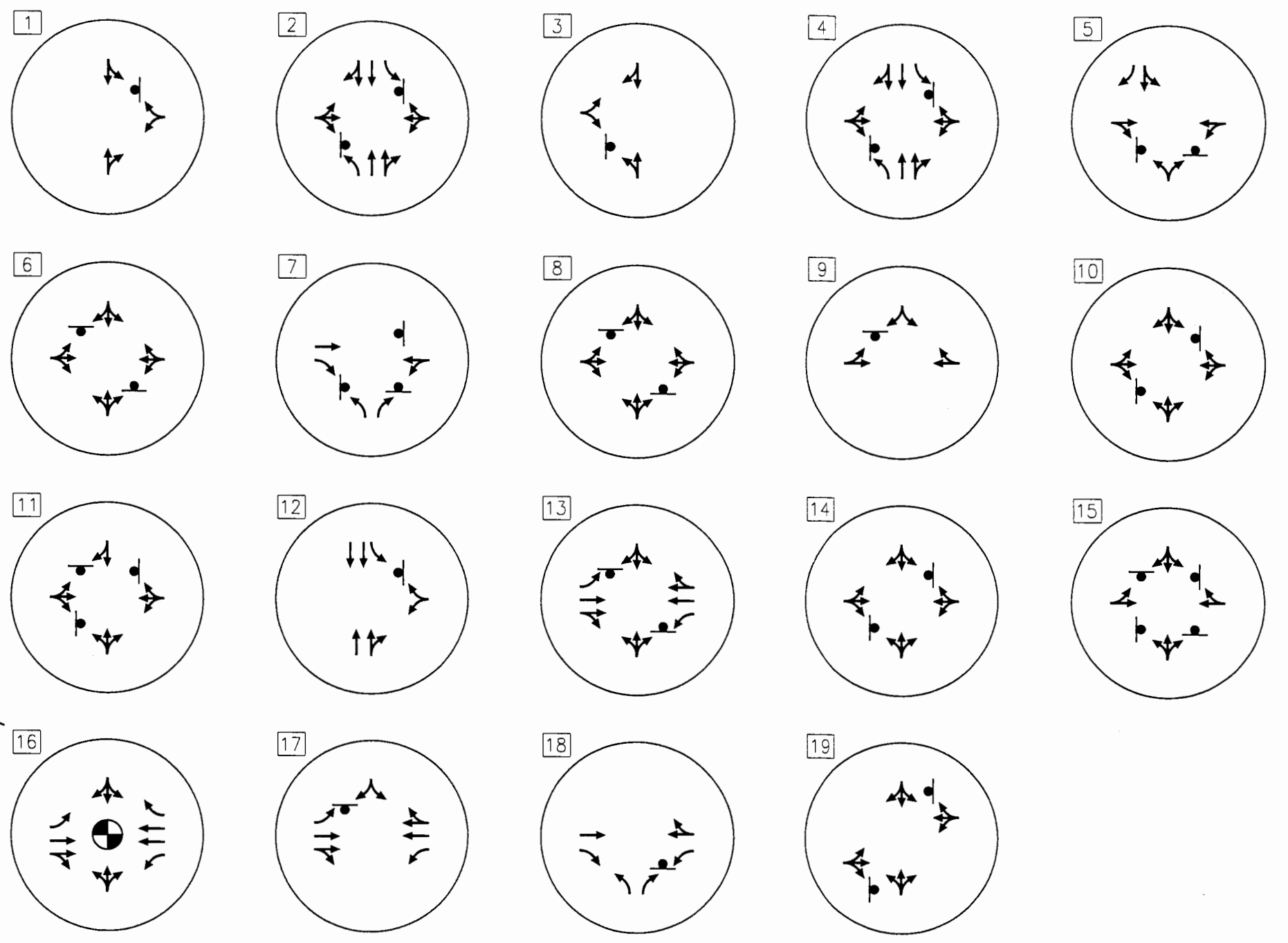
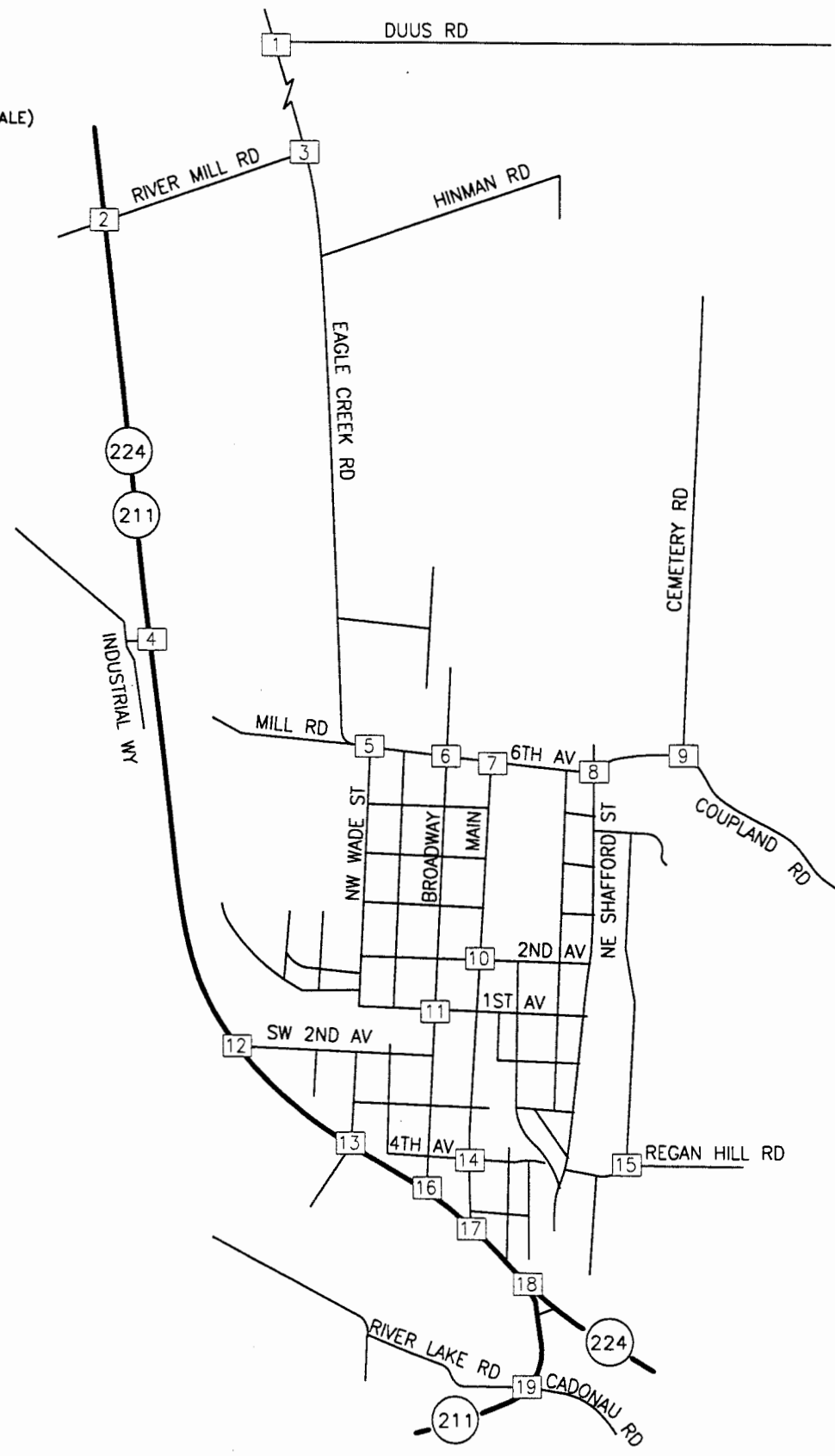
The Estacada TSP Management Team identified several intersections within the UGB that needed to be evaluated from either a safety, capacity, or geometric standpoint. The intersections identified include:

- Highway 224/SW 2nd Avenue
- Highway 224/Broadway Street
- Highway 224/River Mill Road
- Highway 224/Wade Street
- SE 4th Avenue/Shafford Street
- NE 2nd Avenue/Main Street
- NE 6th Avenue/Broadway Street
- NE 6th Avenue/Shafford Street
- River Mill Road/Eagle Creek Road
- Highway 211/River Lake Road
- Highway 224/Main Street
- Highway 224/Highway 211
- Highway 224/Industrial Way
- Duus Road/Eagle Creek Road
- NE 1st Avenue/Broadway Street
- NE 6th Avenue/Eagle Creek/Wade
- NE 6th Avenue/Main Street
- Coupland Road/Cemetery Road
- 4th Avenue/Wade Street



An analysis of the safety, operations, and geometric design of each of the intersections is discussed below. The existing traffic control and lane geometries at each of the study area intersections is shown in Figure 6.

Intersection Operations

Extensive data were collected to establish the existing conditions for the City of Estacada. Road tube count equipment was placed in several locations throughout the city to determine traffic flow patterns and hourly demands on the system.



LEGEND

-  - STOP SIGN
-  - TRAFFIC SIGNAL

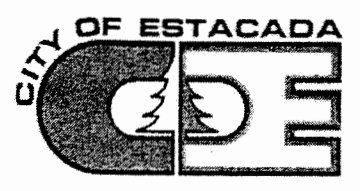
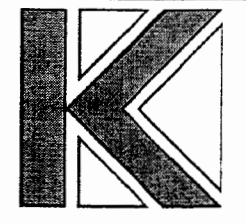


FIGURE 6
EXISTING LANE CONFIGURATIONS
AND TRAFFIC CONTROL DEVICES
 Estacada Transportation System Plan



Conversations with the Estacada TSP Management Team indicated that the afternoon school peak may have volumes as high or higher than the p.m. peak hour. For this reason, the p.m. peak hour counts were supplemented with hourly profiles of the daily traffic patterns on NE 6th Avenue, Main Street, and Broadway in the vicinity of the schools. The hourly traffic profiles on the streets within the vicinity of the schools are shown in Figure 7.

As shown in Figure 7, the volumes during the school peak are approximately 80-90 percent of the weekday p.m. peak hour volumes. For this reason, traffic volumes during the weekday p.m. peak hour were used in the analysis of all study area intersections. Typically, travel patterns during the weekday p.m. peak hour include commuting, shopping, and recreational trips and, therefore, produce higher traffic volumes than any other period of the day or week. Therefore, analysis of system operations during this time period is likely to consider the worst-case condition.

An operational analysis was conducted at each of the study area intersections using the weekday p.m. peak hour volumes shown in Figure 8. All level-of-service (LOS) analyses were conducted in accordance with the 1994 Highway Capacity Manual (HCM), published by the Transportation Research Board. A detailed description of this methodology and the thresholds used to establish each LOS grade for both signalized and unsignalized intersections is included in Appendix B.

Figure 8 shows the delay and volume-to-capacity ratio for each of the study intersections. As shown in Figure 8, all study area intersections operate at level-of-service "D" or better during the weekday p.m. peak hour. In addition, no modifications to the existing traffic control at any of the intersections is needed from a capacity standpoint. Traffic signal warrants were conducted for the intersections with a higher volume intensity and based on the existing data, a traffic signal is not warranted at any of the unsignalized intersections.

Future Use of Traffic Control Devices

Traffic control devices are used to direct and assist vehicle operators in the guidance and navigation tasks required to traverse safely any facility open to public travel. To be effective, a traffic control device should fulfill a need, convey a clear and simple meaning, command respect of road users, and give adequate time for proper response. As the city grows, residents of Estacada may question the placement of traffic control devices. The placement of traffic control requires careful consideration and uniform and consistent practice can reduce the city's liability. There are two primary concerns associated with the inappropriate placement of traffic control devices:

1. The placement of the traffic control devices represents a liability to the city if they are inappropriately used (Placement standards are identified in the Manual on Uniform Traffic Control Devices).
2. The inappropriate use of traffic control devices tends to result in disrespect for the device; potentially leading to driver complacency and future accidents (for which the city may then be liable).

Consultation of a licensed professional traffic engineer is encouraged when the city is considering traffic control devices.

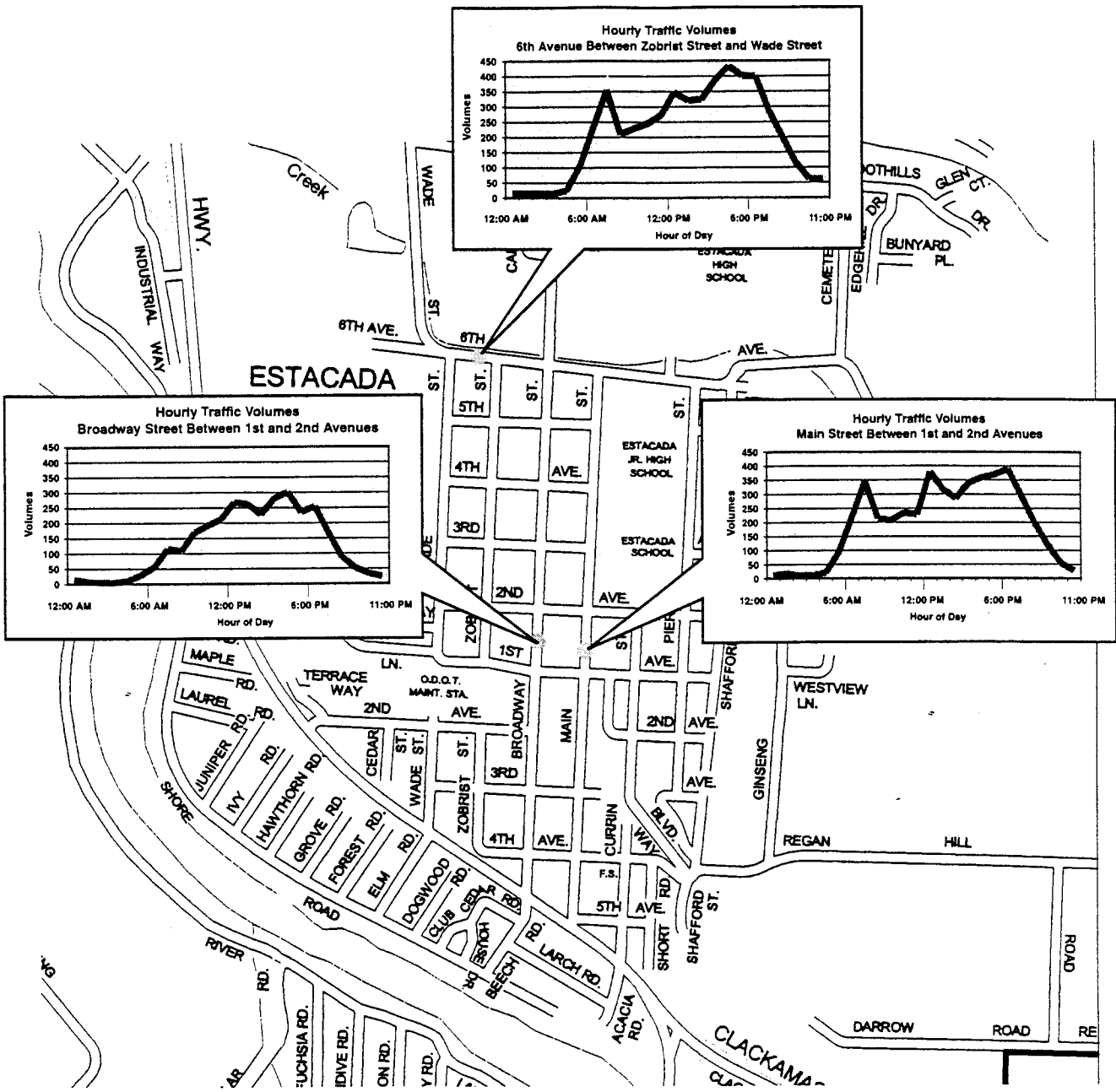
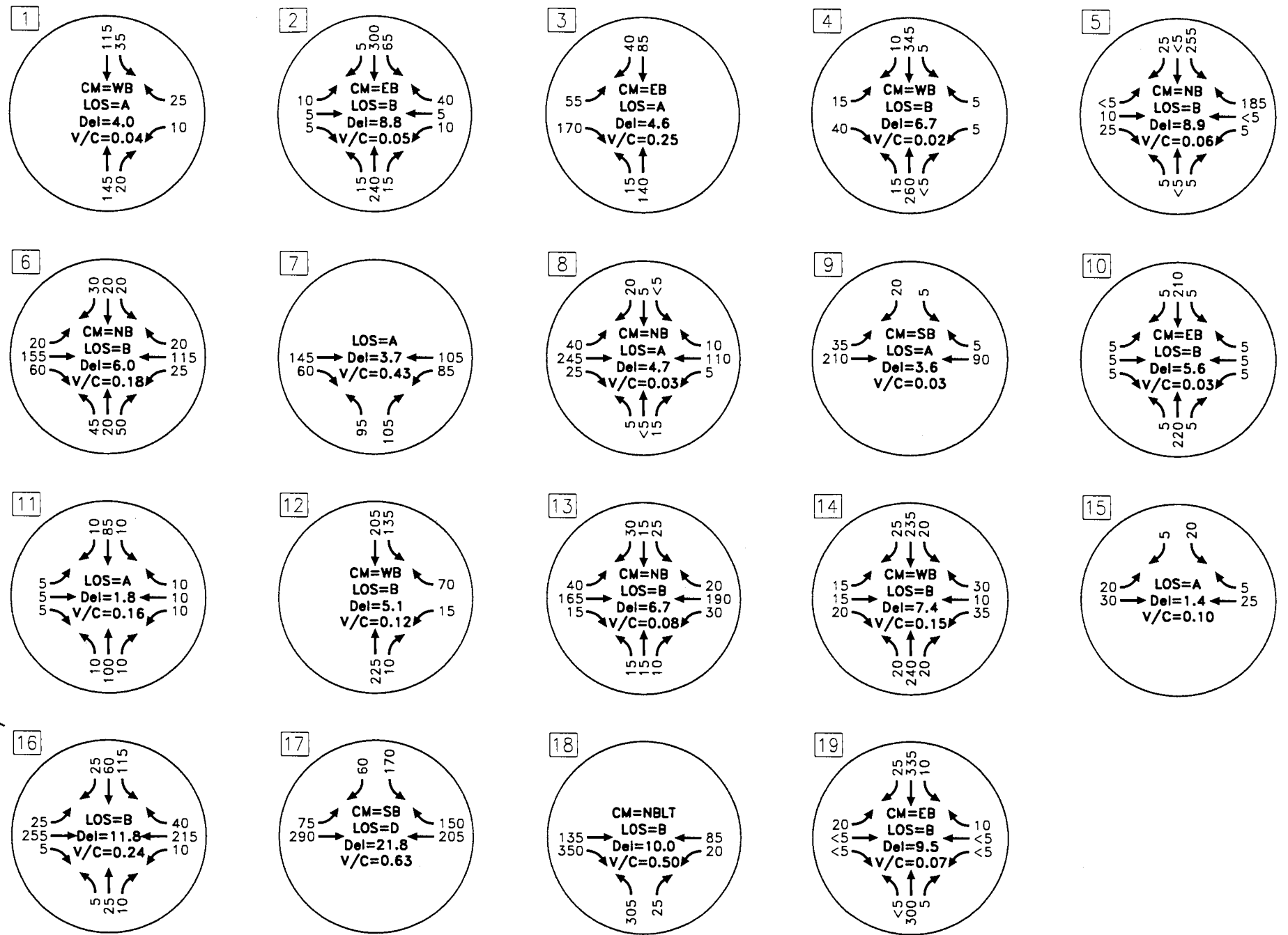
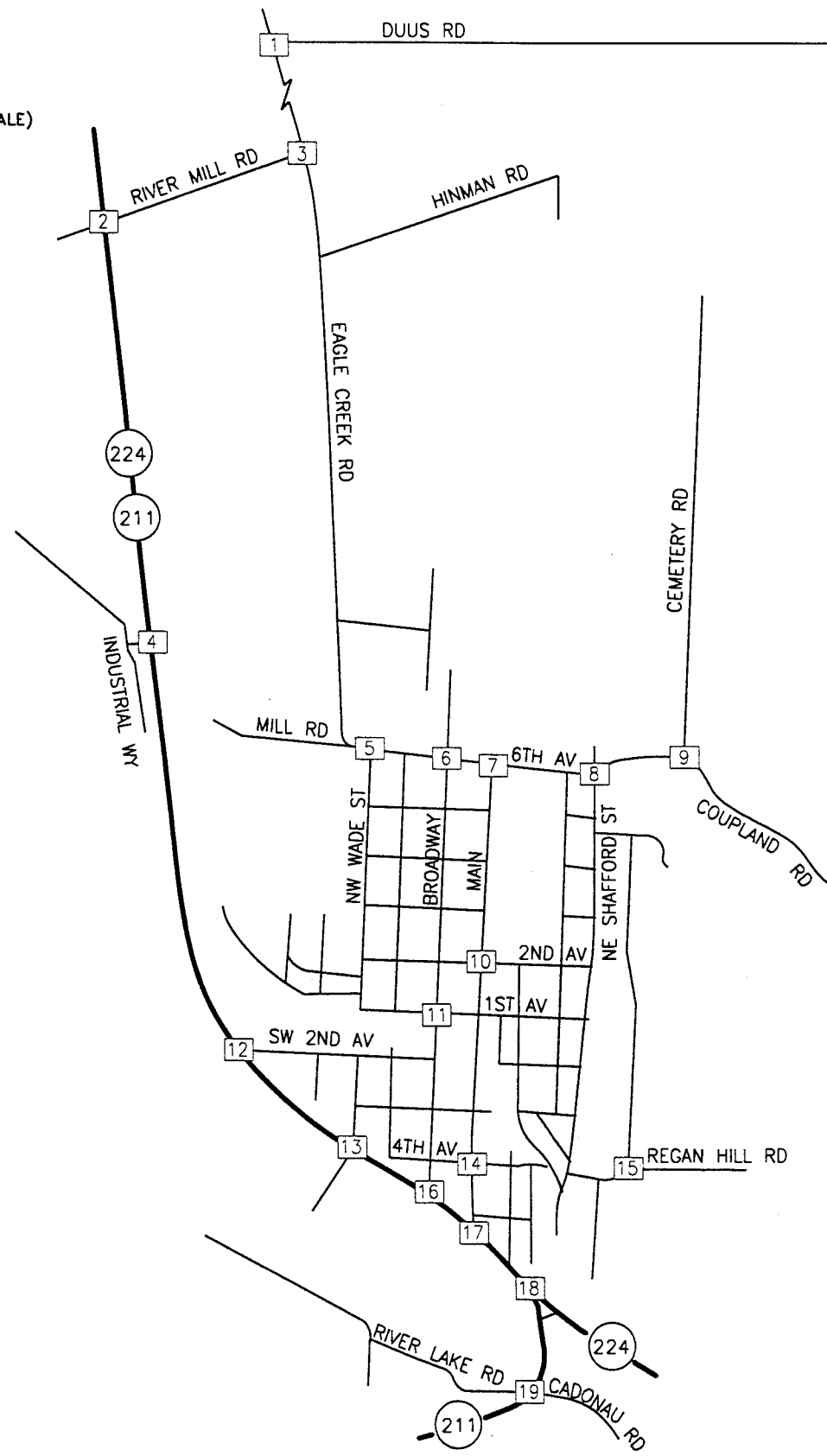


FIGURE 7
HOURLY TRAFFIC PROFILES
FOR CITY STREET SYSTEM
 Estacada Transportation System Plan





LEGEND
 CM = CRITICAL MOVEMENT (UNSIGNALIZED)
 LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/
 CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
 Del = INTERSECTION AVERAGE DELAY (SIGNALIZED)/
 CRITICAL MOVEMENT DELAY (UNSIGNALIZED)
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

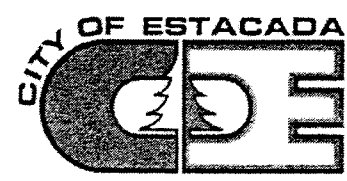
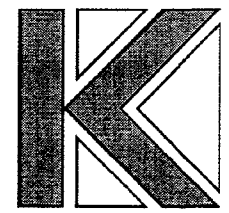


FIGURE 8
1998 EXISTING TRAFFIC VOLUMES -
WEEKDAY PM PEAK HOUR LEVEL OF SERVICE

Estacada Transportation System Plan



Traffic Safety

A summary of the reported accidents on Highway 224/211 within the UGB and at each of the study area intersections was assembled from ODOT records. The ODOT database includes information about accident severity (property damage only, injury, or fatality) and type (i.e., angle, head-on, rear-end, sideswipe, turning, fixed object, pedestrian, and other).

Accident data described by a link level analysis is examined by determining the number of vehicles using the roadway and the rate at which accidents occur along the highway per mile traveled by the vehicles. Accident records for the 3-mile segment of Highway 224 within the urban growth boundary of Estacada were obtained from ODOT and examined for existing safety concerns. This data indicates that there were 21 reported accidents during the five-year period between 1993 and 1998 on this segment of Highway 224, with no fatalities. The reported number of accidents corresponds to an average annual accident rate of 0.51 accidents per million vehicle miles (MVM). This rate does not suggest a potential safety deficiency along this segment of the highway and the data does not suggest any apparent pattern among the reported accidents.

Accident data is described at intersections by examining the rate at which accidents occur, normally based on the number of accidents per million entering vehicles (MEV), or vehicles entering the intersection.

A summary of the accident history at the study area intersections is reported in Table 3.

Table 3 Study Intersection Accident Rates

Intersection	Number of Accidents	Accidents/MEV
Highway 224/SW 2nd Avenue	1	0.07
Highway 224/Broadway	2	0.14
Highway 224/Main Street	5	0.31
Highway 224/Highway 211	8	0.45
NE 1st Avenue/Broadway	2	0.14
NE 2nd Avenue/Main Street	1	0.11
NE 6th Avenue/Eagle Creek/Wade	1	0.09
NE 6th Avenue/Broadway Street	2	0.19
NE 6th Avenue/Shafford Street	1	0.11
Coupland Road/Cemetery Road	1	0.15
River Mill Road/Eagle Creek Road	1	0.08
Highway 211/River Lake Road	1	0.11
Highway 224/Wade Street	1	0.07
Highway 224/River Mill Road	2	0.15
Duus Road/Eagle Creek Road	2	0.16
Highway 224/Industrial Way	0	0.00
SE 4th Avenue/Shafford Street	0	0.00
NE 6th Avenue/Main Street	0	0.00

It should be noted that there were no fatalities reported over the five-year period within the city. In addition, the accident rate at the study intersections does not exceed 0.5 accidents per million entering vehicles (ACC/MEV). An accident rate of greater than 1.0 accidents per million vehicles, for intersections in urbanizing areas, generally indicates that the accident history at an intersection should be examined in detail and potential mitigation measures investigated, if necessary. Finally, there were no apparent patterns among the accidents at any of the intersections that would suggest an inherent geometric deficiency.

Geometric Evaluation

A field survey of the Estacada transportation system revealed that there are several intersections needing modification to the current alignment or improvement to the sight distance available at the intersection to address geometric deficiencies. Although neither the safety nor the operational evaluation suggests an existing deficiency, the design of these intersections is less than ideal and the functional layout could be improved as part of future transportation system improvements in the city. Example locations with geometric deficiencies include:

- the offset intersection of River Lake Road/Cadonau Road/Highway 211;
- the intersection of Regan Hill Road/4th Avenue/Shafford Street; and,
- the available sight distance at the Shafford Street/NE 6th Avenue intersection.

CONCLUSIONS

The inventory and evaluation of the existing transportation system in Estacada revealed the following:

- additional pedestrian facilities are needed to connect existing residential areas with schools and parks in the city;
- there are no on-street striped bicycle facilities within the city;
- no public air or rail facilities are available within the Estacada UGB;
- adequate rail and air freight and passenger service is available through facilities in the City of Portland;
- limited but adequate transit service is provided by Tri-Met and through the community center;
- the city's existing functional classification system needs to be revised;
- there are no existing operational deficiencies at intersections within the city;
- no traffic control modifications are required at this time;
- some of the existing roadways are in poor condition (Main, Regan Hill Road, etc.);
- accident data did not reveal any apparent safety deficiencies at any of the study area intersections; and,
- three study intersections could benefit from geometric improvements to correct skewed alignments and/or sight distance limitations.

Section 3

Future Conditions Analysis

Future Conditions Analysis

This section presents an analysis of future conditions for the transportation system within the City of Estacada. The long-term future transportation needs for the city were examined based on employment and population forecasts, expected development activities, review of the proposed roadway network, results from the operational analysis of the existing street system, and extensive discussions with regional transportation personnel and local citizens.

TRANSPORTATION DEMAND

Future transportation demand within the City of Estacada urban growth boundary was estimated based on expected growth in the study area population, employment, and traffic traveling through the study area for the horizon year 2019. The 20-year forecast planning horizon was chosen to ensure compliance with Oregon's Transportation Planning Rule and to provide a long term view of the performance of the transportation system.

Traffic volume forecasts for the year 2019 were used to determine future traffic conditions on the existing roadway network and where improvements are needed. The adequacy of the transportation system, with respect to all transportation modes (automobile, pedestrian, bicycle, transit, etc.) was considered in this analysis. Based on this analysis, a series of alternatives were analyzed to identify a list of future improvements that maintains and improves the existing system.

Long-term future transportation needs for the City of Estacada were examined based on discussions with the advisory committees and review of the no-build roadway network, results from the operational analyses of the existing street system, and future travel demand forecasts. Future alternative mode plans were developed to ensure provision for pedestrians, bicyclists, and transit users. The alternative mode plans and roadway system alternatives were assessed for their effectiveness in adequately serving demand and satisfying the study goals and objectives.

Population Forecasts

The population of Clackamas County increased from 166,088 in 1970 to 313,200 in 1996, an overall growth rate of approximately 88.6 percent over the past 26 years. This equated to an annual growth rate of approximately 2.5 percent. From 1990 to 1996, the population of Clackamas County grew from 278,850 to 313,200, an annual increase of approximately 2 percent. This growth rate is indicative of stable growth during the past six years. It is expected that the county will continue to grow at this pace.

Because of its rural nature and distance from the City of Portland, the City of Estacada is experiencing a lower rate of growth than the remainder of the county. The population of the city has increased from 1,164 residents in 1970 to 2,065 in 1996. This translates into a 2.2 percent annual growth over the past 26 years. During the six-year period from 1990 to 1996, the population increased from 2,016 to 2,065, an annual increase of approximately 0.5 percent.

Metro, in conjunction with the Center for Population Research and Census at Portland State University, provide population estimates for the region as well as the entire State of Oregon. The Metro growth allocation model forecast identifies an estimated annual growth rate of 2.5 percent during the next 20 years (1994-2015 forecast) for the city. The 2015 forecast for population in Estacada was 3,614 residents. Using Metro's assumed annual growth rate and projecting from 2015 to 2019 increases the estimate to approximately 3,900 residents within the city limits.

Housing

Residential property and existing housing information can be used to estimate travel demand on the transportation system, thus it is important to review areas of growth within the city. Future development can be highly speculative in Estacada because the market tends to be rather volatile. The previous years have seen several proposals for housing subdivisions within the city limits, although only a small number of houses have actually been built. Several proposals during the previous year have raised citizen awareness of the traffic impacts of large developments.

The average household size in Estacada is expected to change somewhat over the 20-year planning horizon. There were 2.7 persons per dwelling unit in 1990 in the Estacada area. This is slightly higher than the county average. It is likely that this average will remain higher than the County average due to growth of the city as a community dedicated to maintaining the quiet, rural lifestyle attractive to many families⁶. Assuming the population forecast is accurate and the average persons per dwelling unit remains relatively constant, an additional 570 houses will be needed in the next twenty years to accommodate the forecasted growth.

Employment Forecasts

The employment base in Estacada is estimated to grow from approximately 883 jobs in 1996 to 1,527 jobs by 2019. This represents an annual increase of 2.5 percent over the 20-year period. The growth in employment within Estacada is likely to occur as industrial and manufacturing jobs, largely due to the city's encouragement of those sectors. Additional growth is also planned for the retail sector, as outlined in the visioning process performed by the city in 1995.

Changing Demand for Transportation Options

There is a potential, as a smaller community develops, that it can become more self sufficient and better able to serve the needs of its population. Under the right mix of land use and development, citizens are able to find the employment and services desired within the community, instead of having to travel to larger urban areas located nearby. The benefit to the transportation system is in the potential for some of these trips to be shorter or made via modes other than the automobile, thereby reducing overall demand on the roadway network. This benefit can be offset if large regional attractors locate in the city.

Generating quantitative future travel demand estimates for alternative modes is a challenging task. Traditional methods (normally an extrapolation of existing data or trends) require a basis in substantial historical data. Such data are not readily available for the Estacada area. Therefore, a qualitative approach was taken in estimating future demand for non-auto traffic.

Traffic Forecasting Methodology

Forecasts of future traffic volumes followed the *Level 1 Trending Forecast* described in the ODOT's Transportation System Planning Guidelines⁷. A Level 1 Trending Forecast estimates future traffic volumes based on historical growth trends of vehicle traffic on the nearest state highway. The state highway is used because of the lack of additional data on the adjacent street system.

Traffic volume data for Oregon Highway No. 171 (Clackamas, ORE 224) is presented in Figure 9. The proximity of this highway data to the city provides a good indication of traffic growth for the area. Review of Figure 9 shows that the annual growth rate was fairly consistent between 1979 and 1998.

Highway 224 -Traffic Growth Trends
 ODOT No. 171

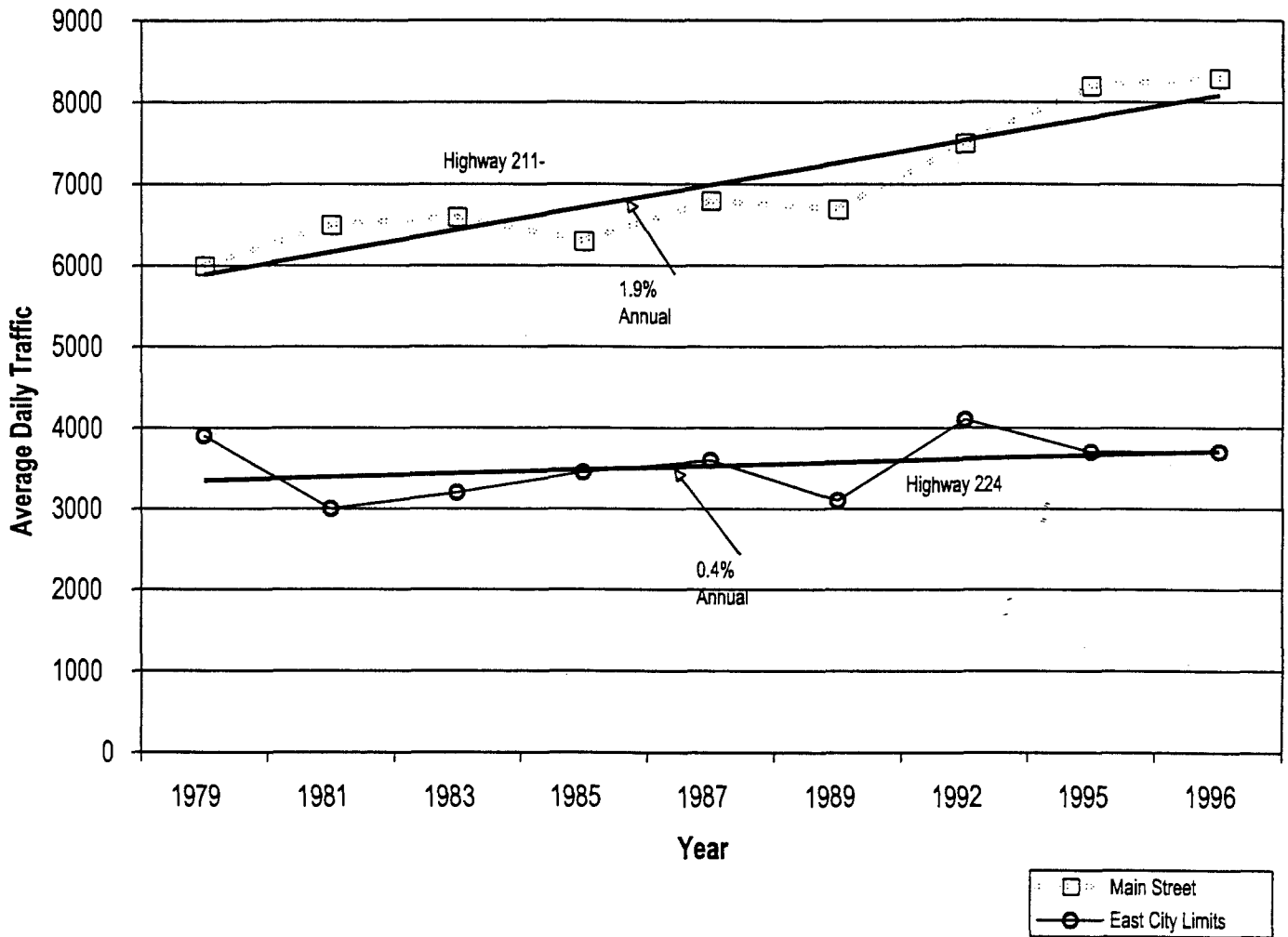
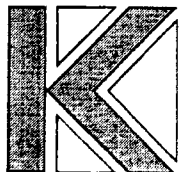


FIGURE 9
 HISTORICAL TRAFFIC VOLUME TRENDS
 HIGHWAY 224 (ODOT NO. 171)
 Estacada Transportation System Plan



East of the city, traffic on ORE 224 has not increased significantly in the past 20 years. This is largely due to the type of traffic that uses ORE 224 east of Estacada. In previous years, during heavy timber production, a steady stream of traffic used the facility throughout the year. More recently, the traffic growth generated by the timber industry has slowed and recreational traffic has increased in the corridor. The average daily traffic has experienced no measurable growth, remaining below 4,000 vehicles per day. West of the Highway 211-224 intersection, the average annual growth on ORE 211-224 in the city has been 1.9 percent.

Traffic volume data for Oregon Highway No. 161 (Woodburn-Estacada, ORE 211) is presented in Figure 10. The Highway 161 data (traffic south of the city) shows an average annual increase of 2.8 percent.

A Level 1 Trending Forecast suggests the use of the growth rate determined from the highway data for traffic projection on the city street network. Based on the volume trends of the past twenty years, it was estimated that an annual growth rate of 2.5% could be used to estimate a reasonable forecast for future traffic volumes on the state highways and local streets. The 2019 forecast for the street network, assuming the 2.5% growth rate, is shown in Figure 11.

An evaluation of the forecast was completed to determine whether the trending analysis was adequate for the local street network. The traffic volume information presented in Figure 11 was compared to the transportation impact studies completed for the following proposed developments within the city limits:

- Estacada Industrial Area (200 acres of light industrial , west of Highway 224);
- Presidential Development (450 single-family units, northeast of the city);
- Whitesell Estates, (approximately 120 single-family units, east of the city); and
- Cazadero Heights (approximately 60 single-family units, south of Regan Hill Road, east of the city).

Review of the trip generation potential of proposed developments within the City of Estacada indicated that the trending forecast required additional modifications to provide a forecast that sufficiently describes future conditions. While the traffic volumes on the highway were considered adequate, the city street system forecasts did not reflect the areas of growth that have been proposed in the city. A hand assignment of traffic based on traditional transportation planning methods was used to revise the Level 1 Trending Forecast. The hand assignment forecast utilized the volume level on the highway from the Trending Forecast that was based on the 2.5% annual growth for highway traffic.

Highway 211 - Traffic Growth Trends
 ODOT No. 161

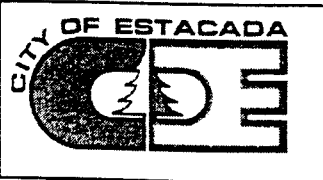
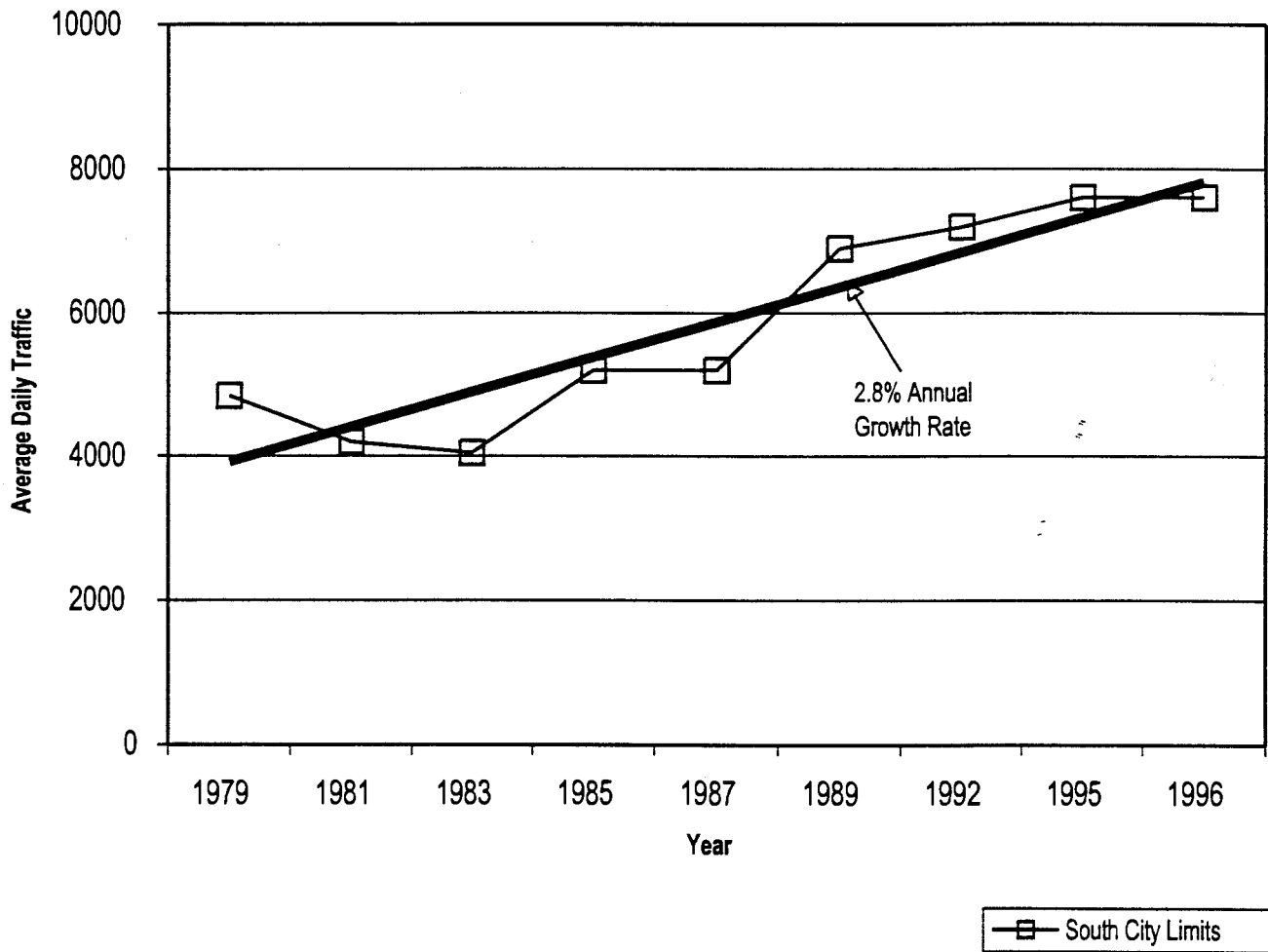
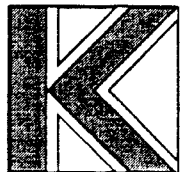


FIGURE 10
 HISTORICAL TRAFFIC VOLUME TRENDS
 HIGHWAY 211 (ODOT NO. 161)
 Estacada Transportation System Plan





NORTH
(NOT TO SCALE)

LEGEND

Average Daily Traffic (VPD)

- 0-5,000
- 5,000-10,000
- 10,000-15,000
- 15,000-20,000
- UGB

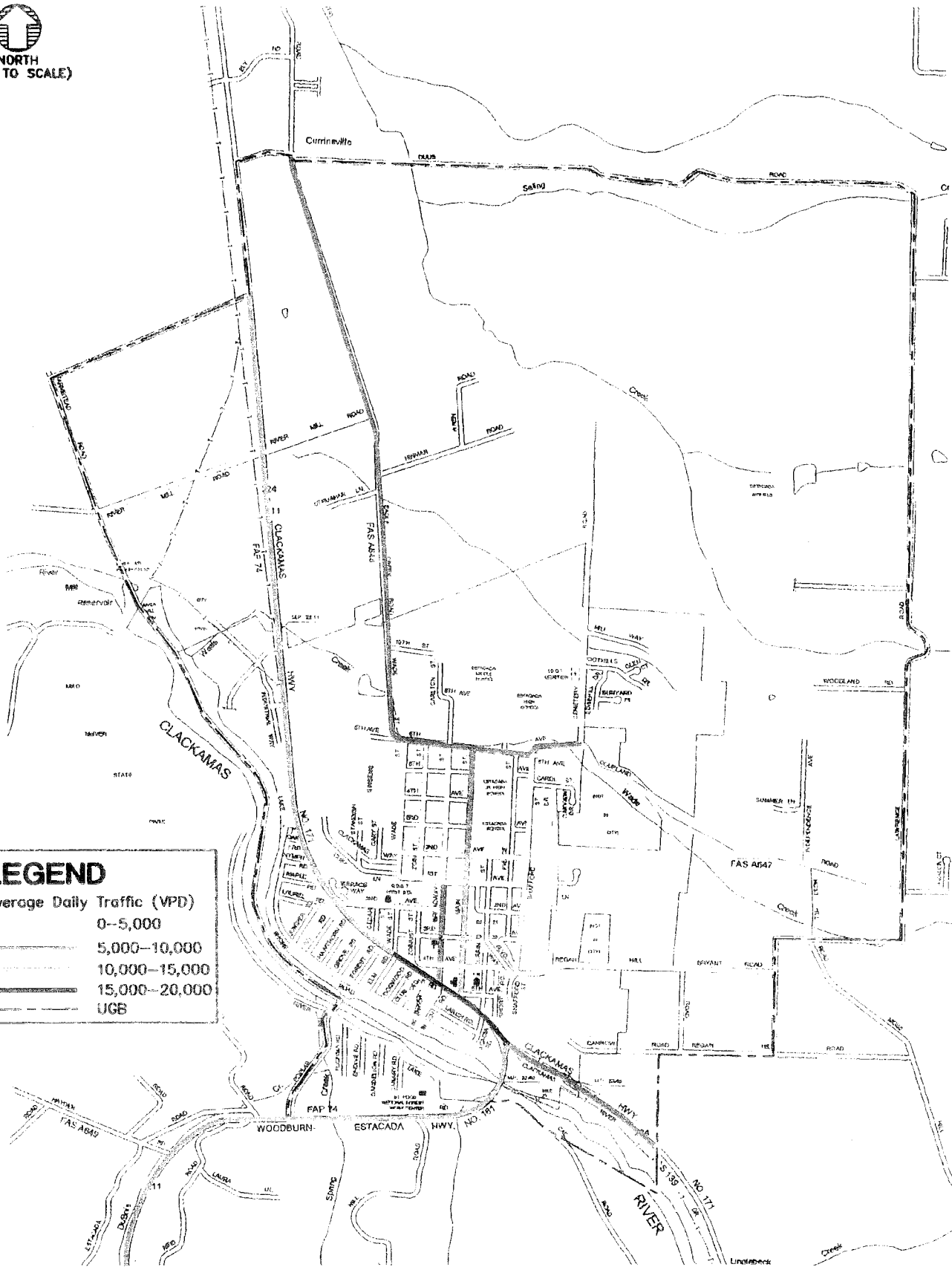
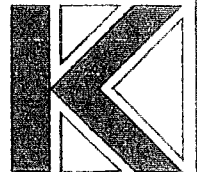


FIGURE 11
2019 FUTURE CONDITIONS ADT FORECAST
TRENDING ANALYSIS-2.5% GROWTH
 Estacada Transportation System Plan



Hand assignment forecasts utilize traditional transportation planning procedures and information about land use, population, and employment to estimate traffic on a transportation network. In the hand assignment traffic forecast, the trip generation potential of prospective developments was calculated based on trip generation rates summarized in the Institute of Transportation Engineers (ITE) Trip Generation Manual⁸. The traffic generated by new developments was added to a background traffic growth to account for increases in external trips (trips that don't have an origin or destination within the UGB) and growth within the city that is not addressed by the identified developments. To account for this citywide growth, a one percent annual growth rate was applied to the existing traffic volumes separately from the traffic assignment that was completed for the land parcels that were identified within the City of Estacada and shown in Figure 12. Figure 13 shows the traffic volume projections for the future year under this hand assignment. A review of the forecasts, particularly in the northeast section of the city, show that the refined estimates more accurately reflect future development proposed within the city limits.

Summary

Following a review of the trending analysis, it was found that the Level 1 Trending Forecast did not adequately describe future traffic conditions for the public street system. A refined hand assignment traffic forecast was developed to improve the forecasts for the public street system. There are two primary reasons for this additional level of detail. First, the land use assignment more adequately describes development of specific land parcels, providing site specific data for analysis. Second, a detailed traffic assignment of new trips onto the system adequately models growth areas and future needs in developing areas. One final benefit of the hand assignment forecast is the increased level of detail that can be provided for improvements.

FUTURE NO-BUILD TRAFFIC OPERATIONS

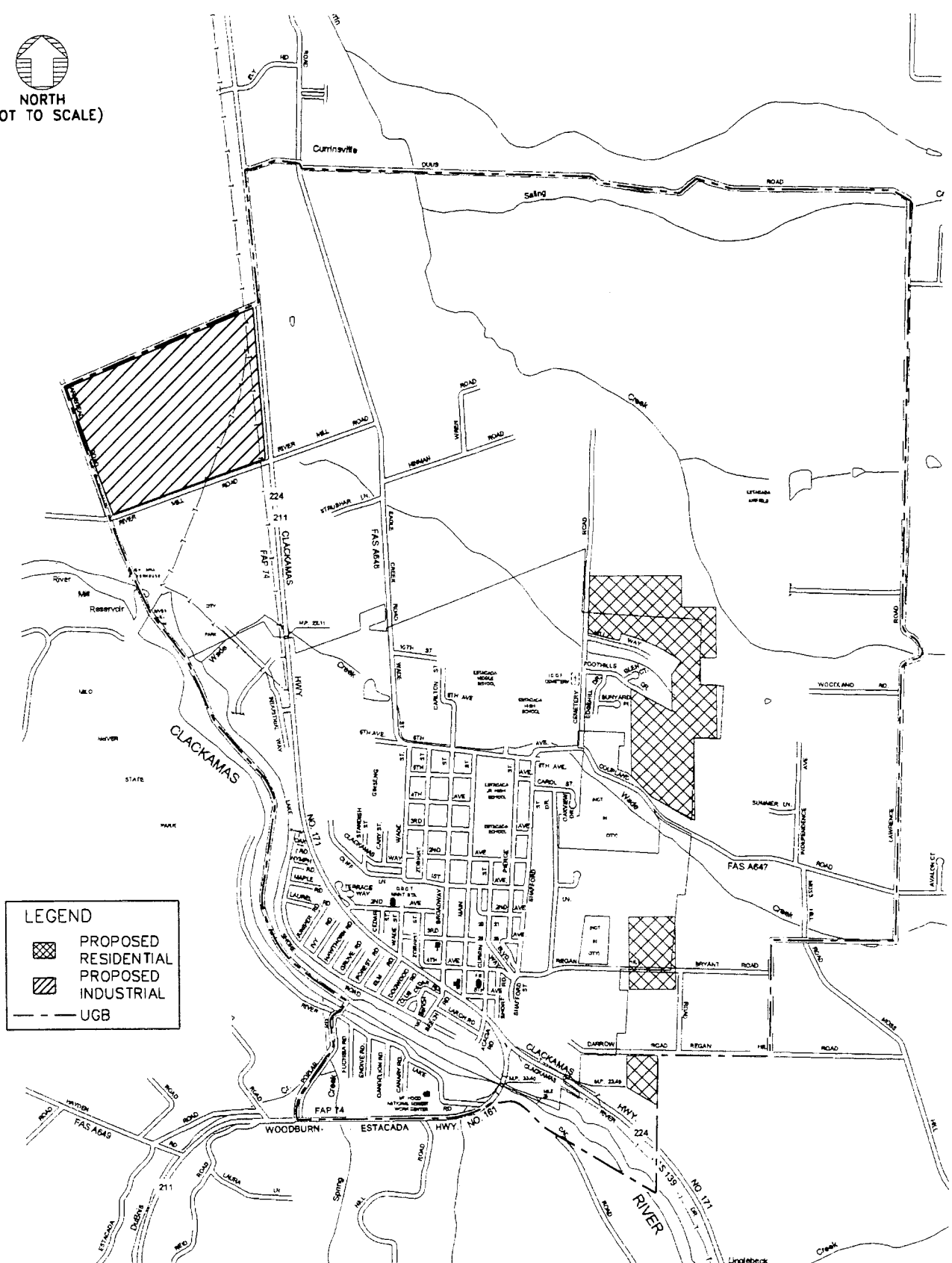
The analysis of no-build future conditions is based on the assumption that no additional transportation facilities other than those with already committed funding will be built. Currently, no future transportation projects are funded for street improvements in the City of Estacada.

Future Conditions for Pedestrian, Bicycle, and Transit Modes

Future demand for pedestrian and bicycle transportation was qualitatively estimated. Pedestrian trips are possibly the least quantifiable and the most difficult to predict. There are numerous trips made using nonmotorized modes in Estacada on a daily basis, yet there is also a great opportunity to increase the number of nonmotorized trips made within the city. The means to promote these modes lie in the provision of safe, convenient, and efficient facilities for the users. These facilities must be developed to serve users in an efficient manner. The number of direct connections provided to major activity generators measures efficiency of the system. Where possible, added connections should reduce the amount of out of direction travel for pedestrians and cyclists.

The existing multi-use path system in Estacada should be expanded to improve the accessibility of the existing recreational resources within the city. The Parks and Open Space Master Plan also recommends improving regional linkages to the city, which would further reinforce the path system for recreational users. Future improvements should consider both pedestrians and cyclists as well as connections to transit.

Another key ingredient in the encouragement of choices other than the automobile is the provision of amenities that offer users a more pleasing experience. Amenities for pedestrians can include wider sidewalks, sidewalk awnings to protect pedestrians from the elements, and street furniture. Bicyclist requirements include safe and convenient bike racks for security, bike lanes for travel on busy streets, and



LEGEND

- PROPOSED RESIDENTIAL
- PROPOSED INDUSTRIAL
- UGB

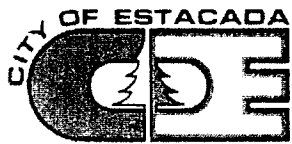


FIGURE 12
IDENTIFIED POTENTIAL DEVELOPMENT SITES
 Estacada Transportation System Plan





NORTH
(NOT TO SCALE)

LEGEND

Average Daily Traffic (VPD)

	0-5,000
	5,000-10,000
	10,000-15,000
	15,000-20,000
	UGB

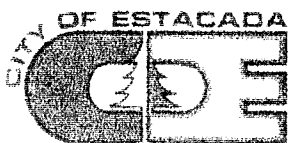
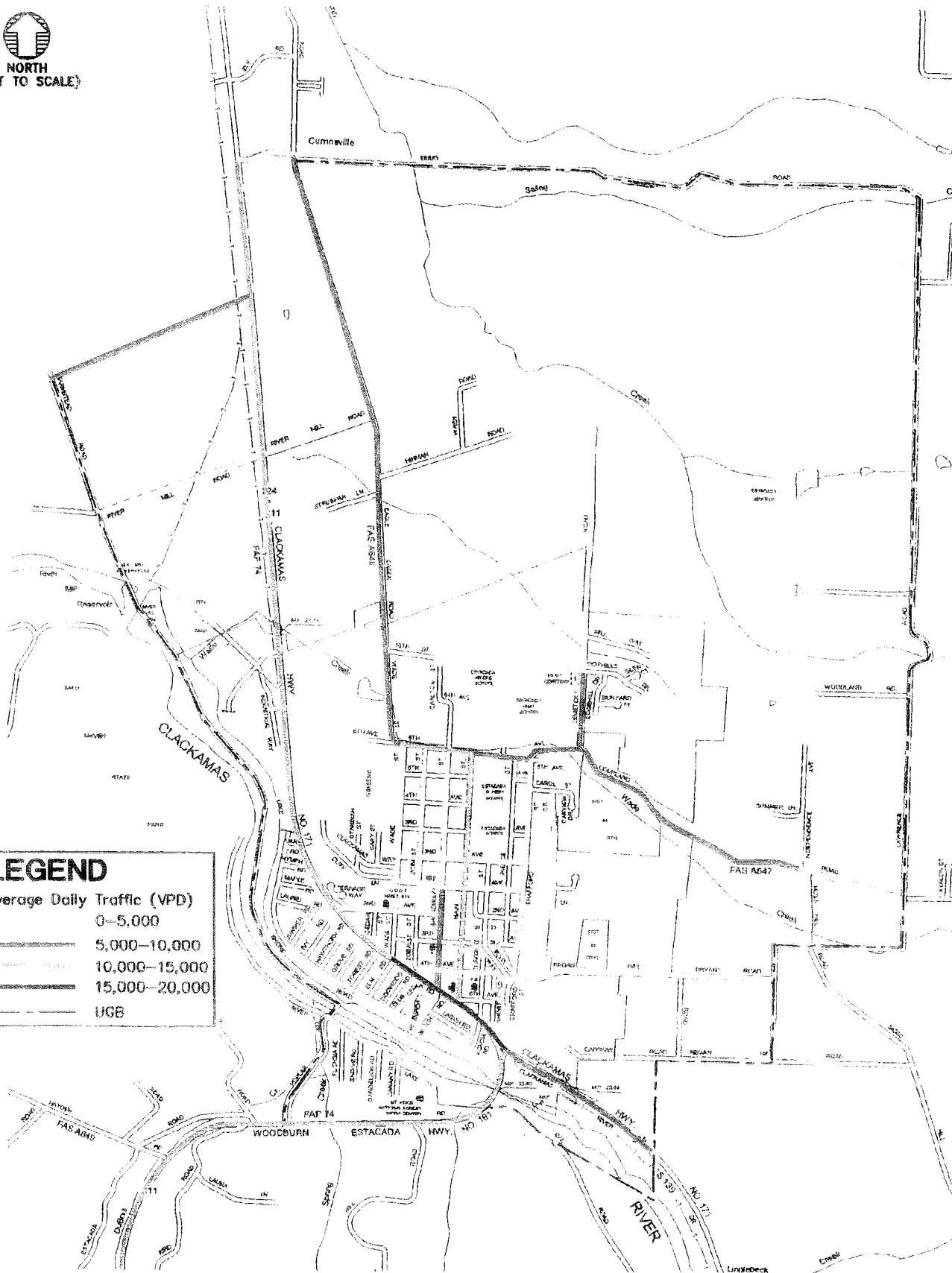
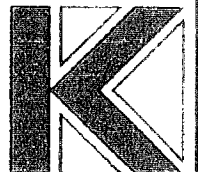


FIGURE 13
2019 FUTURE CONDITIONS
ADT FORECAST HAND ASSIGNMENT
 Estacada Transportation System Plan



other facilities for cyclists located at destinations. Transit users can be enticed with many different types of facilities and should be integrated with the bicycle and pedestrian modes to ensure adequate accessibility. Specific pedestrian, bicycle, and transit improvements will be discussed later in this plan.

Future Conditions for Automobile Traffic

Future peak hour traffic volume estimates are required to reflect the impact of a variety of alternatives on the transportation system. Figure 14 illustrates the forecasted peak hour traffic volumes used in the future year analysis. The traffic volume forecast represents the best estimate of future conditions for both the local system and the state highways.

The level of service results for the key intersections are shown in Figure 14 and have been prepared in accordance with the procedures presented in the 1994 Highway Capacity Manual⁹ (HCM). The 1991 Oregon Highway Plan¹⁰ outlines a level of service standard for the State Highway System, which would include both highways in Estacada. Both Highway 211 and Highway 224 are considered highways of a District level of importance. The level of service standard for both of these highways is level of service D. The Oregon Highway Plan goes on to state that the level of service will be determined by the 1985 Highway Capacity Manual. Because the HCM has been updated since the Oregon Highway Plan was published, the analysis is completed using the updated procedures of the Highway Capacity Manual.

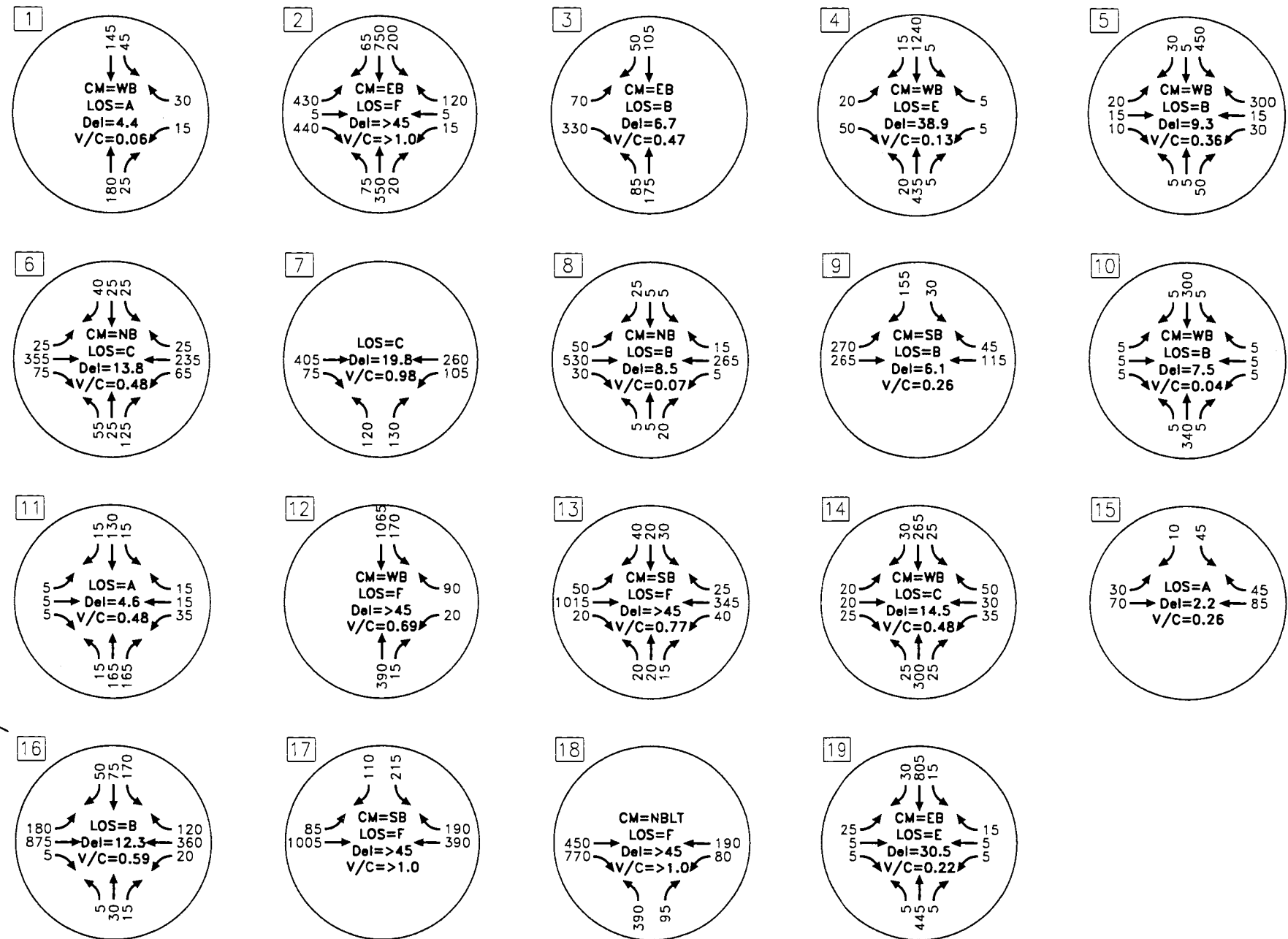
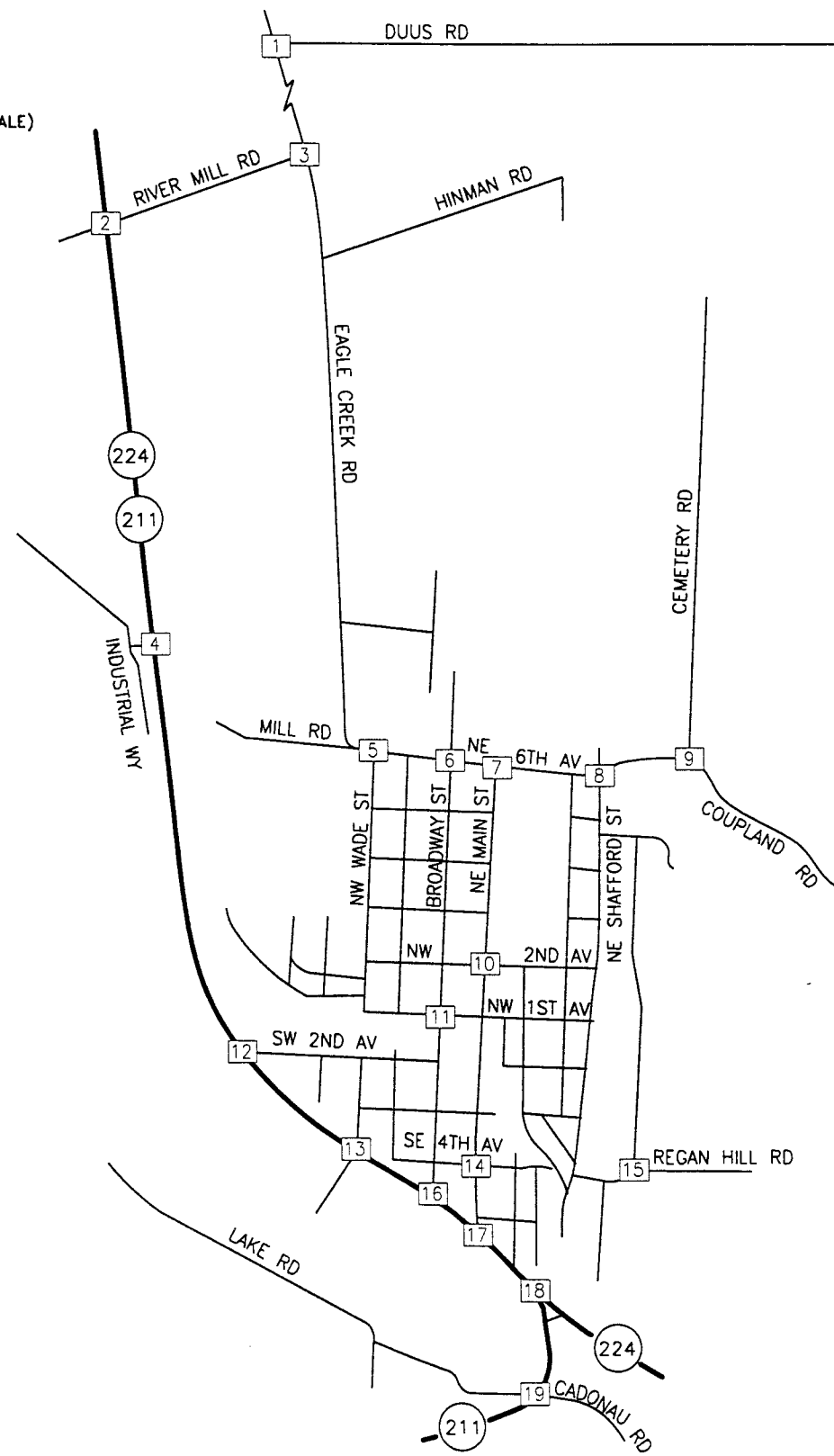
As shown in Figure 14, several of the stop-controlled approaches to the highway (side streets intersecting with the highway) will operate at or near capacity in 2019, with high delay for the side street movements. The level of service reported for these intersections is based on the delay that the minor street approach experiences. It is important to note that vehicles traveling through the city on the highway will not experience an unacceptable level of service; although as delay for the side street increases, side street motorists become more likely to accept shorter gaps, introducing potential safety concerns for the highway. It is recommended that accident rates throughout the city be monitored in the future to identify specific locations where safety deficiencies may exist. The remainder of the unsignalized intersections in the city will operate acceptably.

It should be noted that this analysis has identified the impacts of specific developments that the trending forecast scenario could not. In particular, the development of the industrial park property west of the Highway provides a keen insight as to the future needs of the transportation system.

To address the forecast deficiencies, it is recommended that Highway 211-224 be monitored closely in the future to determine adequate timing for improvements for the intersections throughout the corridor. Specific long-term improvement options are discussed in the following section.

Signal Warrant Analysis

Estacada currently has only one traffic signal - at the Highway 211/Broadway intersection. It is not unusual for a community such as Estacada to have more than one traffic signal on the highway in order to maintain acceptable traffic operations and to allow safe pedestrian crossing of the highway at grade. However, signals may only be installed when traffic signal warrants are met. A traffic signal warrant is a policy that is used to judge whether the installation of a traffic signal may be appropriate. The Manual of Uniform Traffic Control Devices (MUTCD)¹¹, is the national standard that was used to consider several unsignalized intersections in the city. Using the warrants presented in the MUTCD, traffic engineers can evaluate several categories that may justify a traffic signal. Traffic signal warrants in the MUTCD consider traffic levels throughout the day, during the peak hour, the presence of pedestrians, and accident rates in order to justify signal installation. Based on the future forecasts developed, MUTCD warrants were checked and the results of the analyses are shown in Table 4:



LEGEND
 CM = CRITICAL MOVEMENT (UNSIGNALIZED)
 LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/
 CRITICAL MOVEMENT LEVEL OF SERVICE
 (UNSIGNALIZED)
 Del = INTERSECTION AVERAGE DELAY (SIGNALIZED)/
 CRITICAL MOVEMENT DELAY (UNSIGNALIZED)
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

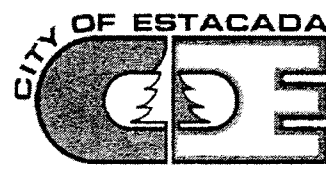


FIGURE 14
2019 HAND ASSIGNMENT ANALYSIS -
WEEKDAY PM PEAK HOUR LEVEL OF SERVICE

Estacada Transportation System Plan

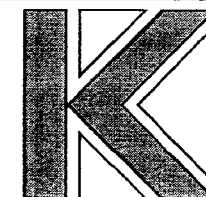


Table 4 Traffic Signal Warrant Analysis

Intersection	Level of Service	MUTCD Warrants Met?		
		Warrant 1 Minimum Vehicular Volume	Warrant 2 Interruption of Traffic	Warrant 11 Peak Hour Volume
Highway 224/Main Street	F	Yes	Yes	Yes
Highway 224/Main Street	F	No	Yes	Yes
Highway 224/Main Street	F	Yes	Yes	Yes
Highway 224/Main Street	E	Yes	No	Yes
6 th Avenue/Main Street	D	No	No	No*

* Three-legged intersections warrant special consideration, such as intersection delay and capacity studies

As shown in Table 4, it is likely that the intersections that meet warrants will require a traffic signal or other types of traffic control change in the future. These intersections should be closely monitored over the next 10-15 years to determine the timing for installation of a traffic signal or other mitigation. A detailed review of the mitigation measures identified for the intersections is included in the next section of this memorandum.

IDENTIFICATION OF DEFICIENCIES

In addition to the previously described capacity analysis, the future conditions evaluation involved the review and identification of other system deficiencies. This evaluation included a review of all transportation modes.

Pedestrian Circulation

As documented in the Existing Conditions technical memorandum, the City of Estacada's pedestrian network includes sidewalks along many of the local streets within the downtown. The presence of sidewalks decreases in the outer portions of the city and there are no sidewalk facilities along Highway 211-224 through town. Specific pedestrian improvements to enhance the existing system are identified in Section 4.

Bicycle Circulation

The City of Estacada does not currently offer designated bicycle facilities with the exception of the River Trail multi-use path. Connections to the recreational facilities (Clackamas River and the regional parks) are currently limited for cyclists. Improving the accessibility of the existing recreational areas was the primary motivation in developing the alternatives. The alternatives presented in Section 4 identifies a comprehensive bicycle system for the city.

City code policies state that all new arterials + collector will have designated bike lanes

Public Transit

The City of Estacada is served by Tri-Met, which serves the Portland-metropolitan area and parts of Clackamas County. The primary deficiency with respect to the existing service is the limited frequency on Saturday and lack of service on Sunday. An alternative analysis presented in Section 4 reviews potential improvements to the existing service within the city.

bus stop shelters?

SUMMARY

The projected future conditions analysis identifies several key findings including:

- The City of Estacada's population is forecast to grow by an average annual rate of 2.5 percent (a 65 percent increase) over the next 20 years.
- The City of Estacada's transportation system is expected to accommodate future growth in travel demand without triggering the need for major capacity-related roadway improvements. The installation of traffic signals along the highway will mitigate the operational deficiencies identified in the 2019 traffic forecast.
- An analysis of the circulation system within the city found that enhancements were needed outside of the downtown area to improve accessibility for all modes, especially pedestrian and bicycle.

Section 4

Alternatives Analysis

Alternatives Analysis

INTRODUCTION

This section describes future transportation improvement alternatives for the city that could be implemented to mitigate existing and future transportation system deficiencies. The improvements are divided into four parts: geometric improvements, capacity improvements, roadway connectivity improvements, and other needed transportation improvements. A geometric deficiencies list was developed through field studies and through evaluation of existing transportation data. This list identifies intersections that could be improved to enhance the safety of the traveling public. Operational improvements include long-term roadway improvement alternatives that will increase vehicular capacity to meet the projected demand. Multimodal improvements were identified to address overall system deficiencies related to the pedestrian, bicycle, and transit system.

Special effort was provided in considering and recommending improvements to the pedestrian and bicycle systems. Recommendations were developed that create direct linkage provide for a continuous pedestrian and bicycle transportation system. The alternative analysis and subsequent recommendation process were handled separately to ensure that a complete system for each mode was identified without constraint.

PROPOSED GEOMETRIC IMPROVEMENTS

The need for mitigation of existing and future roadway/intersection operations in Estacada is relatively limited in scope. The topography in and around Estacada makes the design of roadways and pedestrian and bicycle facilities difficult in many instances. For that reason, there exist some geometric deficiencies that are of concern, but because no operational or safety problem currently exists or is anticipated in the future, the need for improvement is considered as a long-term need.

River Lake Road/Cadonau Road/Highway 211

These intersections provide access to the southern portion of Estacada and the recreational uses on the Clackamas River. The intersections are poorly aligned because of the horizontal alignment of the highway along this segment. The River Lake Road and Cadonau Road intersections with Highway 211 are offset by approximately 100 feet, which can result in left turn conflicts between vehicles at these intersections. The sight distance is also limited at this location for the side street approaches resulting in a potentially unsafe condition. The close proximity of the intersecting roadways to the Clackamas River bridge (ODOT Bridge #02208) would require widening of the bridge to address the deficiencies. Although the existing geometry is not ideal, improvements are not recommended at this location in the near-term. As traffic volumes increase along the highway, safety and operations at these intersections should be monitored to determine the need for improvements. Furthermore, if replacement of the bridge is deemed necessary in the future, the design should accommodate realignment of this intersection.

To improve the existing intersection, the intersection can be realigned and striping can be installed to provide better defined movements. This improvement would require right-of-way acquisition from each side of the Highway and street widening on the side street approaches. The realignment of the intersection would allow for efficient operations of the intersection. The second alternative includes closing the River Lake Road access to the Highway and requiring the residents on River Lake Road to use Poplar Road. Consideration of either alternative should include access for emergency vehicles and the effect of additional traffic on Poplar Road.

This intersection should be monitored in the future to identify whether the traffic volumes on the Highway warrant consideration of these potential mitigation options.

Regan Hill Road/4th Avenue/Shafford Street

Another geometric improvement that considered by the TSP Advisory Committee was the reconfiguration and modification of the existing traffic control at the Regan Hill/4th Avenue/Shafford Street intersection. This five-legged intersection is configured such that the Regan Hill traffic is required to stop and travel out of direction to continue on 4th Avenue. The angle of the different legs at the intersection and the proximity of private driveways within the intersection make this a difficult intersection to navigate. Figure 15 shows a potential mitigation strategy that can be implemented to improve future intersection operations. This improvement realigns the intersection to improve the through movement on 4th Avenue to Regan Hill Road and increase the sight distance for vehicles on Shafford Street.

Shafford Street/NE 6th Avenue

Shafford Street intersects NE 6th Avenue on a horizontal curve west of the high school. This intersection is slightly offset from the staff parking lot driveway, which is a one-way driveway into Estacada High School. The sight distance from the Shafford Street leg of the intersection is limited by the roadway curvature. It is recommended that frontage shrubbery on the southwest corner of the intersection be limited to low lying landscape that does not further obstruct sight distance. Figure 16 shows the proposed realignment of this intersection.

Duus Road/Eagle Creek Road

At the Duus Road/Eagle Creek Road intersection, sight distance is limited by the existing landscaping. It is recommended that the Clackamas County or the city require landscaping maintenance on the Duus Road approach to improve sight distance at the intersection.

FUTURE OPERATIONAL IMPROVEMENTS

The existing transportation infrastructure (street widths and right-of-way) within the central city is sufficient for the future travel demand. There does not appear to be the need to provide additional travel lanes to any study area roadway for capacity purposes. The need for operational improvements center around increasing capacity at intersections and improving connectivity to preserve the existing capacity of the system and for improved connectivity. Specific intersection and roadway improvements are discussed below.

Highway 211-224/River Mill Road Intersection

The Traffic Impact Study conducted for the Northwest Estacada Industrial Area (Kittelson & Associates, Inc., May 1998) outlined the impacts associated with the buildout of the 200-acre parcel located northwest of the River Mill Road/Highway 211-224 intersection. The study recommended the installation of a traffic signal at the River Mill Road/Highway 211-224 and NW Park Avenue/Highway 211-224 intersections at full build-out of the proposed site and the development of a local street system on-site.



NORTH
(NOT TO SCALE)



LEGEND

- EXISTING STREET
- CONCEPTUAL IMPROVEMENT

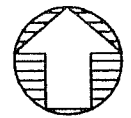


FIGURE 15

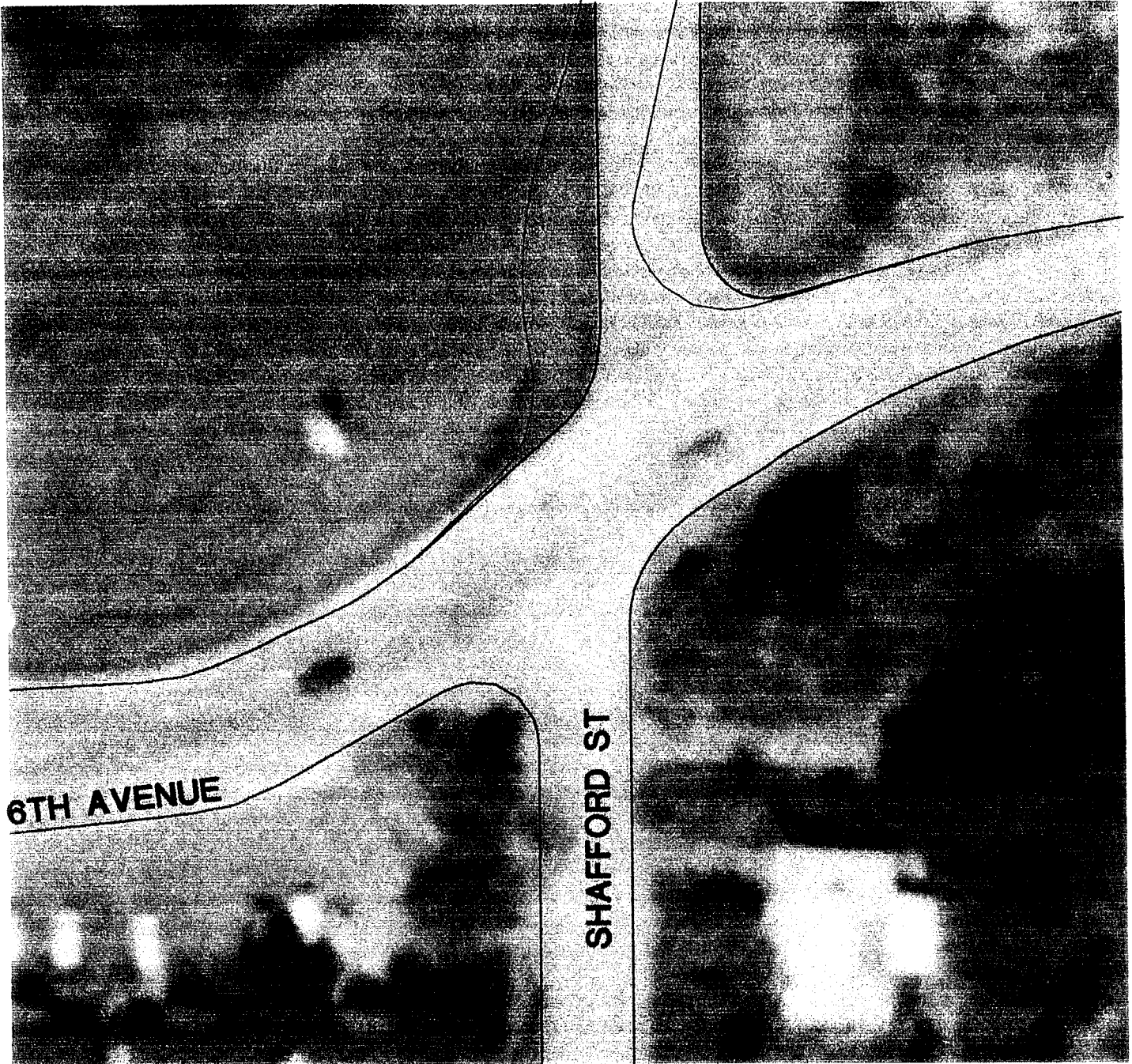
**CONCEPTUAL IMPROVEMENT
REGAN HILL/SHAFFORD/4TH AVE INTERSECTION**

Estacada Transportation System Plan





NORTH
(NOT TO SCALE)



LEGEND

- EXISTING STREET
- CONCEPTUAL IMPROVEMENT



FIGURE 16

**CONCEPTUAL IMPROVEMENT
NE 6TH AVE/SHAFFORD ST**

Estacada Transportation System Plan



Highway 211/Highway 224 Intersection

As discussed in the previous section, the Highway 211/224 intersection is projected to operate at LOS F in the future. The existing traffic control at the intersection includes stop control on the Highway 211 (northbound) approach. The alternatives identified to address the LOS deficiency include the following:

- modify the traffic control so the Highway 224 (westbound) approach is stop-controlled;
- install a traffic signal; or
- construct a roundabout at the intersection.

Alternative 1: Provide stop control to Highway 224 approaches

The intersection geometry was reviewed to identify whether the lower volume movements (Highway 224 westbound and eastbound through) could be stop controlled. Under this scenario, the eastbound right-turn (Highway 224 to Highway 211 traffic) would be uncontrolled as would the northbound left and right-turn movements. This type of control was used at the intersection prior to the 1970s. In the 1970s, the original control change was implemented to improve route continuity on Highway 224 and to comply with driver expectancy. In other words, the intersection control was changed because a stop sign on a straight section of highway is contrary to drivers' expectations, and can create confusion for unfamiliar drivers. Other factors considered included the higher speeds on the Highway 224 approach because of the layout of the intersection and the curvature of the highway. The advantage associated with the control change at the intersection is that this change would be the lowest implementation cost option.

The disadvantages associated with a control change include:

- the stop control may be counter to and result in a violation of driver expectancy; and
- this change may only be a short-term solution, depending on traffic patterns at the intersection.

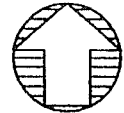
Alternative 2: Install a traffic signal

The installation of a traffic signal at the intersection was also reviewed as a possible improvement for the intersection. Figure 17 provides a layout sketch for the traffic signal. Analyses of the future forecasts indicate that the intersection will likely meet signal warrants, within the next 20 years. The advantages associated with the installation of a traffic signal at this location include:

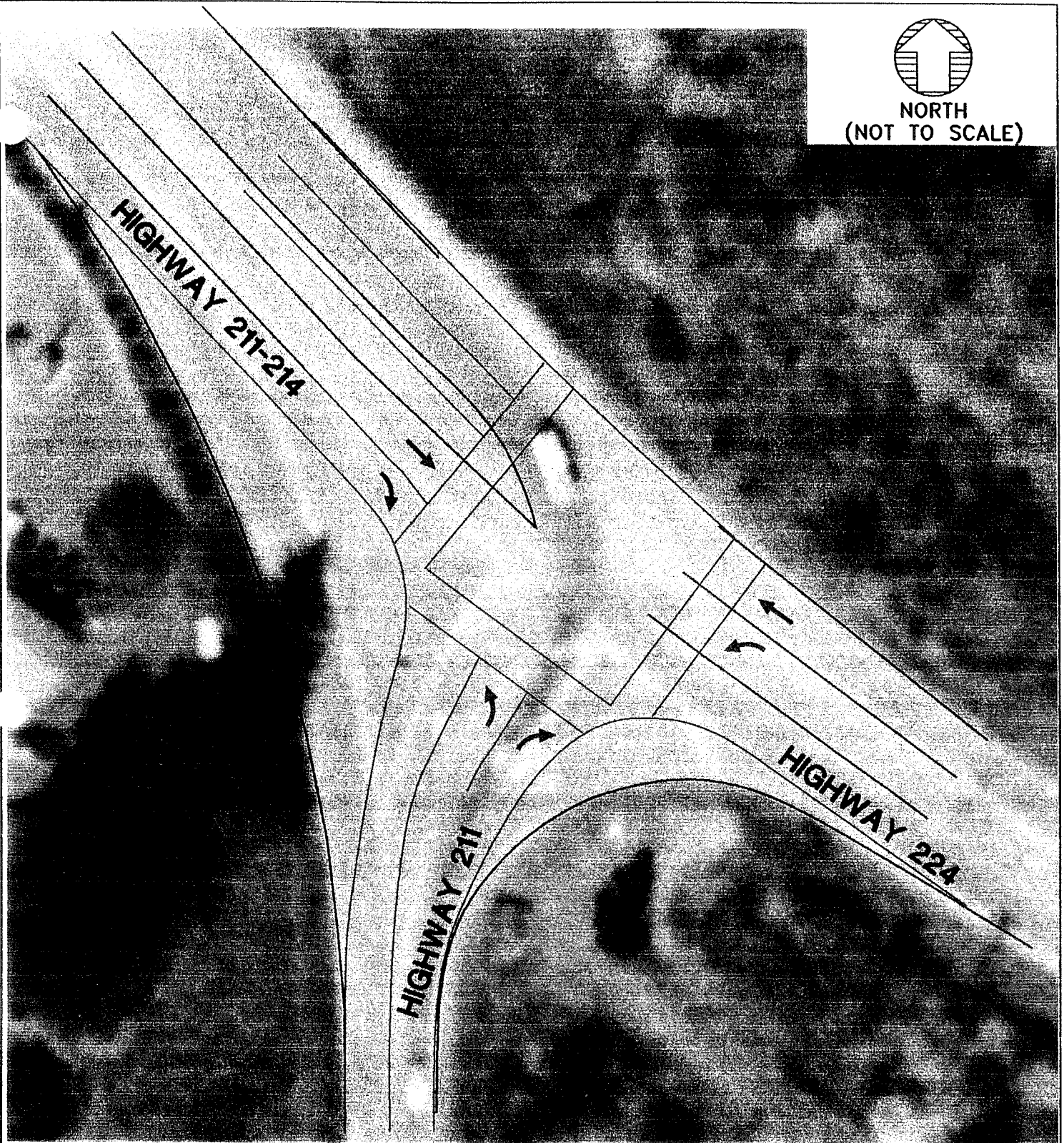
- reduces delay on the Highway 211 approach as compared to the existing stop control;
- restores future intersection operations to acceptable levels; and,
- driver expectancy issues can be addressed through advance signing and flashing beacons.

The disadvantages associated with the installation of a traffic signal include:

- increases maintenance costs for ODOT or city depending on arrangement for control of traffic signals (per previous agreement).



NORTH
(NOT TO SCALE)

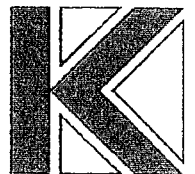


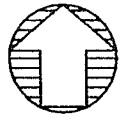
LEGEND

- EXISTING STREET
- - - CONCEPTUAL IMPROVEMENT

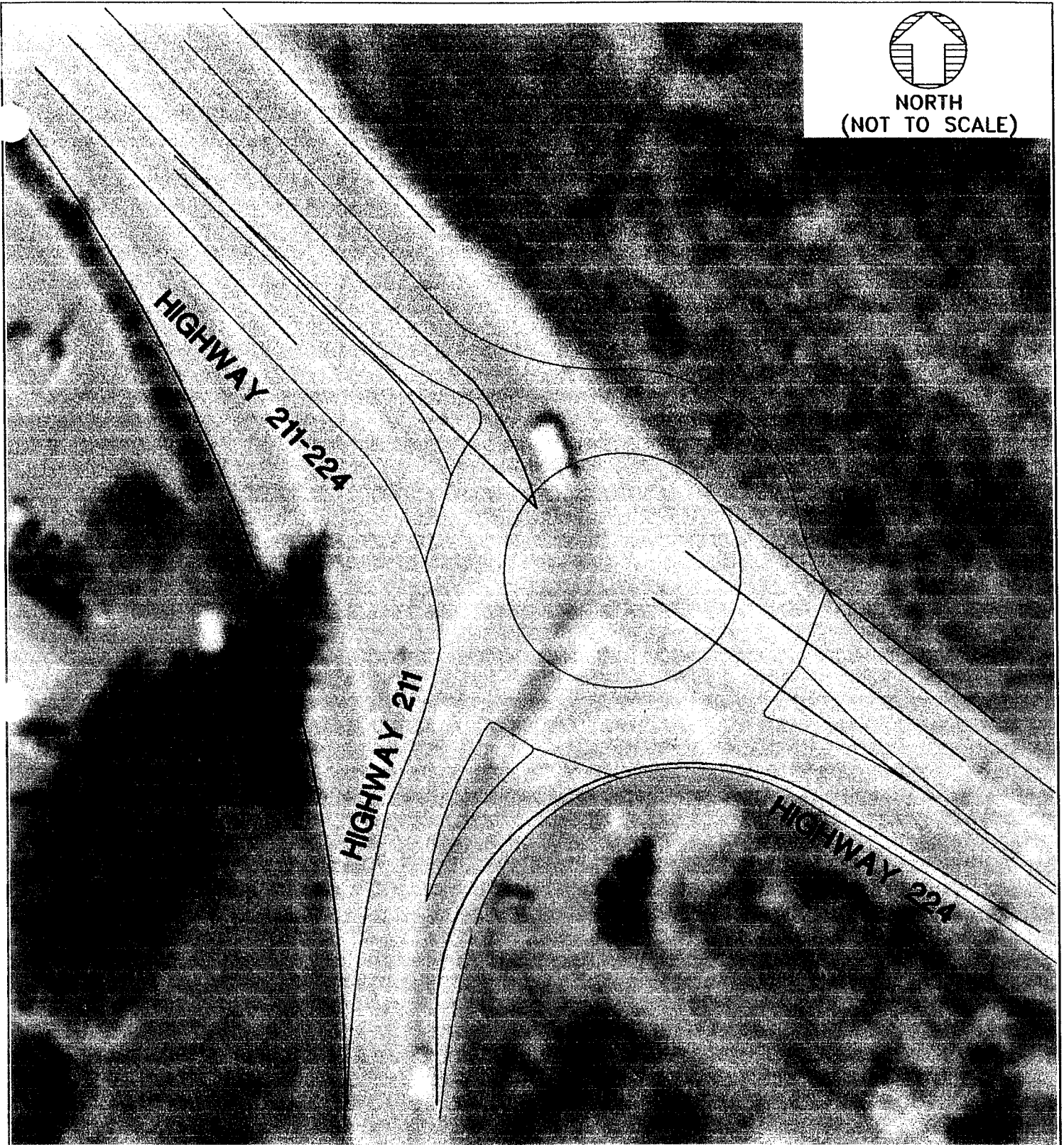


FIGURE 17
CONCEPTUAL IMPROVEMENT 'A'
HWY 211 - HWY 224 INTERSECTION
 Estacada Transportation System Plan





NORTH
(NOT TO SCALE)



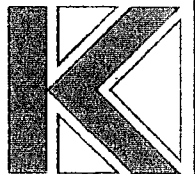
LEGEND

- EXISTING STREET
- - - CONCEPTUAL IMPROVEMENT



FIGURE 18

**CONCEPTUAL IMPROVEMENT
HIGHWAY 211-HIGHWAY 224 INTERSECTION
Estacada Transportation System Plan**



Alternative 3: Construct a roundabout at the intersection

Installation of a roundabout was reviewed as a possible improvement for the intersection, and Figure 18 provides a sketch for this alternative. The advantages associated with the installation of a roundabout include:

- reduces delay on the approaches and reduces speeds as vehicles enter the city;
- improves safety for motor vehicles (reduced severity of accidents);
- lower maintenance costs over the life of the roundabout (as compared to a traffic signal); and,
- a roundabout could serve as a gateway to the city.

The disadvantages associated with the installation of a roundabout include:

- higher initial costs for construction and right-of-way as compared to a signal or stop-control; and,
- potential for public resistance to this type of control due to unfamiliarity.

Recommendation

The intersection treatment in Alternative 1 is the lowest cost, but does not provide a long-term mitigation of a potential capacity deficiency. The consideration of the traffic volumes at this intersections should be monitored closely in the future to insure traffic operations and safety are not compromised during the peak periods.

Highway 211-224 Access to Downtown Estacada

Safe and convenient access to the central city from the highway is of primary importance to local residents. Analysis of the 2019 No Build peak hour forecast revealed that the unsignalized approach to Highway 211-224 at Main Street will exceed capacity and operate at a poor level of service in the future. As it becomes more difficult to turn left from Main Street onto the highway it is likely that many motorists will modify their routes to use the Broadway/Highway 211-224 traffic signal for egress from the downtown. While it is probable that a larger portion of the traffic leaving downtown will use the existing traffic signal at Broadway, it is important to recognize the capacity limitation that the Broadway signal presents. A series of alternatives were reviewed to mitigate potential access deficiencies into the downtown including:

- implementing a one-way couplet in the downtown on Main and Broadway;
- installing a traffic signal at Main Street; or,
- installing a traffic signal at SW 2nd Avenue.

Alternative 1: One-Way Couplet -- Main and Broadway

An alternative treatment was developed and reviewed using street circulation as a way to increase capacity and improve access to the city. This alternative included conversion of Main and Broadway to one-way streets one block north of the Highway. Figure 19 shows the alternative circulation plan proposed to improve future egress from downtown. The alternative provides egress via the traffic signal at Broadway, rather than the unsignalized Main Street approach. One of the primary issues associated with this circulation change is the effect of the access to the fire department. There are additional issues (such as public acceptance, sign installation and maintenance) that would need to be considered prior to conversion of the city streets to one-way traffic. Strictly from a traffic operations standpoint, however, this option

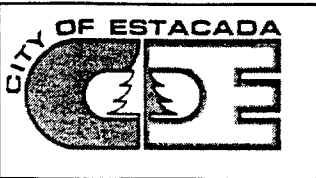
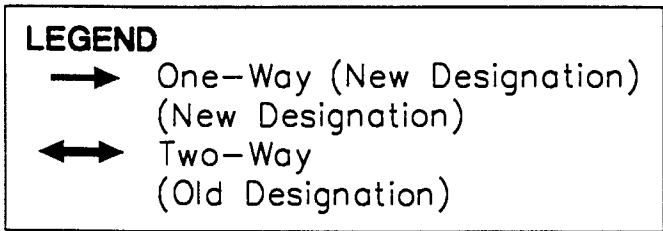
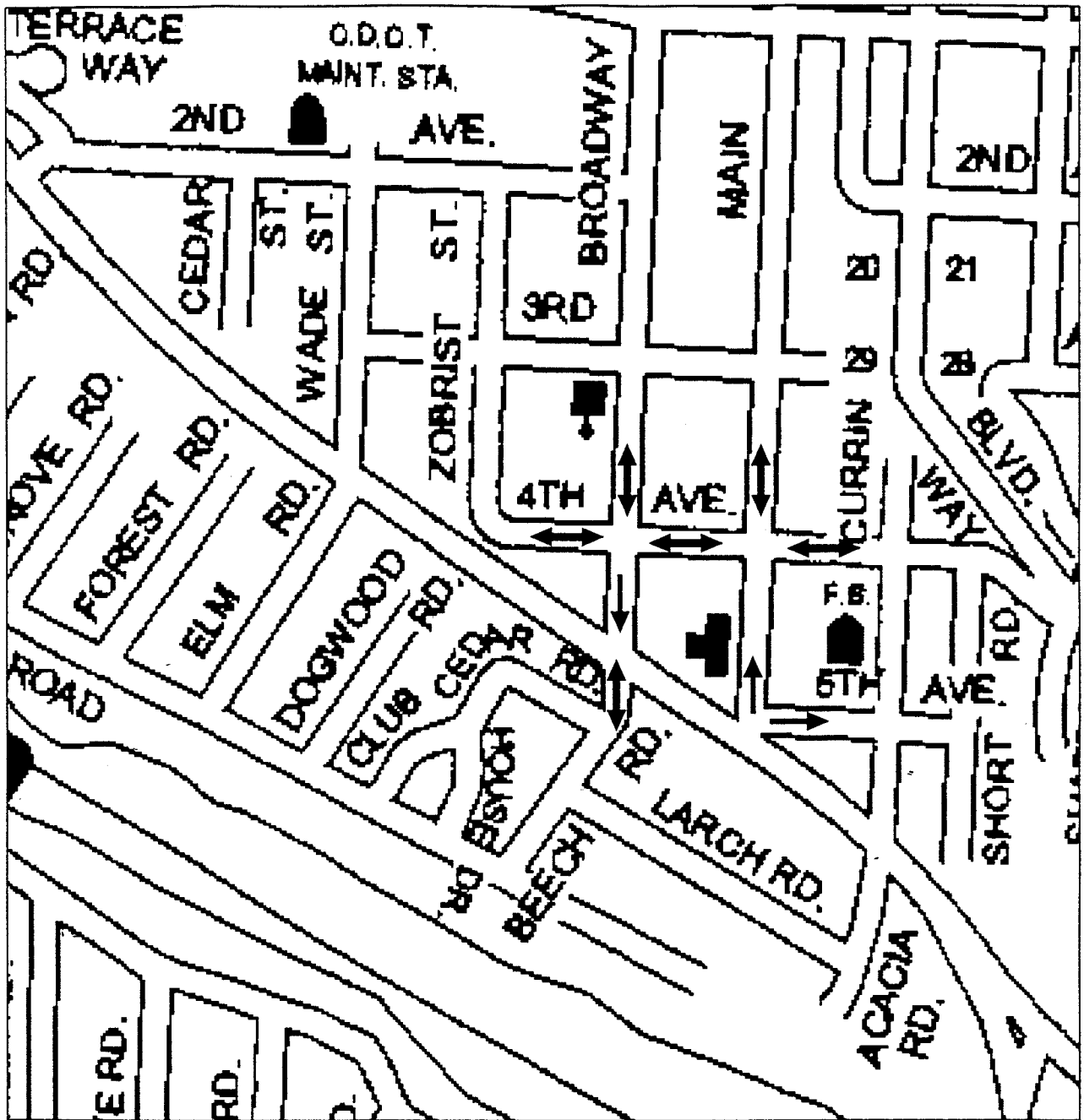
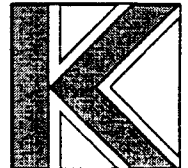


FIGURE 19
ONE-WAY CIRCULATION PLAN -
DOWNTOWN ESTACADA
 Estacada Transportation System Plan



would mitigate the forecasted capacity deficiency. The advantages of modifying the circulation system to a one-way couplet include:

- traffic operational benefits, including increased capacity and reduced conflicts between turning movements and pedestrians;
- improved utilization of the signalized approach on Broadway (by vehicles accessing the highway); and,
- likely to be lowest cost implementation.

The disadvantages associated with this option include:

- reduces accessibility for businesses along Broadway and Main;
- requires out-of-direction travel in the downtown; and,
- requires the use of the highway for local circulation needs.

Alternative 2: Install a traffic signal at Main Street intersection

As discussed in Section 3, the forecast volumes at the Main Street/Highway 224 intersection will warrant a traffic signal in the future. The close proximity of the Main Street intersection to the signal at the Broadway intersection would require specific coordination between the two signals on the Highway and could result in constrained operations if proper coordination is not maintained. Although signal control strategies could be developed to handle the turning traffic that exists at the two intersections, the distance between the intersections violates ODOT spacing standards for traffic signals and an exception would have to be made for this intersection.

Alternative 3: Install a traffic signal at Highway 211-224/2nd Avenue intersection

Installation of a traffic signal was reviewed as a possible improvement for the 2nd Avenue intersection as a way to provide a second alternative for access to downtown. The advantages associated with the installation of a traffic signal at this location include:

- a traffic signal would provide an intervening opportunity to access the Downtown in advance of the Broadway signal for vehicles traveling southbound on the highway, thereby reducing the volumes on the highway south of SW 2nd Avenue; and
- a signal would provide another opportunity for pedestrians and cyclists to cross the Highway.

The disadvantages associated with the installation of a traffic signal include:

- increases maintenance costs for ODOT or city depending on arrangement for control of traffic signals (per previous agreement); and
- Many of the business are located in close proximity to Main and Broadway; signalized access at SW 2nd Avenue will not provide as direct of access to these businesses.

Recommendation

The intersection treatment in Alternative 1 is the lowest cost alternative, and would likely mitigate the forecasted capacity deficiency. The consideration of the effects on local businesses and access to the central city would have to be considered carefully. Regardless, it is recommended that this issue be monitored closely in the future to insure efficient access to the commercial district is maintained.

ROADWAY CONNECTIVITY IMPROVEMENTS

The existing grid system within the City of Estacada serves its residents well. A grid system provides good accessibility for vehicles and other users to access the services of the downtown area. Connectivity of the street system is important for emergency vehicle access, pedestrian and bicycle mobility, and should be promoted during the development of new subdivisions and commercial properties.

The roadway system should continue to be developed to ensure that adequate circulation is provided. To enhance the connectivity of the system, several roadway projects were identified. These projects should be considered separately and selected based on the basis of future system needs. However, as properties develop throughout the city, careful consideration should be given to the type and location of connections to the existing street system, and to connectivity and access issues within any new development. It is essential to consider pedestrian, bicycle and vehicular access both to and within the new development and to provide a sense of linkage to and continuity with the existing system. It is expected that the five alternatives identified by this analysis will be complimented by additional connections in the future as Estacada grows and additional right-of-way is acquired.

The following proposed roadway projects are shown in Figure 20. It should be noted that the improvements identified in Figure 20 represent conceptual alignments only; a detailed engineering study will need to be conducted to identify the specific alignment of any proposed roadway. The following section describes each new roadway project proposed in the alternatives analysis.

Alternative 1A: Hill Way Extension

An extension of Hill Way west to Eagle Creek Road would provide a second east-west connector to the highway from the northwest part of the city. This connection will become increasingly important as additional residential subdivisions are constructed in this area. The advantages associated with this connection include:

- provides residents in the northeast section of the city with an alternate connection to Eagle Creek Road and the Highway;
- provides a secondary access to residents on Cemetery Road to enhance emergency vehicle services; and
- provides infrastructure for future residential development in areas to the north of the high school.

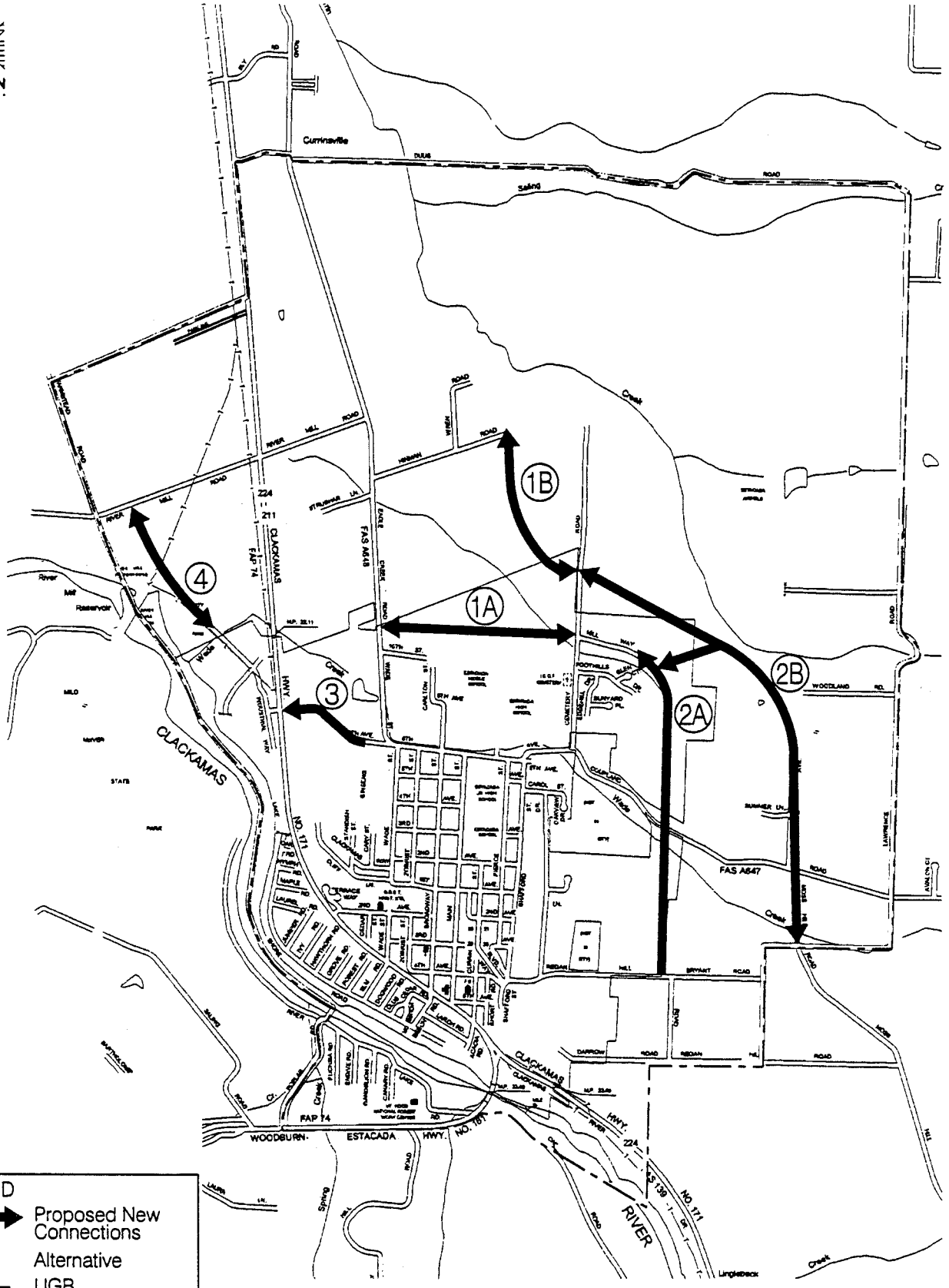
The specific disadvantages associated with this alternative include:

- right-of-way availability is limited due to lower potential for redevelopment on the parcels adjacent to the proposed extension; and
- sections of alignment adjacent to the school property may result in higher construction costs for city because the half-street improvement would have to be funded by the city.

Alternative 1B: Alternative to Hill Way Extension

An alternative to the Hill Way extension would include an alignment that allows construction based on the development of property between Cemetery Road and Eagle Creek Road. One possible alternative includes a connection via the current Hinman Road alignment. This improvement would provide similar advantages to Alternative 1A, although depending on the alignment the connection may be more difficult because of the topography.

(NOT TO SCALE)



LEGEND




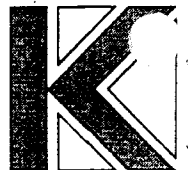
-  Proposed New Connections
-  Alternative UGB
-  UGB



FIGURE 20
PROPOSED ROADWAY PROJECTS
 Estacada Transportation System Plan



The advantages associated with this connection include:

- offers similar improvements as Alternative 1A; and
- sections of alignment will be funded by developers as a condition of approval.

The disadvantages associated with this connection include:

- promotes development further from the city center, which induces longer trips to downtown and less walking and biking trips; and
- increases traffic on Hinman Road.

Recommendation

The alignment in Alternative 1B allows the city to require road construction as the property in this area develops. While the alignment of Alternative 1A is easily defined, it would be cost-prohibitive because of the right-of-way acquisition involved and primarily for this reason, Alternative 1B is recommended. The alignment of this connection should consider terrain, but as parcels develop in this area an east-west easement connection should be provided to the city and either half- or full-street improvements should be conditioned on development in this area.

Alternative 2A: Regan Hill Road-Hill Way Connection

One of the deficiencies of the future system is the lack of connectivity east of the central city. This is primarily due to the existing topography constraints between Regan Hill Road and Coupland Road. A north-south connection between Regan Hill Road and Hill Way is recommended to address this circulation deficiency. There are several advantages associated with this connection including:

- improved pedestrian, bicycle, and vehicle access to the east;
- improved emergency vehicle access; and
- this new roadway would provide an alternate travel route for destinations north of the city.

Alternative 2B: Regan Hill Road-Cemetery Road Connection

The terrain between Coupland Road and Regan Hill Road makes road construction costs and development difficult. An alignment further east of Alternative 2A is more feasible and would provide the intended connection.

Recommendation

The alignment in Alternative 2B reduces the reliance on Hill Way and reduces out of direction travel for all modes in this emerging neighborhood. The consideration of terrain and construction costs for the alignment also favor the connection proposed in Alternative 2B.

Alternative 3: NE 6th Avenue/Mill Road Extension to Industrial Way

An extension of NE 6th Avenue to the Highway 211-224/Industrial Way intersection was identified to improve overall connectivity of the transportation system for pedestrians, cyclists, and motorists. The extension of Mill Road west to Industrial Way would provide another location for access to the highway. Discussions amongst the citizens considered this improvement desirable for accessibility to the recreational uses at the Park and to improve access to the schools and the north section of the city. One additional advantage associated with this alternative is that this connection would provide another alternative to the existing routes, reducing reliance on the highway and Eagle Creek Road.

Alternative 4: River Mill Road-Industrial Way Connection

To reduce reliance on the highway for local trips in the northwest portions of the city, a connection from River Mill Road to Industrial Way is recommended. This connection would provide an alternative to the Highway for traffic circulation at the Estacada Timber Park and the NW Estacada Industrial Park. This connection would provide a suitable location for a traffic signal on Highway 211-224 that would allow crossing for pedestrians and cyclists to the Riverfront trail and the Timber Park.

OTHER TRANSPORTATION DEFICIENCIES

Pedestrian System

The key objective in the identification of future pedestrian improvements was to provide connectivity between major activity centers. Within the City of Estacada, these activity centers include the downtown, Estacada High School, Estacada Grade School, the parks, the post office, the Community Center, and other recreational areas. According to the existing conditions analysis and feedback received from the general public and the Study Advisory Committee, the following improvements should be considered in the future:

- the provision of continuous sidewalk network in the vicinity of the schools and the residential areas surrounding the school;
- the provision of sidewalks on Cemetery Road linking the major subdivisions with the schools;
- completion of sidewalk links along Main Street;
- provision of curb extensions and pavement markings that clearly delineate crosswalks;
- use of median treatments along the highway that provide pedestrians with a safe-haven at mid-crossing;
- sidewalks on the Highway near the entrance to the downtown, around City Hall, the public library, and the community center; and
- sidewalks connecting the downtown with the Clackamas River and the recreational facilities at McIver Park.

The public input process for the TSP identified community concerns regarding the lack of pedestrian crossings along Highway 211-224, especially in the vicinity of the central business district. The combination of Highway 211-224's wide pavement width, growing traffic volumes, and commercial orientation in this area confirm the need for additional pedestrian amenities. In addition to providing traditional sidewalk and multi-use path facilities, there are several other potential enhancements that should be considered along Highway 211-224 including:

- provision of additional street lighting to enhance visibility of pedestrians at night;
- construction of curb extensions that reduce the exposed crossing distance pedestrians must walk; and
- use of median treatments that provide pedestrians with a "safe-haven" at a mid-crossing; potential locations include Main and the Wade Street-Elm Road intersections.

Bicycle System

Bicycle facilities are needed for both commuting and recreational purposes within the city. Thus, consideration of bike lanes, multi use trails and connections via the street system should be considered for cyclists. Designated on-street bike lanes are not recommended for the city street system because the existing volumes on the system do not warrant separation of bicycle traffic. In the future, the higher volume streets, Main, Broadway, 6th Avenue and Eagle Creek Road should be monitored to ensure conditions for cyclists are comfortable. Improvements to the connectivity of the system will occur concurrently with roadway improvements. There are some existing streets that can be restriped to provide bike lanes and separate cyclists from traffic. Main Street is one example where angled parking could be converted to parallel parking and bike lanes could be added. The Highway 211-224 corridor has an intermittent shoulder for bicycle traffic that could be enhanced by bicycle route signing and increasing the frequency of maintenance activities, i.e. sweeping the highway, and updating the striping. The planning completed for the multi-use paths in the Estacada Parks and Open Space Master Plan should be followed to improve the recreational opportunities within the city.

Transit System

Transit service provides mobility to community residents who do not have access to automobiles and provides an alternative to driving for those who do. Transit service should meet the needs of both travelers within the city and those making trips outside the community. Potential improvements for the transit system include:

- improved connections with the neighborhood south of the Highway;
- provision of additional service on the weekends and during peak periods;
- improved visibility for existing stops and park and ride facilities; and
- provision of sidewalks that can improve accessibility to bus stops.

Discussions with local agency staff and citizens indicated that there exists a need to improve accessibility of transit for the elderly. Consideration should be given to coordinating the existing dial-a-ride service provided by the Senior Center with similar services in neighboring communities. Combining Estacada with other neighboring communities such as Molalla, would improve the frequency of trips to specialized medical service providers or other destinations.

POLICY ALTERNATIVES EVALUATION

The following discussion presents specific policies and other alternatives that were considered for inclusion as part of the plan.

Reduce Vehicular Reliance through Zoning and Development Code Revisions

In part, Oregon's Transportation Planning Rule seeks to reduce the reliance on personal vehicles as a mode of travel through the creation of environments that foster alternative modes of transportation. Local land uses can have a significant impact on the form of transportation necessary to travel from one location to another. Specifically, by carefully structuring local zoning and development codes, development activities can be focused such that a more self-contained community can be achieved. Construction of mixed-use developments, the location of commercial and service businesses in the vicinity of residential land uses, and the provision of employment opportunities near residential areas are all means by which the need for travel by personal automobile can be reduced.

Recommendation

In relatively rural areas such as Estacada, the need to travel long distances to employment, commercial, and service opportunities fosters a travel environment dependent on personal automobiles. The provision of a mix of uses and additional employment opportunities (such as the Industrial Park) within the community will strengthen the community and ensure that Estacada can achieve self-sufficiency from other communities. Reducing the dependence on automobiles for mobility is accomplished by providing facilities for pedestrians, cyclists, and others. Proper design for accommodating pedestrians and cyclists can be accomplished by requiring developers to provide facilities. Building near the sidewalk line is one of the crucial elements in creating places that are appealing to pedestrians¹² and should be identified in the zoning codes. Zoning, land use, and allowable development forms play an integral part in transportation choices.

Continued Access Management Along Highway 211-224

The Oregon Department of Transportation has established access spacing standards for Highway 211 and Highway 224. These standards, which are presented in detail in the next section, are intended to ensure the long-term safety and efficiency of the Highway 211-224 corridor. Implementation of the standards as they relate to local development activities will be essential to ensure the long-term viability of the corridor.

The future conditions analysis, as presented in this document, assumes that current public roadway spacing along Highway 211-224 will be maintained into the long-term future. As long as the current public road access spacing standards are maintained and new private access points are allowed in accordance with the access spacing standards presented in Section 5, it is expected that the forecast future traffic conditions will be reflective of long-term operations along the Highway 211-224 corridor. Conversely, if multiple additional access points are granted along Highway 211-224, it can be expected that additional incremental delay will be added to the highway's operations.

Recommendation

The existing access control should be maintained as closely as possible. No specific construction need is evident to implement this improvement as it simply promotes compliance with existing roadway policy. No immediate land use actions would be required either. Instead, as property along the highway is developed or redeveloped, appropriate action should be taken by local and state agencies to ensure that the relevant access spacing standards are reasonably enforced. **Section 5, Transportation System Plan** includes an access management plan for city streets and a corresponding implementation strategy complete with typical spacing standards, driveway widths, etc.

Implement Transportation Demand Management Measures

Transportation Demand Management (TDM) measures identify opportunities to reduce the impact of trips generated by various land uses. Specifically, TDM techniques typically seek to reduce reliance on single-occupant vehicle trips and promote the use of alternative travel modes by persons accessing a given area or facility. The Transportation Planning Rule encourages the evaluation of TDM measures as part of the TSP development process.

TDM strategies often focus on major employers or other sources of traffic that can be influenced through scheduling changes, alternative transit opportunities such as carpools and buses, and other means. Oftentimes, financial disincentives are included in programs as a revenue generator to support other elements of an overall program. The success of fee parking and other commonly used disincentives is dependent on the environment in which a given employer is located.

Given the few number of major employers and the rural nature of the area, the TDM measures available are limited in scope as compared to larger metropolitan areas. Typical TDM measures such as fee parking are not practical in a community where employee-paid parking does not exist and employers are often located several miles from the population base. Although no major employers are located within the area, residents can still be encouraged to carpool when appropriate. Provision of sidewalks and other pedestrian amenities in key locations is another means by which the use of non-auto dependent travel can be encouraged.

Recommendation

Given the relatively remote location and character of the City of Estacada, TDM efforts would likely be most successful if focused on efforts to develop the community's pedestrian and bicycle infrastructure. Creation of pedestrian and bicycle facilities will at least provide the community's residents with a viable alternative mode of transportation for local travel.

Improved Transit Service to Reduce Reliance on the Automobile

Public transportation provides mobility for those lacking transportation options and for those concerned about increasing traffic congestion and the environment. For public transportation to provide an option to citizens, service must be consistently available. Currently, existing service is not provided every day. For transit to contribute effectively to the goal of reducing reliance on the automobile, transit service must be added to the existing schedule.

Recommendation

The existing service can be improved by increasing service frequency via days and hours of coverage provided. The next section outlines a number of recommendations for improvements to the current service.

SUMMARY

This section has presented the alternatives that have been developed and evaluated to address the near-term and long-range transportation deficiencies within the City of Estacada urban growth boundary. Section 5, which follows, incorporates the recommended improvements for each transport mode into the city's transportation system plan.

Section 5

Transportation System Plan

Transportation System Plan

This section describes the individual elements that will comprise the Transportation System Plan for the City of Estacada. The preferred alternative presented in this TSP consists of those transportation improvements necessary to support the development of the city. The TSP addresses several components for development of the future transportation network including:

- Roadway System Plan
- Pedestrian System Plan
- Bicycle System Plan
- Public Transportation System Plan
- Marine System Plan
- Air/Water/Pipeline System Plan
- Access Management Plan
- Implementation Plan

The individual plans presented in this section were developed specifically to address the requirements of Oregon's Transportation Planning Rule. Projects associated with each plan element have been identified and costs have been estimated as described herein. The recommendations set forth by this plan reflect the findings of the existing and future conditions analyses, the alternatives analysis, and the concerns expressed by both the citizens of Estacada and the public agencies that serve them.

ROADWAY SYSTEM PLAN

The roadway plan for the City of Estacada is relatively straightforward. A review of the future year forecasts and level of service analysis provides an insight into the needs of the system and areas of critical importance. Development of the roadway system plan was completed in three steps. The first step included a detailed review of the functional classification system and recommendations for new classifications and design standards associated with each facility. Based on this initial steps, roadway cross sections and design standards are proposed for future modernization of existing roadways and construction of new streets.

Recommended Functional Roadway Classifications

The need for a functional street classification system arises from the need to balance mobility and accessibility. Functional classes establish a standard to which a roadway must be built. This standard is designed to accommodate the traffic demands that are expected and are acceptable to the community. The concepts of mobility and accessibility are considered during the development of the functional classification map to ensure that adequate facilities are planned. Planned facilities should provide sufficient access to adjacent land uses and ensure neighborhood livability.

The recommended classification system reflects multimodal needs, a system hierarchy, and trip type. For example, long distance trips are facilitated on streets that are designed for higher speeds, whereas local trips can be accommodated on shorter, low volume streets. Finally, the system accommodates pedestrian or bicycle travel as well as auto usage.

The recommended functional classification system for Estacada relies on four levels of streets to address the needs for mobility and accessibility. The functional purpose of each classification is described below.

Arterials

The primary function of arterials is to provide through-movement of traffic, primarily serving automobile mobility, pedestrian, and bicycle needs. In small communities, arterials are roadways that primarily serve traffic entering and leaving the urban incorporated area. Arterials tend to carry significant interurban travel between downtown areas and outlying residential areas. While arterials may provide access to adjacent land, that function is subordinate to the travel service provided to major traffic movements. Arterials are the longer distance, highest volume roadways within the urban growth boundary. Although focused on serving longer distance trips, pedestrian and/or bicycle activities are associated with the arterial streetscape.

Major Collector

The primary function of a major collector is to facilitate the movement of city traffic within the urban growth boundary of the city. Collectors should provide limited access to commercial properties while maintaining circulation and mobility for users. Their connectivity and their higher traffic volume within the city distinguish collectors, although they are designed to carry lower traffic volumes at slower speeds than arterials. Major collector streets are characterized by two or three-lane facilities. Bike lanes should be striped where traffic intensity and speed on these facilities warrant consideration or where the street directly connects to a land use which generates bicycle traffic, i.e., a school or park.

Minor Collector

The primary function of a minor collector is to connect neighborhoods with major collector streets and to facilitate the movement of local traffic. Speeds on these facilities should remain low to ensure community livability and safety for pedestrians and cyclists of all ages. On-street parking is more prevalent and pedestrian amenities are typically provided on minor collectors. Striped bike lanes are unnecessary for many minor collectors because the traffic volumes and speeds should allow cyclists to travel concurrently with motorists.

Local Streets

Local streets are intended to provide access to private dwellings and businesses. The local street is characterized by two travel lanes, with on-street parking typically provided on one or both sides. Local streets should be designed to serve pedestrians and the community, as the local street is part of the public realm. Street trees and other diversions should be encouraged to reduce the speed of vehicles in neighborhoods where children play.

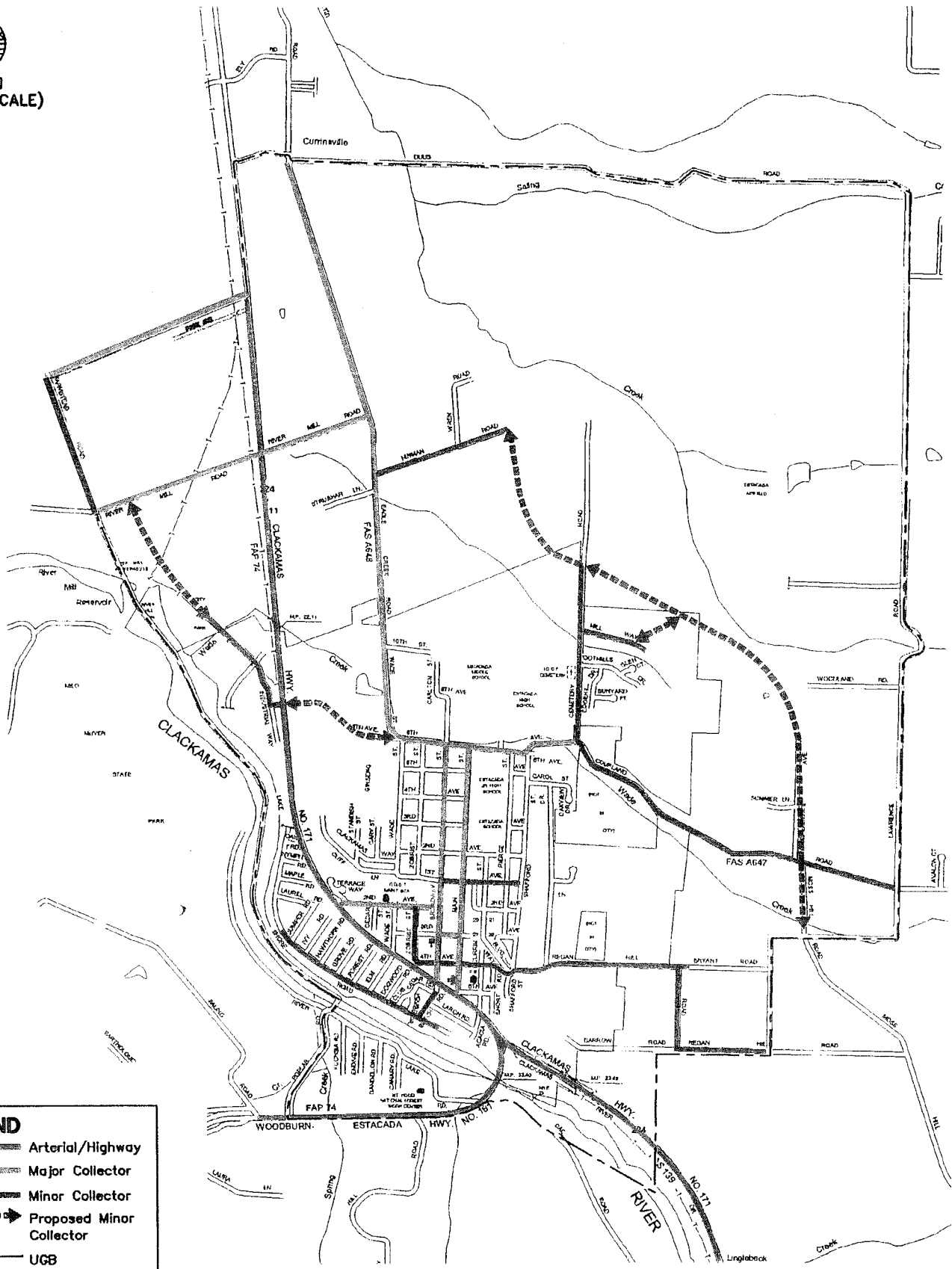
Using the four roadway designations described, the Functional Classification Plan presented in Figure 21 was developed. Under the proposed plan, the unmarked streets would be designated as local streets. New streets proposed by development must be reviewed by the Public Works Department to insure system consistency and to review the design.

Roadway Design Standards

Roadway design standards are based upon functional and operational characteristics of streets such as travel volume, capacity, operating speed, adjacent land use, and composition of traffic. They are necessary to ensure that the system of streets, as it develops, will be capable of serving the traveling public while also accommodating the accessibility of adjacent lands.



NORTH
(NOT TO SCALE)



LEGEND

- Arterial/Highway
- Major Collector
- Minor Collector
- Proposed Minor Collector
- UGB

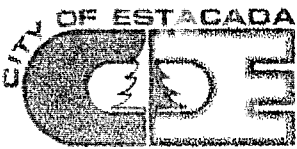
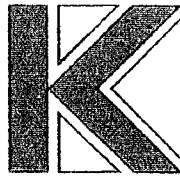


FIGURE 21
FUNCTIONAL CLASSIFICATION PLAN
Estacada Transportation System Plan



The proposed roadway design standards are shown in Figure 22. The typical roadway section provides a blueprint for the expected cross section of the existing and future streets. The recommended cross sections illustrated are intended for planning and design purposes for new construction as well as those locations where it is physically and economically feasible to improve existing streets.

The typical cross sections present standards that allow flexibility in defining the roadway width. Where geometric conditions are limiting right-of-way and road widths can be reduced based on the optional features that are noted on the standard cross sections. The use of optional components such as on-street parking and planter strips would be subject to the discretion of the City of Estacada. In the case of Highway 211-224, appropriate representatives from ODOT would have ultimate authority over the roadway design. Alignment and operational characteristics should be considered and thoroughly reviewed when considering a new road or an upgrade of an existing street within the system.

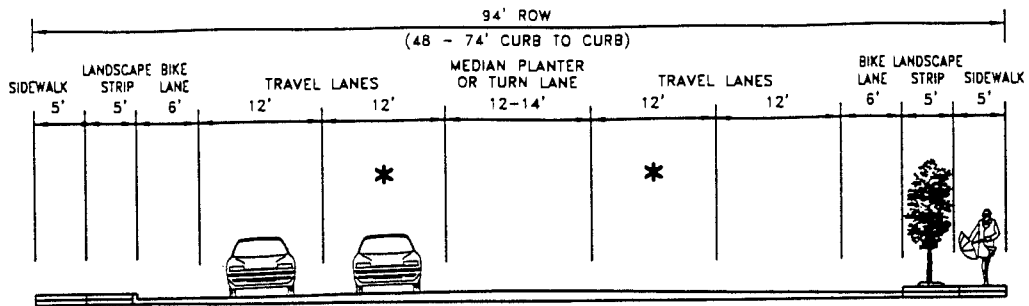
An arterial such as Highway 211-224 will have a right-of-way requirement of 94 feet and will include 2-5 12-foot wide travel lanes. Both arterial cross-section options incorporate six-foot wide sidewalks separated from the highway by a seven-foot wide landscape strip. Six-foot wide on-street bike lanes are also included in both arterial cross-section designs. No on-street parking will be permitted. In reviewing these standards, it should be noted that ODOT would have the ultimate authority as to which improvements are implemented along Highway 211-224. South of the Highway 211-224 junction, the roadways will transition to the two- to three-lane cross section.

Major collector streets will have a right-of-way requirement of 82 feet and a required cross-section consisting of two 12-foot wide travel lanes and five-foot wide sidewalks. Optional landscape strips and on-street parking may also be required at the discretion of the city. If the city chooses not to require these amenities, the right-of-way width required should be reduced. Minor collector streets can be designed with narrower travel lanes and wider landscape strips or sidewalks to help reduce speeds. Local streets will have a right-of-way requirement of 60 feet and should include five-foot wide sidewalks on both sides of the street. Requirement of adjacent landscape strips and parking on one side may be made at the discretion of the city, although right of way should be acquired in any case for utility easements.

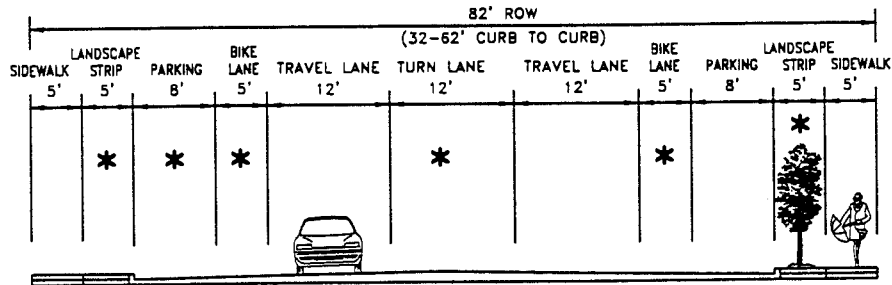
Other Considerations

The availability of streetscape treatments such as landscape strips, pedestrian refuges and bike lanes will prove valuable to the city as instruments by which the character of roadways can be influenced. Streetscape treatments such as street trees can be used to reduce the perceived impact a roadway has on the community. Narrower streets or streets that have a "skinny" feel due to the presence of closely spaced trees or buildings that are designed with minimal setback may also be desirable in some neighborhood areas for use as a deterrent to through or speeding traffic on local streets.

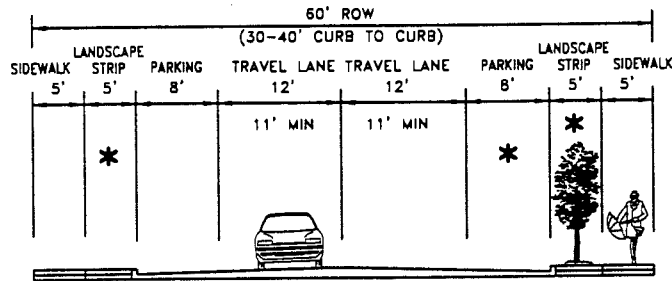
Special consideration for school zones is necessary and require reduced speed limits during the hours when children are going to and from school and during special events. Usually school speed zone signs are used and complimented by flashing beacons and pavement markings that make drivers aware of the school zone.



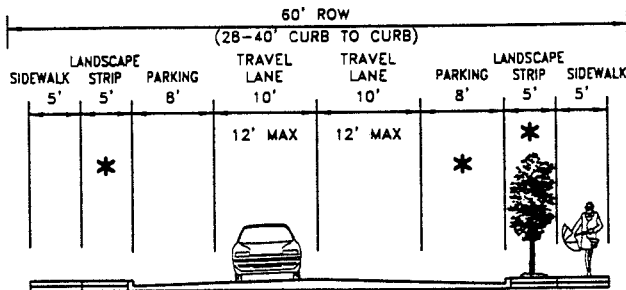
ARTERIAL/HIGHWAY



MAJOR COLLECTOR



MINOR COLLECTOR



LOCAL (RESIDENTIAL)

* - OPTIONAL

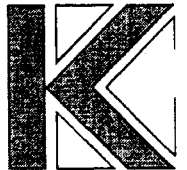
NOTES: 10' sidewalks may be requested in commercial districts per Estacoda subdivision ordinances
 11' travel lanes minimum for minor collector
 a 4' right of way easement is required for local streets if travel lanes are only 10' wide



FIGURE 22

STREET DESIGN STANDARDS

Estacoda Transportation System Plan



ODOT Access Management Standards

The 1991 Oregon Highway Plan specifies an access management classification system for state facilities and has classified Highway 211-224 as being of a *District Level of Importance (Category 5)*. The pending revisions to the Oregon Highway Plan (1999 edition) are expected to maintain the *District Level of Importance* classification along Highway 211-224. Although Estacada may designate the state highways as arterial roadways within their transportation system, the access management categories for these facilities should generally follow the guidelines of the current Oregon Highway Plan. Future developments along Highway 211-224 (zone changes, comprehensive plan amendments, redevelopment, and/or new development) will be required to meet the current Oregon Highway Plan Level of Importance and Access Management policies and standards.

Variance Process

Access variances may be provided to parcels whose highway frontage, topography, or location would otherwise preclude issuance of a conforming permit and would either have no reasonable access or cannot obtain reasonable alternate access to the public road system. In such a situation, a conditional access permit may be issued by ODOT and the City of Estacada for a single connection to a property that cannot be accessed in a manner that is consistent with the spacing standards.

The permit should carry a condition that the access may be closed at such time that reasonable access becomes available to a local public street. Approval condition might also require a given land owner to work in cooperation with adjacent land owners to provide either joint access points, front and rear cross-over easements, or a rear-access upon future redevelopment. In addition, approval of a conditional permit might require ODOT-approved turning movement design standards to ensure safety and managed access.

City Standards for Access Management

Table 5 identifies recommends minimum public street intersection and private access spacing standards for the City of Estacada roadway network as they relate to new development and redevelopment. Table 6 identifies standards for private access driveway widths. In cases where physical constraints or unique site characteristics limit the ability for the access spacing standards listed in Table 5 and Table 6 to be met, the City of Estacada should retain the right to grant an access spacing variance. County facilities within the city's urban growth boundary should be planned and constructed in accordance with these street design standards.

Table 5 Minimum Intersection Spacing Standards

Functional Classification	Public Street (feet)	Private Access Drive (feet)
Arterial	1,320	500
Major Collector	600	150
Minor Collector	300	100
Local	150	50

Table 6 Private Access Driveway Width Standards

Land Use	Minimum (feet)	Maximum (feet)
Single Family Residential	12	24
Multi-Family Residential	24	30
Commercial	30	40
Industrial	30	40

A variance process similar to that described above for the ODOT access management plan should consider land use needs on a case-by-case basis during development review.

Management Techniques

From an operational perspective, the City of Estacada should consider implementing access management measures to limit the number of redundant access points along roadways. This will enhance roadway capacity and benefit circulation. Improvements that should be considered include:

- planning for and developing intersection improvement programs in order to regularly monitor intersection operations and safety problems;
- purchasing right-of-way and closing driveways; and
- installing positive channelization and driveway access controls as necessary.

Enforcement of the access spacing standards should be complemented with the availability of alternative access points. Purchasing right-of-way and closing driveways without a parallel road system and/or other local access could seriously effect the viability of the impacted properties. Thus, if an access management approach is taken, alternative access should be developed prior to “land-locking” a given property.

As part of every land use action, the City of Estacada should evaluate the potential need for conditioning a given development proposal with the following items, in order to maintain and/or improve traffic operations and safety along the arterial and collector roadways:

- Crossover easements should be provided on all compatible parcels (considering topography, access, and land use) to facilitate future access between adjoining parcels.
- Conditional access permits should be issued to developments having proposed access points that do not meet the designated access spacing policy and/or have the ability to align with opposing driveways.
- Right-of-way dedications should be provided to facilitate the future planned roadway system in the vicinity of proposed developments.
- Half-street improvements (sidewalks, curb and gutter, bike lanes/paths, and/or travel lanes) should be provided along site frontages that do not have full-buildout improvements in place at the time of development.

PEDESTRIAN SYSTEM PLAN

The key objectives in the development of the pedestrian and bicycle system plan was to provide connectivity between activity centers and improve the safety of pedestrians throughout the city. With

the City of Estacada, these activity centers primarily include the post office, commercial businesses within the downtown, the schools, parks, and the existing Riverfront Trail.

The street design standards (Figure 22 Roadway Design Standards) ensure that pedestrian facilities are provided in conjunction with all new or substantially reconstructed streets within the city. It is essential that existing sidewalks be connected to new sidewalks as new developments are constructed or as road improvements are made.

The opportunity to increase the number of pedestrian trips throughout the city and improve connectivity in the existing system are key strategies for the plan. Sidewalks and other improvements are identified to improve the ability of pedestrians to move about the city and increase the utilization of the network.

The most important existing pedestrian needs in Estacada are providing sidewalks on arterials and collectors that provide connectivity to key activity centers. Initial improvements should focus on filling in gaps where sidewalks are discontinuous and improving connections to schools, parks, and other prioritized areas. Figure 23 shows the pedestrian plan overlaid on top of the city street system. The connections recommends in the City of Estacada Parks and Recreation and Open Space Master Plan document are incorporated into the Pedestrian Plan. The Pedestrian Plan aims to improve the existing system by improving links and intersections as denoted on the pedestrian plan.

In order to achieve an interconnected walkway network, sidewalks need to be constructed by the city when completing roadway projects and by new development as required in local Transportation Planning Rule regulations. Sidewalks should be constructed on both sides of the street where pedestrian activity is high and out of direction travel for pedestrians is undesirable. Sidewalks should be built to current City of Estacada design standards in compliance with the Americans with Disabilities Act (at least four feet of unobstructed sidewalk).¹³

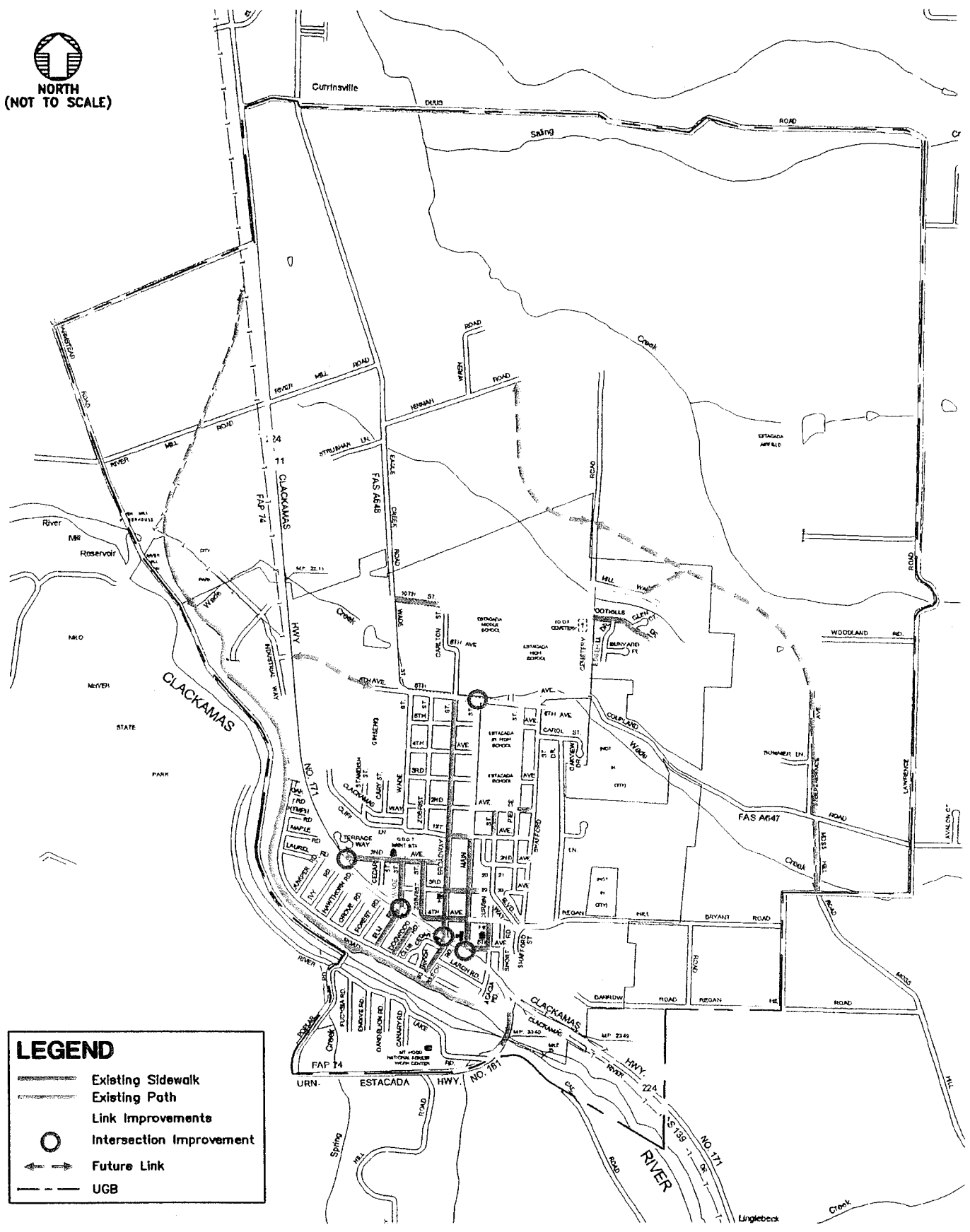
Multi-Use Facilities

An expansion of the existing Riverfront Trail would increase the accessibility of the recreational areas in the city. A review of the City of Estacada Parks Recreation and Open Space Master Plan indicated that there are several potential connections of interest to the city. The existing right-of-way includes the Springwater rail line right of way which could be used to connect the Timber Park with other parts of the city. The design facilities should include at least 8 feet of paved surface and should have 2 foot shoulders on either side of the path. The width of the path can be narrowed in sections where constructing the width is cost prohibitive. Figure 24 shows the cross section as identified in the Parks Recreation and Open Space Master Plan.

Other Pedestrian Amenities

Pedestrianways in the central business district require additional consideration because of sidewalk activity and the presence of street furniture and other amenities. Where pedestrian amenities such as street furniture and other items are located on the sidewalk, widths for the sidewalks should be increased to a ten feet cross section at a minimum. A design standard for this arrangement is shown in Figure 25.

It is also important to maintain facilities that encourage visibility of the pedestrian in areas where automobile drivers may not expect pedestrians. Pedestrian amenities such as curb extensions, street planters, street lights, and wide sidewalks act as buffers and improve the safety of pedestrians throughout the city. Crosswalks should include striped lanes on the street or surface treated sidewalks that positively delineate the pedestrian route and draw motorists' attention to pedestrians. An example of median crossing treatments is shown in Figure 26.



LEGEND

- Existing Sidewalk
- Existing Path
- Link Improvements
- Intersection Improvement
- Future Link
- UGB

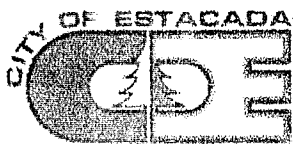
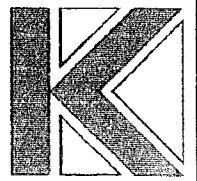
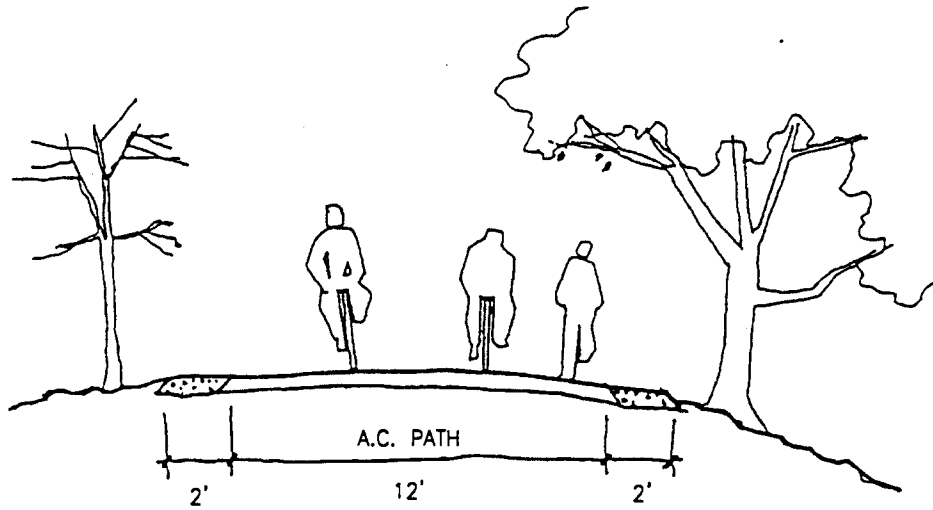
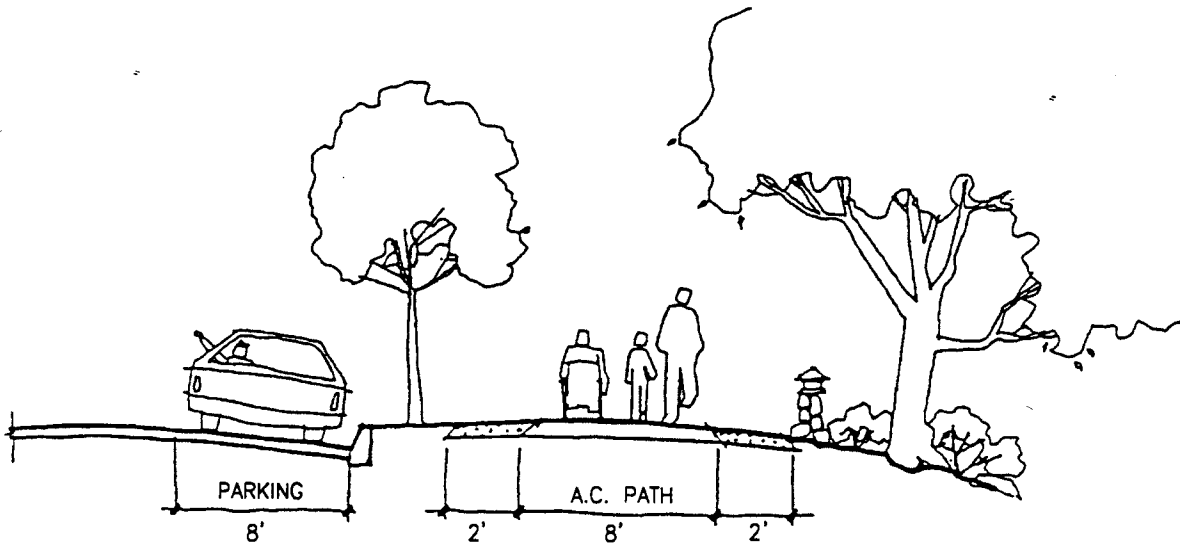


FIGURE 23
PEDESTRIAN SYSTEM PLAN
 Estacada Transportation System Plan





MULTI-PURPOSE TRAIL



RIVERFRONT TRAIL

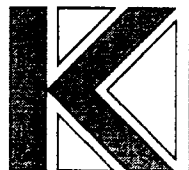
SOURCE: ESTACADA PARKS, RECREATION AND OPEN SPACES PLAN

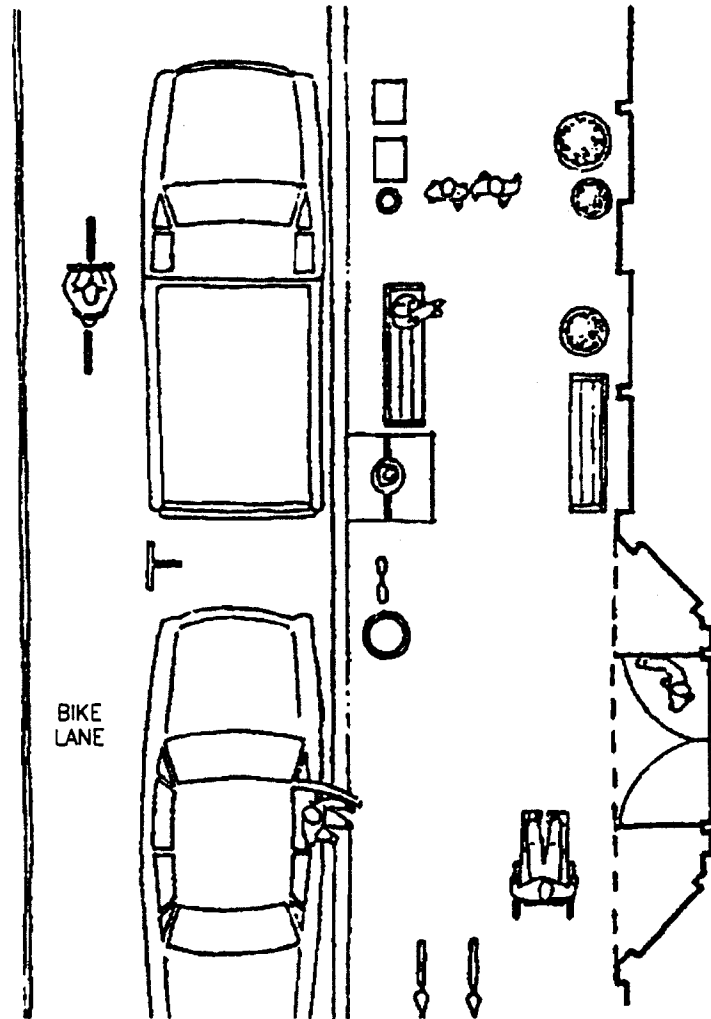
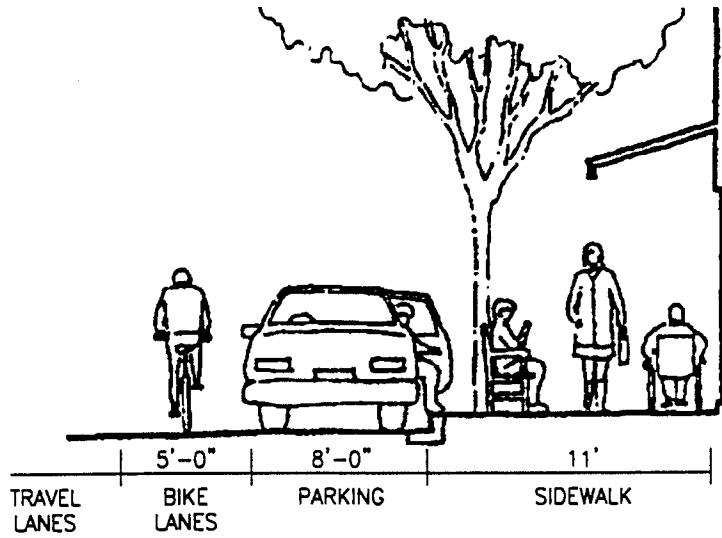


FIGURE 24

DESIGN STANDARD FOR MUTLI-USE PATHS

Estacada Transportation System Plan



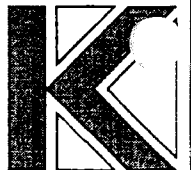


BIKE LANE ONLY IF TRAFFIC VOLUMES WARRANT

SOURCE: METRO - CREATING LIVABLE STREETS



FIGURE 25
PEDESTRIAN DESIGN FOR
COMMERCIAL DISTRICTS
 Estacada Transportation System Plan



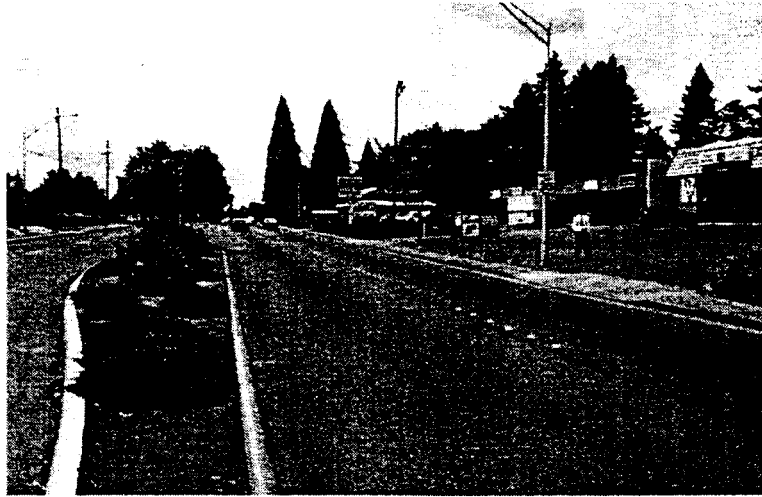
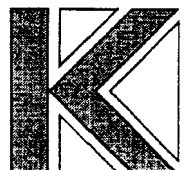


FIGURE 26
EXAMPLES OF
MEDIAN CROSSINGS ON HIGHWAYS
Estacada Transportation System Plan



BICYCLE PLAN

The Bicycle Plan is intended to establish a network of bicycle routes that connect the city's bicycle generators and provide a safe and effective system of bicycle facilities. Several of the streets within the city are designated Bike Streets. The streets designated as bike streets should be monitored in the future to ensure that a safe environment exists for cyclists. A safe environment for cyclists exists when automobile traffic is less than 3,000 vehicles per day or where speeds are lower than 25 miles per hour³.

Figure 27 shows the bicycle plan overlaid on top of the city street system. The Bicycle Plan has been developed with the understanding that, as traffic increases on the local street system, the provision of striped on-street bike lanes may be required to maintain the perceived safety for bicycles within the system and to promote increased ridership.

Bicycle routes identified by the City of Estacada Parks Recreation and Open Space Master Plan have also been reviewed and included in the bicycle plan presented in this memorandum. The plan is also intended to complement the Clackamas County Bicycle Master Plan¹⁴ where possible.

Additional improvements to the bicycle system center around the provision of amenities for cyclists. It is recommended that the city develop a policy that requires bike racks outside of new developments within the downtown. Bike racks should also be added to some of the existing buildings within the city, including the post office, the library, and City Hall. The minimum requirements for bicycle parking spaces presented in the Oregon Bicycle and Pedestrian Plan should be reviewed during development review by the city to encourage bicycle use and provide opportunity for cyclists to secure their bicycles during trips.

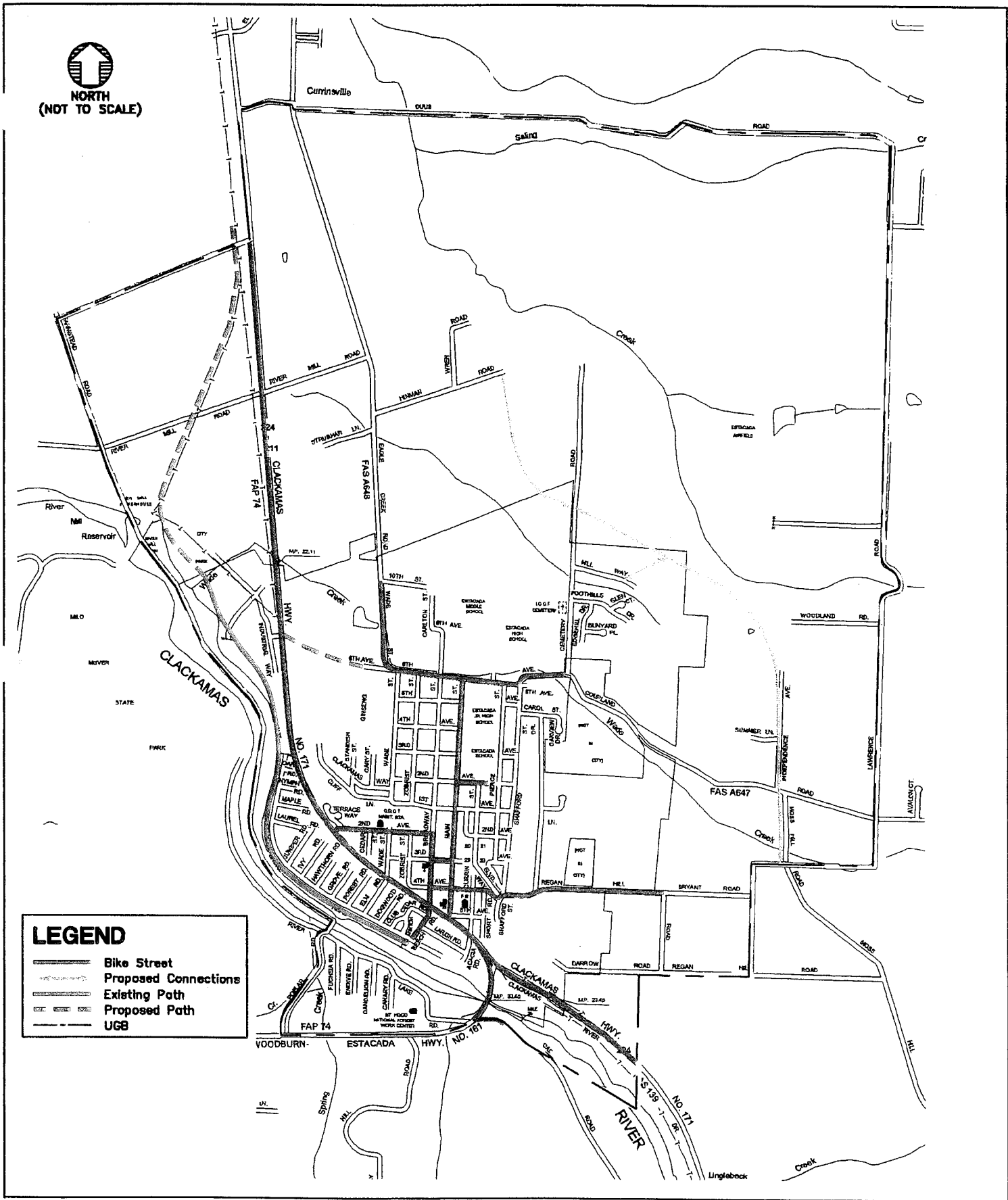
The Oregon Bicycle and Pedestrian Plan provides appropriate guidelines for the planning and design of bicycle and pedestrian facilities. There are many considerations required in the design of a bicycle system. The Oregon Bicycle and Pedestrian Plan should be consulted prior to the implementation of any proposed project to address both pedestrian and cyclist issues.

PUBLIC TRANSPORTATION SYSTEM PLAN

Transit service provides mobility to community residents who do not have access to automobiles and provides an alternative to driving for those who do. Transit service should meet the needs both of travelers within the city and those of travelers making trips outside of the community.

Background

As detailed in the **Existing Conditions** section, public transportation within the City of Estacada is currently provided by Tri-Met, the Estacada School District, and the Estacada Community Center. While increased usage of these services is desirable, there are no current or pending plans to expand public transportation services to the area in the short-term. Tri-Met has recommended increasing service on the Estacada route as a part of their Transit Choices for Livability¹⁵ study. Funding for the increased service would improve the service frequency and overall level of service. Aside from the aforementioned services, for most of the city's residents, private transportation is the only available option to get to the local medical, social, and retail services and the educational and employment opportunities located in adjacent communities.

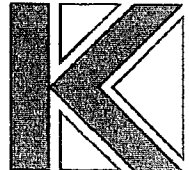


LEGEND

- Bike Street
- Proposed Connections
- Existing Path
- Proposed Path
- UGB



FIGURE 27
BICYCLE SYSTEM PLAN
 Estacada Transportation System Plan



Discussions with local agency staff and Transportation Advisory Committee members indicated that the available public transportation services are not as well used as they could be, suggesting that there is a need to create greater awareness of the services among community members. Community input stressed the need for improved service on weekends and expanded service on weekdays. It was further observed that the population under the driving age is particularly under-served and, as the community grows in geographic size, their overall accessibility will be diminished.

Recommended Service Enhancements

Overall, the City of Estacada should continue to monitor the adequacy of the transit service provided to the community and work with Tri-Met to expand service. In addition, two improvement strategies were identified for further consideration. First, both the city and Tri-Met should promote a greater public awareness of the available public transit services by providing additional information at City Hall and at the bus shelters. Increased awareness of the park and ride location at the highway would encourage ridership; the addition of signage for the park and ride would improve visibility.

Secondly, consideration should be given to coordinating trip requests received at the Community Center neighboring communities such as Molalla. It is recommended that future studies consider the connection further.

Close coordination between the City of Estacada and adjacent communities is also encouraged and should increase ridership and efficiency through better use of the resources available. Coordinated trips to local community events would likely generate significant interest. Ultimately, if an increased demand for service can be established and documented, additional resources (i.e. funding, equipment) may be pursued through grant applications or other alternative financing sources.

RAIL SYSTEM PLAN

There is no direct rail service to Estacada. The existing industries are not directly dependent on freight rail service and do not generate sufficient demand to warrant improved access.

MARINE SYSTEM PLAN

As previously noted in the **Existing Conditions** section, the Clackamas River borders the City of Estacada and serves as a means of recreational transportation. The City of Estacada should actively support the continued presence of boat launches in the area as an effective means of recreational transportation. The creation of multi-use paths and other facilities that promote the multi-modal use of the recreational areas along the shore of the Clackamas River should also be encouraged.

AIR TRANSPORTATION SYSTEM PLAN

The passenger and freight air transportation demands of the City of Estacada are primarily serviced by a system of four airports owned and operated by the Port of Portland. These airports are designed to meet the needs of commercial aviation and personal and business aircraft for passenger and freight movement. The airports are:

- Portland International Airport (PDX)
- Hillsboro Airport
- Troutdale Airport
- Mulino Airport

Each airport serves a particular role in the overall air transportation system, and is equipped to cater to different types and volume of aircraft. Regional, national, and international freight cargo and air passenger services are provided at the Portland International Airport (PDX). Located north of the Estacada study area and primarily accessed via I-205 and Airport Way, PDX provides access for passengers, and cargo from the Portland-Metropolitan area to over 120 cities worldwide, including destinations throughout the Pacific Rim. In 1997, a total of approximately 330,000 operations were flown to or from this airport. That same year, the airport served a total of more than 12,800,000 passengers from regional, national, and international services and 260,000 tons of air cargo was handled.

Near-term improvements to PDX air terminal facility are presently under construction, which once completed will provide improved facilities for air travelers through the airport.

The existing airport facility has two parallel runways. The Port of Portland reports that relocation of a runway may not be necessary until total annual operations reach approximately 500,000. Over the past five years, average annual growth in total operations from Portland International Airport has grown at a rate of just over three percent per annum. Demand projections prepared by P & D Aviation Inc., indicate that by 2020 the airport will be required to serve around 29 million passengers, 823,000 tons of air freight and 505,000 aircraft operations annually.

Based on these demand estimates, the relocation of a replacement runway is likely to be required prior to the 2020 design horizon. The Port of Portland is currently undertaking a master planning process for the development of airport facilities to meet the anticipated future demands.

The Mulino airport site was selected for development in 1979 after being determined by the Port of Portland as the best suited option to meeting the needs of the Clackamas County region. Located several miles west of Estacada, this airport offers general aviation facilities and plays an important role as an airport for small propeller-driven aircraft.

The Estacada airport is a private airport within the urban growth boundary that provides landing facilities for the public. Covered under the Oregon Statute 836.600, the airport is provided protection under state law. The existing aircraft tie downs are used frequently. The hangars are preferred by existing users and are often near capacity. Growth in activity at the airport is likely as the airport adds hangars and supplements services.

There is no near-term expansion planned for the airport. Future improvements are likely to include expansion of the 16-34 runway to 4,000 feet of paved surface and installation of an instrument landing systems (ILS). The airport and the ODOT Aeronautics Division requested an aviation easement agreement from the City of Estacada for the Estacada Airport. This aviation easement should be considered in conjunction with development review. Furthermore, the Oregon statutes require that when a jurisdiction reviews their comprehensive plan an Airport Overlay District is required for the land area surrounding the airport.

The City of Estacada should support the continued use and expansion of local and regional air transportation facilities.

PIPELINE SYSTEM PLAN

No major pipelines within the City of Estacada were identified within the urban growth boundary. The River Mill Dam operates on the Clackamas River east of Estacada and provides power for the region. The dam is operated by Portland General Electric and power generated from the dam is transferred via transmission lines to the Estacada Substation that is located on the southeast corner of the Highway 211-

224/Broadway intersection. The Farraday-River Mill lines are 57kV lines that carry power to along the river through the Estacada urban growth boundary.

IMPLEMENTATION PLAN

This section has outlined specific transportation system improvement recommendations as well as a corresponding timeline for implementation of the identified improvements. The sequencing plan presented is not detailed to the point of a schedule identifying specific years when infrastructure should be constructed, but rather ranks projects to be developed within the near-term and long-term horizon periods. In this manner, the implementation of identified system improvements has been staged to spread investment in this infrastructure over the 20-year life of the plan.

The construction of roads, water, sewer, and electrical facilities in conjunction with local development activity should be coordinated if the City of Estacada is to develop in an orderly and efficient way. Consequently, the plans recommends in the TSP should be considered in light of developing infrastructure-sequencing plans, and may need to be modified accordingly.

SUMMARY OF TRANSPORTATION IMPROVEMENTS

The planned transportation improvements in the City of Estacada over the next 20 years, to meet both short- and long-term needs, are listed in Table 7. The projects are listed in order of priority and have been divided into two time periods; 0 to 5 years (near-term improvements) and 6 to 20 years (long-term future improvements). The roadway improvements are necessary as development and redevelopment of properties occur. Pedestrian and bicycle improvements are implementation measures for the respective plans. The intersection improvements are existing needs, but are not considered immediate at this time. In the future, these locations should be monitored and if conditions warrant, can be raised on this list to mitigate the safety deficiency.

Table 7 Summary of Improvement Program

Alternative Number	Improvement Description	Estimated Cost*	Implementation Timeline
#1	6 th Avenue Sidewalks (Wade Street to Shafford Street)	\$90,000	Near-term future
#2	6 th Avenue Sidewalks (Shafford Street to Hill Way)	\$55,000	Near-term future
#3	Hinman to Cemetery Road Connection	\$1,000,000	As development occurs
#4	Cemetery to Coupland Road Connection	\$1,400,000	As development occurs
#5	Coupland Road to Regan Hill Road Connection	\$1,000,000	As development occurs
#6	Improved Maintenance (Streets/Sidewalks)	\$40,000/year	Annual costs
#7	Main Street Sidewalks (6 th to 1 st Ave)	\$80,000	Near-term
#8	Restriping City Streets	\$50,000	Near-term
#9	Highway Improvements for pedestrians	\$150,000	Near-term
#10	Extension of 6 th Avenue east to Highway	\$650,000	As redevelopment occurs
#11	Cemetery Road Sidewalks	\$155,000	Near-term
#12	2 nd Avenue Sidewalks	\$60,000	As appropriate
#13	1 st Avenue Sidewalks	\$20,000	Near-term
#14	Highway 211-224 (Sidewalk or multi-use path)	\$620,000	Long-term future /ODOT
#15	Industrial Way Extension	\$800,000	As development occurs
#16	Wade Street Sidewalks	\$75,000	Long-term future
#17	Pierce Street Sidewalks (6 th Ave to 1 st Ave)	\$75,000	Long-term future
#18	Regan Hill-Shafford Street Intersection	\$300,000	Long-term future
#19	4 th Avenue - Regan Hill Road Sidewalks	\$160,000	Long-term future
#20	Highway 211 (Sidewalk on one-side)	\$150,000	Long-term future /ODOT
#21	River Mill Road (continuation of existing trail)	\$270,000	Long-term future
#22	Hill Way Sidewalks	\$45,000	Long-term future
#23	Shafford Street High School Driveway	\$150,000	If a problem arises
#24	Highway 211-224 Intersection Improvement	\$200,000	As warranted /ODOT
#25	Transit System Planning	\$20,000	Long-term future
#26	One-Way Street Conversion	\$50,000	As needed
Total funds needed (City Improvements)		\$2,605,000	
Total (Developer, ODOT, and City Combined)		\$8,425,000*	

*Estimated costs are in 1999 dollars and do not include right-of-way acquisition

SUMMARY

The adoption and implementation of this Transportation System Plan will enable the City of Estacada to rectify existing transportation system deficiencies while also facilitating growth in the study area under the population and employment levels assumed in this study. Updates to the transportation system plan should occur as necessary to insure compliance with the Transportation Planning Rule and verification of growth as reported in this study.

Section 6

Transportation Funding Plan

Transportation Funding Plan

INTRODUCTION

The Transportation Planning Rule (OAR 660-12-040) requires that the City of Estacada Transportation System Plan (TSP) include a transportation financing program. These programs are to include:

- a list of planned transportation facilities and major improvements;
- a general estimate of the timing for planned transportation facilities and major improvements;
- determination of rough cost estimates for the transportation facilities and major investments identified in the TSP (intended to provide an estimate of the fiscal requirements to support the land uses in the acknowledged comprehensive plan(s) and allow jurisdictions to assess the adequacy of existing and possible alternative funding mechanisms); and,
- a discussion of existing and potential financing sources to fund the development of each transportation facility and major improvement (which can be described in terms of general guidelines or local policies).

The timing and financing provisions in the transportation financing program are not considered a land use decision as defined by the TPR and ORS 197.712(2)(e) and, therefore, cannot be the basis of appeal under State law. In addition, the transportation financing program is intended to implement the comprehensive plan policies, which provide for phasing of major improvements to encourage infill and redevelopment of urban lands, prior to facilities that would cause premature development of urbanizable areas or conversion of rural lands to urban uses.

CITY OF ESTACADA FUNDING HISTORY

The Street Fund for the City of Estacada provides an annual budget of approximately \$214,000 (based on a three-year average) that is dedicated entirely to the operation and maintenance of the City's transportation facilities. Maintenance and preservation are the major work activities performed on the local street system by the City's Public Works Department. Table 8 shows the various sources of revenue that make up the annual Street Fund budget.

Table 8 Sources of City Street Fund - Fiscal Year 1998-1999

Source	Amount
Oregon State Fuel Tax	\$93,000
Special Cities Allotment	\$25,000
Transfer from City General Fund	\$38,000
Other Sources (property owner contributions, interest, etc.)	\$60,600
Total	\$216,600

The existing funding sources does not adequately address the needs throughout the city. There are several options for the city to consider. The primary goal of the funding plan is to reduce the reliance on special grants and the transfer from the city's General Fund.

OREGON TRANSPORTATION FUNDING HISTORY

Road-Related Funding

The most significant portion of Oregon's highway user taxes and fees come from federal fuel and vehicle taxes, state taxes, and general motor vehicle fees. These categories account for 32 percent, 34 percent, and 25 percent, respectively, of all highway user taxes and fees collected in the State. Through the fiscal year 1996, the matching ratio in Oregon for Interstate Funds was: Federal 92.22 percent and State 7.78 percent¹⁶.

During the 1980's, Oregon's transportation budget was bolstered by a series of two-cent annual gas tax increases. At the same time, the Federal Government was increasing investment in highways and public transportation. The situation is different today. The last three Oregon Legislatures failed to increase the gas tax and federal budget cuts are reducing transportation funding available to Oregon. The State Highway Fund is further losing buying power because the gas tax is not indexed to inflation, and increased fuel efficiency of vehicles reduces overall consumption. Nevertheless, fuel taxes are the largest single source of highway revenues at approximately \$390 million annually. Weight-miles taxes are the second largest source of revenue to the Highway Fund, at approximately \$215 million annually.

Oregon Highway Trust Fund revenues are distributed among State (60.05 percent), County (24.38 percent) and City (15.57 percent) governments to fund their priority road needs. Under the 1997-1999 legislatively adopted Department of Transportation budget, a total of \$2,284 million revenue dollars was identified. Of the total available revenue, approximately \$317 million dollars was allocated to counties and \$185 million to cities¹⁷.

Oregon law allows local government, in addition to receiving state highway trust fund revenues, to levy local fuel taxes for street related improvements. Multnomah and Washington Counties, and some small cities (Tillamook, The Dalles, Woodburn) have used this authorization. Several attempts have been made by other jurisdictions, but have not been supported by the local electorate. As few local governments have implemented this option, non-user road revenues tend to be relied upon to supplement the funds received from state and federal user revenues. Other local funding sources have included property tax levies, local improvement district assessments, bonds, traffic impact fees, road user taxes, general fund transfers, receipts from other local governments, and other miscellaneous sources.

Oregon's current fee for cars and other light vehicles weighing 8,000 pounds or less is \$30 biennially. Oregon law permits local governments (counties) and governmental entities to impose local option vehicle registration fees. To date, Clackamas County has not implemented this tax.

Cities in Oregon have relied more on transfers from their general funds to support roadway improvements, than have counties. Ballot Measure 5, however, approved by the voters in 1990, reduced the range of funding and financing options available to both cities and counties. Measure 5 limited the property tax rate for purposes other than for payment of certain general obligation indebtedness to \$15 per \$1,000 of assessed value. The measure further divided the \$15 per \$1,000 property tax authority into two components: \$5 per \$1,000 dedicated to the public schools; the remaining \$10 dedicated to other local government units, including cities, counties, special service districts, and other non-school entities. The tax rate limitation for cities and counties went into effect in 1992. The school portion of the measure was phased in over a five-year period beginning in FY 1992. In 1996, voters again approved a property tax limitation measure, Ballot Measure 47, which will further impact the ability of cities and counties to pay for needed infrastructure through historic or traditional means.

At the same time that increased growth and increased transportation demands are occurring, cities and counties have lost another traditional source of revenue for infrastructure construction and modernization - timber harvest receipts. Under a 1993 negotiated mitigation plan, federal forest receipts to support county roads are decreasing 3 percent per year. In 1996, counties received 74 percent of their 1986-90 average receipts, and by 2003 they will receive 55 percent of the late 1980s average receipts.

Given this funding environment, current funding levels and sources are not adequate to meet the transportation needs of the State, counties, or cities, for the next 20 years. In response to this gap between needs and funding, Governor Kitzhaber organized the Oregon Transportation Initiative to look at statewide transportation needs and to develop a program to address how these needs will be met. Through a public process led by business and civic leaders across the State, findings and recommendations on the state of transportation needs and methods to address those needs was submitted to the Governor in July 1996.

A result of these recommendations was the appointment of a committee to develop a legislative proposal to the 1997 Legislature regarding transportation funding. Part of that proposal included a process for identifying a "base" transportation system, with a priority of maintenance, preservation, and operation of a system of transportation facilities and services that ensures every Oregonian a basic level of mobility within and between communities. Other components included provisions for realizing efficiencies resulting from better intergovernmental cooperation (shared resources and equipment, better communication on project needs and definition), and elimination of legislative barriers to more efficient and cost-effective methods of providing transportation services. Unfortunately, the State Legislature was unable to reach consensus on the means to collect and distribute the funds, and the package failed. The current legislature is reviewing a proposal for a 4-cent gas tax increase that includes a \$10/year vehicle registration fee increase. A similar proposal was not passed during the 1997 Legislature.

A part of future transportation funding will include identification of relationships and responsibilities relative to delivery of projects and services. In Oregon, the primary state role has been to construct and maintain the state highway system and to assist local government with funding of other modes. The State also has a role in intercity passenger services and airports. This has historically been minor but would grow significantly, if serious efforts were put into intercity transportation improvements. Local governments provide local transit and airport support, in addition to providing maintenance, preservation, and construction for local roads, streets, and bridges. The Federal Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) began moving decision-making for federal programs to states and this program and other state policies incorporated in the Oregon Transportation Plan (OTP) encourage reassessment of responsibilities and obligations for funding. The Transportation Equity Act for the 21st Century (TEA21), passed in 1998, has continued the efforts first initiated by ISTEA.

These changing relationships have resulted in two significant issues for State and local governments. First, there is no clear definition of State responsibility. At one time, the State operated on an informal consensus that it should provide one-half the match on federally funded, local, and other projects that served statewide needs. No similar consensus seems to exist today. The State's responsibility for transit, airports, and other local transportation infrastructure and services is not clear. The question of regional equity is raised in considering especially high-cost project needs, such as the Bend Parkway or the Portland area light rail program. Regional equity will probably require consideration of all modes together, because different regions may have different modal needs and financial arrangements.

Given this dynamic transportation funding environment, it is clear that local governments need to reassess traditional methods of funding projects and look creatively at ways to meet public expectations of high quality transportation services.

Transit Funding

Transit service in Oregon has evolved from private development and reliance on user fees for operating revenue, to public ownership with public subsidy for operations. No clear philosophy of the State role in providing transit services is evident and the State is discussing how it should raise revenue in support of transit. The State has used general funds, lottery funds, stripper well funds, cigarette tax revenue, and other funds at various times to support transit service. These efforts have largely been targeted towards supplying half the required match to federal capital improvement grants. Tri-Met receives funding under the payroll tax that is assessed and paid by employers within their service area.

While the state's role in transit funding is limited, the ODOT Public Transit Section does currently administer three public transit funding sources. These include Small City and Rural Transit Assistance (Section 18), the Special Transportation Fund (STF), and Section 16.

The Special Transportation Fund is intended for elderly and disabled citizens and is funded through the State cigarette tax. Funding for the purchase of vehicles and equipment for special transportation providers (i.e., servicing the elderly and disabled) is provided through a federal funding program known as Section 16.

POTENTIAL TRANSPORTATION FUNDING SOURCES

There are a variety of methods to generate revenue for transportation projects. Funding for transportation improvement projects are derived from three sources: federal, state, and local governments. Appendix C (Table C-1) provides a summary of federal, state, and local highway, bridge, sidewalk, and bicycle funding programs respectively, which have typically been used in the past. Although property tax is listed as a possible revenue source, the impacts of Ballot Measure 47 severely limit the opportunities for this funding source.

Appendix C (Table C-2) presents details of the revenue sources for streets, bridges, sidewalks, and bicycle facilities currently used by cities. The information is summarized by type of facility, and indicates the percent of revenue each funding source represents for all cities in Oregon, likely trends for the source, known constitutional or other limitations, and their respective rates.

A similar list of transportation funding sources for transit projects is included in Appendix C (Table C-3). This is summarized with the general status of each funding source in Table C-4.

The City of Estacada is currently reviewing the development of a Transportation System Development Charge (SDC). An SDC would be assessed to new development to help fund the improvement costs identified in the Estacada Transportation System Plan.

POTENTIAL FUNDING SOURCES

Potential funding sources in the 20-year program are grouped into general categories. This includes potential federal, state, and local funding, where local funding will require institution of a major, new funding source to supplement funds from a potential transportation system development charge. This could include added street bonding, local improvement districts, a local gas tax, hotel/motel tax, and/or a street utility fee. A combination of these funding sources could very easily produce the revenue stream necessary to accommodate the 20-year capital improvement needs of the community.

The recommended approach is comprised of two primary sources to supplement the existing City Street Fund. Largely because the existing funding is inadequate, a street utility fee is recommended to address the existing deficiencies. The principle consideration with respect to the street utility fee is whether the

citizens will support such a fee for maintenance purposes. Just as citizens and businesses pay for water and sewer that supplies a home or business, a fee would be assessed to all businesses and households by the city for maintenance on city streets. The fees are typically based on the amount of use generated by that particular use, which is estimated by national averages based on the land use and the size of the building. This fee is being used in Tualatin and Wilsonville, where it is used effectively to improve the city street system through preventive maintenance.

The second part to the recommended funding plan is the addition of a Transportation Systems Development Charge. Transportation SDCs are widely used in high growth cities and counties throughout the State. Most cities in the Portland metropolitan area now use SDCs to improve their city street network and address capacity related deficiencies and growth. A transportation SDC is a sliding scale fee which is charged all new development to pay for transportation improvements that are needed as a result of the development. The fee is normally based upon the number of vehicle trips generated by the development. Credits are often given for "qualified improvements" made by a developer to an adjacent arterial or collector street which would reduce the SDC charge.

ORS 223.297 to 223.314 prescribes specific requirements which a SDC must meet to be considered legal. It specifies that a SDC may be used only for capital improvements and defines the range of eligible capital facility improvements (i.e., water, sewer, drainage, transportation, or parks). ORS also defines the method for determining the amount which may be charged by a SDC, the types of eligible projects for funding and annual review provisions. The use of the transportation SDC is a major source of funding for growth-related transportation improvements and can help temper growth related impacts to the transportation system. SDCs remove much of the growth related burdens from the citizens when prepared effectively.

Section 7

Land Use Ordinance Modifications

Land Use Ordinance Modifications

The purpose of this section is to summarize recommended amendments to the city's codes to implement the TPR. Specific amendments to the Comprehensive Plan and Municipal Code are summarized below.

It is stressed that the Oregon Department of Land Conservation and Development is in the process of developing two model ordinances that can assist the city to establish appropriate regulations – a model zoning ordinance for small communities and an infill and redevelopment ordinance. The model zoning ordinance and accompanying guidebook is being developed specifically for small cities with populations under 10,000. Cities are encouraged to refer to the model ordinance and guidebook for strategies and model code provisions that can be readily adapted, adopted and implemented locally to focus and stimulate urban residential and commercial development.

MODIFICATIONS TO THE EXISTING ORDINANCES

Private Driveways - 9.060

The ordinance describing the construction standards of private driveways should include a description of the minimum average spacing for private driveways. The following text should be added to support the access management standards for the city streets.

Access Spacing for Private Driveways. All private drives shall be spaced at a distance that insures efficient operation of the transportation system. The spacing guidelines for private drives vary depending on type of street the property abuts. The spacing standards are as follows:

Functional Classification	Private Access Drive (feet)-
Arterial	500
Major Collector	150
Minor Collector	100
Local	50

Road (Street) Definition - 10.202.97

The road street definition should be changed to reflect the following text in support of the transportation system planning completed for the comprehensive plan.

A public or private way created to provide vehicular access to one or more lots, parcels, areas of tracts of land, excluding a private way that is created to provide access to such land in conjunction with its use for forestry, mining, or agricultural purposes.

1. Arterial: The primary function of arterials is to provide through-movement of traffic, primarily serving automobile mobility, pedestrian, and bicycle needs. Arterials tend to carry significant interurban travel between downtown areas and outlying residential areas. While arterials may provide access to adjacent land, that function is subordinate to the travel service provided to major traffic movements.
2. Major Collector: The primary function of a major collector is to facilitate the movement of city traffic within the urban growth boundary of the city. Collectors should provide limited access to

commercial properties while maintaining circulation and mobility for users. Bike lanes should be striped where traffic intensity and speed on these facilities warrant consideration or where the street directly connects to a land use which generates bicycle traffic, i.e., a school or park.

3. The primary function of a minor collector is to connect neighborhoods with major collector streets and to facilitate the movement of local traffic. Speeds on these facilities should remain low to ensure community livability and safety for pedestrians and cyclists of all ages.

4. Local streets are intended to provide access to private dwellings and businesses. The local street is characterized by two travel lanes, with on-street parking typically provided on one or both sides. Local streets should be designed to serve pedestrians and the community, as the local street is part of the public realm.

5. Cul-de-Sac or Dead End Street: A minor street with only one outlet which provides a vehicular turnaround.

6. Minor Streets: A street designed to provide access to abutting residential property with only incidental service to through traffic.

7. Private Road: A road created by easement.

8. Public Road: A road dedicated for public use.

Parking - 10.22X.3.b

The Estacada Code requires parking for each zoning code established within section 218 of Chapter 10. The parking requirements (minimum spaces required) are excessive and should be reduced to limit the amount of land and dedicated asphalt required for development of commercial and multiple-family residential developments. The Institute of Transportation Engineers provides guidelines for parking supply in their Parking Generation Manual.

Shared parking can also be used to minimize the amount of space dedicated to parking. Complimentary uses within the central business district that require parking at different times during the day can share parking spaces under agreements between the property owners. An example of this is in town that works well today is the IGA supermarket and the video store.

Recommended residential and industrial parking requirements are shown below.

Section	Land Use	Minimum Required	Recommended
10.220	Low Density Residential Zone R-1	One per home	3 spaces/home
10.221	Medium Density Residential Zone R-2	One per home	2 spaces/home
10.222	Multiple Family Residential Zone R-3	One per home	1.5 spaces/unit
10.225	Light Industrial Zone M-1	1.6/1,000 sf	Per use
10.226	Heavy Industrial Zone M-2	Per use	Per use

Further consideration should be given to less restrictive parking requirements in section 238 of Chapter 10. The Off-Street Parking Requirements outlined in 10.238.17 could refer to the ITE Parking Generation Manual.

Block Length

Change maximum block length 10.750.14 to 800 feet and add additional language to encourage shorter spacing between blocks to encourage connectivity.

1. Connections to existing or planned streets and undeveloped properties along the border of a parcel are recommended at 400-foot intervals.
2. The city shall set a maximum block length standard of 800 feet between street centerlines unless the city determines that adjacent layout or topographical features justify greater length.

Airport Overlay Zone

Add language to support the protection of the area surrounding the airport as required by ORS 836.600.

ACCESS MANAGEMENT AND DEVELOPMENT REVIEW ORDINANCE

The following access management and development review language is recommended to be adopted by ordinance to maintain the integrity of the local transportation system. It should be reviewed by Estacada's City Attorney to ensure that all the appropriate references are included.

X-X-X Access Management Policy

1. Purpose and Description: The purpose of this requirement is to maintain the State of Oregon Highway Plan level of importance and associated operating standards on Highway 211-224 and to develop a standard for access onto arterial, collector, and local streets within the city's urban growth boundary, while maintaining an expedient process for reviewing land uses that may affect these areas.
2. Application: The City Planning Commission shall designate all city streets and state highways classified as local, collector, or arterial as an access management roadway. This shall be known as the Access Management List. From time to time, other streets within the city may be reviewed through the hearing process and added to the List. At a public hearing, evidence shall be presented by appropriate state, local and federal agencies, interested groups, and/or property owners to show that the areas under consideration should be added to the List. The Planning Commission shall determine the economic, social, environmental and energy consequences on the resource site and on any conflicting uses of areas proposed to be added. If the Planning Commission finds that any roadway should be included in this designation, to meet the requirement of the city's Comprehensive Plan or Transportation System Plan, it shall be included in the Access Management List. When a development is proposed along an Access Management roadway, the Planning Director shall review the development to see if it meets the requirements of this subsection.
3. Permitted Uses: Uses and developments permitted outright or conditionally in the underlying zone shall be permitted if they comply with the following standards for gaining access to adjacent roadways.

Criteria for Review and Disposition:

1. The basic access spacing requirements are as follows:

**CITY OF ESTACADA
 ACCESS SPACING POLICY**

Functional Classification	Public Street (feet) **	Private Access Drive (feet) **
Arterial	1,320	300 - 500
Collector	300	75
Local	150	15

* Consistent with Oregon Highway Plan guidelines

** Spacing measured from centerline to centerline

2. Applicants must submit a preliminary site plan for review by the Planning Director, prior to receiving an access or zoning permit. At a minimum, the site plan will illustrate:

- A. The location of existing access point(s) on both sides of the road within 500 feet in each direction for driveway requests on arterials and 300 feet on collector streets.
- B. Distances to neighboring constructed public access points, median openings, traffic signals, intersections, and other transportation features on both sides of the property including the section of roadway between the nearest upstream and downstream collector.
- C. Number and direction of site-access driveway lanes to be constructed, as well as an internal signing and striping plan
- D. All planned transportation features on the local transportation system (such as auxiliary lanes, signals, etc.)
- E. Trip generation data or appropriate traffic studies (See Part 3 for traffic impact study threshold requirements)
- F. Parking and internal circulation plan
- G. Plat map showing property lines, existing and required right-of-ways, and ownership of abutting properties
- H. A detailed description and justification of any requested access variances

The site plan should be drawn at a scale no smaller than 1 inch equals 100 feet. The plot should show property boundaries, existing and proposed land uses, existing and proposed transportation facilities, and any other pertinent information that would help identify how the proposed use is compatible with the proposed transportation system. The Planning Director shall (where applicable) refer the request to other agencies or individuals for their review and comment.

3. All land use actions, new developments, and/or redevelopments accessing the transportation system will need to provide traffic impact studies to the city and appropriate agencies (Clackamas County and/or ODOT) if the proposed land use meets one or more of the following traffic impact study thresholds. A traffic impact study will not be required of a development that does not exceed the stated thresholds.

- Trip Generation Threshold - 50 newly generated vehicle trips (inbound and outbound) during the adjacent street peak hour

- Mitigation Threshold - installation of any traffic control device and/or construction of any geometric improvements that will affect the progression or operation of traffic traveling, entering, or exiting the highway
- Heavy Vehicle Trip Generation Threshold - 20 newly generated heavy vehicle trips (inbound and outbound) during the day

Trip Generation estimates should be based on the latest addition of the Institute of Transportation Engineers Trip Generation Manual. The city may use alternative data when, in the Planning Director's opinion, the alternative data are more reliable and realistic for a particular development than those identified by the latest Trip Generation Manual.

All traffic impact studies will need to be prepared by a registered professional engineer in accordance with ODOT's development review guidelines, unless the city adopts its own traffic impact study guidelines. It is recommended that the City of Estacada adopt development review guidelines.

4. Upon receiving a development request and information referenced in Parts 2 and 3, the Planning Director or authorized individual shall review the request to determine if:

A. The road system is designed to meet the projected traffic demand at full build-out and the functional roadway classification standards are consistent with the proposed use.

A. Access points are properly placed in relation to sight distance (i.e., does the driveway location meet both intersection and stopping sight distance requirements), driveway spacing, and other related considerations, including opportunities for joint or crossover access. Entry roads should be clearly visible from the local, collector, or arterial street.

B. The design of the building accommodates non-automobile modes by providing ADA accessible pedestrian connections from the building to the existing system and bicycle parking that is accessible.

C. The road system provides adequate access to buildings for residents, visitors, deliveries, emergency vehicles, and garbage collection.

D. The frontage of single-family dwelling units is located on interior local streets rather than collectors or arterials when possible.

E. The pedestrian path system links buildings with parking areas, entrances to the development, open space, and recreational and other community facilities (i.e., addresses the requirements of the Transportation Planning Rule).

F. The site plan provides for potential future crossover or consolidated access, and/or alternative access.

G. The Planning Director shall require the applicant to sign and record an access or crossover easement where applicable, prior to issuing final approval.

H. Access points not meeting the specified spacing requirements for the facility will require an access variance. The access variance will be reviewed by ODOT for proposed Highway 211-224 access driveways and by the City of Estacada for all other facilities within the urban growth boundary. Variances will be allowed under the following conditions:

a) The parcel's highway frontage, topography, or location would otherwise preclude issuance of a conforming access point.

b) Alternative access (cross-over easement, shared, side-street, and/or rear access) is not available to a parcel.

An approved access variance will provide the parcel with a conditional access permit. The conditional access permit will remain valid until a neighboring (adjacent or across the highway) piece of property goes through a land use action or alternative access is provided. The city, county, or ODOT will then have the right to either relocate the conditional access driveway to align with an opposing driveway, eliminate the access and provide cross-over access, or consolidate the access with an adjacent parcel.

5. Once the city has reviewed the elements identified in Part 4, the city should determine whether the proposed land use action should be conditions with one or more of the following items in order to maintain the existing operation and safety of existing facilities and provide the necessary right-of-way and improvements to develop the future planned transportation system.

1) Crossover easement agreements will be required on all compatible parcels (topography, access, and land use) to facilitate future access between adjoining parcels.2) Conditional access permits will be issued on new developments that have proposed access points that do not meet the designated access spacing policy and/or have the ability to align with opposing access driveways.

3) Right-of-way dedications will be required to facilitate the future planned roadway system in the vicinity of the proposed development.

4) Half-street improvements (sidewalks, curb and gutter, bike lanes/paths, and/or travel lanes) should be provided along site frontages that do not have full-buildout improvements in place at the time of development.

Definitions:

Access: A means of approach to provide vehicular or pedestrian entrance or exit to a property. This may not necessarily include all movements.

Access Classification: A ranking system for roadways used to determine the appropriate degree of access management. Factors considered include functional classification, the appropriate local government's adopted plan for the roadway, subdivision of abutting properties, and existing level of access control.

Access Connection: Any driveway, street, turnout or other means of providing for the movement of vehicles to or from the public roadway system.

Access Management: The process of providing and managing access to land development while preserving the regional flow of traffic in terms of safety, capacity, and speed.

Access Spacing: The distance between access locations, measured from the closest edge of pavement of the first access to the closest edge of pavement of the second access along the edge (either side) of the traveled way.

Conditional Access: An access granted to a parcel that will be relocated or eliminated at the time alternative access is provided.

Cross Access: A service drive providing vehicular access between two or more contiguous sites so the driver need not enter the public street system.

Crossover Easement (Access): A legal agreement that allows for access to one parcel through the access of another.

Easement: A grant of one or more property rights by a property owner to or for use by the public or another person or entity.

Functional Classification: A system used to group public roadways into classes according to their purpose in moving vehicles and providing access.

Joint Access (or Shared Access): A driveway connecting two or more contiguous sites to the public street system.

Right-of-Way: Land reserved or used for a highway, street, alley, walkway, drainage facility, or other public purpose.

Temporary Access: Provision of direct access to the controlled access facility until such time as adjacent properties develop, in accordance with a joint access agreement or frontage road plan.

Section 8

Transportation Planning Rule
Compliance

Transportation Planning Rule Compliance

In April 1991, the Land Conservation and Development Commission (LCDC), with the concurrence of ODOT, adopted the Transportation Planning Rule (TPR), OAR 660 Division 12. The TPR requires local jurisdictions greater than 2,500 to prepare and adopt a Transportation System Plan (TSP). Outlined below is a list of recommendations (designated by *italics*) and requirements for a TSP for an urban area with a population between 2,500 and 25,000, and how each of those were addressed in the City of Estacada TSP. The comparison demonstrates that the City of Estacada TSP is in compliance with the provisions of the TPR in advance of their reaching a population of 2,500.

DEVELOPMENT OF A TRANSPORTATION SYSTEM PLAN

TPR Recommendations/Requirements

City of Estacada TSP Compliance

Public and Interagency Involvement

- Establish Advisory Committees. A Citizens Advisory Committee and Technical Advisory Committee was established at the outset of the project. Membership on the Technical Advisory Committee included members of the City, County, and ODOT staff. Membership on the Citizens Advisory Committee included representatives from all facets of the community.
- Develop informational material. Technical memoranda and current status reports of work undertaken and completed by the advisory committee were published and made available to the public throughout the project. Press releases concerning the project and opportunities for participation at public workshops were published and materials (including report text, charts, and maps) were prepared for review defining critical components of the city's TSP.
- Schedule informational meetings, review meetings and public hearings throughout the planning process. Involve the community. Three meetings were held through the planning process. The meetings were advertised by distribution of meeting notices. Two of the three meetings were followed by Open Houses that were advertised and open to the public.
- Coordinate Plan with other agencies. Coordination with local government agencies was accomplished by including them on the project mailing list, individual project briefings/meetings, and participation on the both the Management Team and the TAC.

Review Existing Plans, Policies, Standards, and Laws

- *Review and evaluate existing comprehensive plan.* The following plans were reviewed as part of the development of the TSP: *1991 Oregon Highway Plan*, (June, 1991); *1996 Oregon Bicycle and*

Pedestrian Plan; City of Estacada Comprehensive Plan, (1984); Draft Statewide Transportation Improvement Program (2000-2003).

- *Land use analysis - existing land use/vacant lands inventory.*
- *Review existing ordinances - zoning, subdivision, engineering standards.*
- *Review existing significant transportation studies.*
- *Review existing capital improvements programs/public facilities plans.*
- *Americans with Disabilities Act requirements.*

In developing the forecast of transportation needs, an analysis was conducted of current land use designations and land status within the project area to determine the capacity for growth, which would increase demand for transportation services. Population and employment forecasts were prepared for the year 2019 that reflect regional growth prospects and the city's economic role in the region. Estimates of needed housing, commercial, and employment lands were derived from these forecasts.

Existing City Subdivision Ordinances, Zoning Ordinances, and Streets Master Plan were reviewed for adequacy in the development of the City of Estacada TSP.

Significant transportation studies reviewed as part of the City of Estacada TSP include the above mentioned comprehensive plan and the associated transportation element, the Clackamas County Rural TSP (incomplete), and the City's Parks, Recreation, and Open Space Study.

The city does not currently have a capital improvement program in place.

The ADA requirements were reviewed and acknowledged as part of the City of Estacada TSP development.

Inventory Existing Transportation System

- *Street system (number of lanes, lane widths, traffic volumes, level of service, traffic signal location and jurisdiction, pavement conditions, structure locations and conditions, functional classification and jurisdiction, truck routes, number and location of accesses, safety, substandard geometry).*
- *Bicycle ways (type, location, width, condition, ownership/jurisdiction).*
- *Pedestrian ways (location, width, condition, ownership/jurisdiction).*
- *Public Transportation Services (transit ridership, volumes, route, frequency, stops, fleet, intercity bus, passenger rail, special transit services).*

An inventory of the existing street network, traffic volumes, traffic control devices, accident history, and levels of service is provided in Section 2: Existing Conditions.

As noted in Section 2: Existing Conditions, there is one existing bicycle path within the City of Estacada.

As noted in Section 2: Existing Conditions, there are several existing pedestrian ways within the City of Estacada.

A summary of the existing public transportation services is presented in Section 2: Existing Conditions.

- Intermodal and private connections. A summary of the existing intermodal and private carrier transportation services is presented in Section 2: Existing Conditions.
- Air transportation. A summary of existing air transportation facilities is provided in Section 2: Existing Conditions.
- Freight rail transportation. As noted in Section 2: Existing Conditions, there are no freight rail transportation services within the City of Estacada.
- Water transportation. A summary of water transportation services is provided in Section 2: Existing Conditions.
- Pipeline transportation. A summary of pipeline transportation services is provided in Section 2: Existing Conditions.
- *Environmental constraints.* There are no known environmental constraints within the City of Estacada.
- Existing population and employment. As outlined Section 1: Introduction, the 1997 City of Estacada population is approximately 2,160 persons in the city. This information and employment data cited in Section 3: Future Conditions Analysis, is included in Future Conditions as the basis for the forecasts that were performed for this TSP.

Determine Transportation Needs

- Forecast population and employment Population and employment forecasts were prepared for the year 2019 that reflect regional growth prospects and City of Estacada's economic role. This information is summarized in Section 3: Future Conditions.
- Determination of transportation capacity needs (cumulative analysis, *transportation gravity model*). Travel demand forecasts were undertaken as part of this project. The methodology for travel forecasting and assumptions used in the transportation model are contained in Section 3: Future Conditions, which presents an analysis of future transportation conditions and identifies capacity needs.
- Other roadway needs (safety, bridges, reconstruction, operation/maintenance). Non-capacity related transportation needs are identified and recommended for implementation in Section 5: Transportation System Plan.
- Freight transportation needs. Freight transportation needs are adequately met via motor carrier freight services.
- Public transportation needs (special transportation needs, general public transit needs). Public transportation needs and recommended improvements are discussed in Section 5: Transportation System Plan
- Bikeway needs. Future bicycle and pedestrian improvements are to be made in conjunction with roadway improvements to provide cyclists and pedestrians with full
- Pedestrian needs.

accessibility to City of Estacada's street system. Plans for these facilities are shown in Section 5: Transportation System Plan.

Develop and Evaluate Alternatives

- Update community goals and objectives.
- Establish evaluation criteria.
- Develop and evaluate alternatives (no-build system, all build alternatives, transportation system management, transit alternative/feasibility, improvements/additions to roadway system, land use alternatives, combination alternatives).
- Select recommended alternative.

Goals were established as part of the TSP development (see Section 1: Introduction).

Evaluation criteria was established from the study goals and objectives and used to develop the Preferred Alternative presented in Section 5: Transportation System Plan.

Section 4: Alternatives Analysis includes a summary of the land use and transportation alternatives considered and analyzed the TSP. Land uses, roadway alternatives, transportation system management options, bike and pedestrian options were analyzed.

A recommended alternative for roadways, bikeways, and pedestrian facilities is contained in Section 5: Transportation System Plan.

Produce a Transportation System Plan

- Transportation goals, objectives and policies.
- Streets plan element (functional street classification and design standards, proposed facility improvements, access management plan, truck plan, safety improvements).
- Public transportation element (transit route service, transit facilities, special transit services, intercity bus and passenger rail).
- Bikeway system element.
- Pedestrian system element.
- Airport element (land use compatibility, future improvements, accessibility/connections/conflicts with other modes).
- Freight rail element (terminals, safety).
- Water transportation element (terminals).

Specific recommendations regarding transportation goals and policies are outlined in Section 5: Transportation System Plan.

The streets (roadway) plan element is outlined in Section 5: Transportation System Plan.

The public transportation element is outlined in Section 5: Transportation System Plan.

The bikeway plan is outlined in Section 5: Transportation System Plan, and shown in Figure 27.

The pedestrian plan is outlined in Section 5: Transportation System Plan, and shown in Figure 27.

The airport element is outlined in Section 5: Transportation System Plan.

There is no rail service available or anticipated to serve the City of Estacada.

The water transportation element is outlined in Section 5: Transportation System Plan

Produce a Transportation System Plan (Continued)

- *Transportation System Management element (TSM).* TSM element not applicable per OAR 660-12-020(2)(f) and (g).
- *Transportation Demand Management element (TDM).* TDM element not applicable per OAR 660-12-020(2)(f) and (g).

Implementation of a Transportation System Plan

Plan Review and Coordination

- Consistent with ODOT and other applicable plans. See Section 5: Transportation System Plan

Adoption

- Is it adopted? *To follow.*

Implementation

- Ordinances (facilities, services and improvements; land use or subdivision regulations). Included in Section 7: Policies and Land Use Ordinance Modifications.
- Transportation financing/capital improvements program. The transportation finance plan is summarized in Section 6: Transportation Funding Plan.

Section 9

References

References

- ¹ Transportation Planning Rule, State of Oregon, Department of Land Conservation and Development, OAR-660-12- 005(2, 14, and 15).
- ² City of Estacada Parks, Open Spaces, & Recreation Master Plan, City of Estacada, 1996.
- ³ Oregon Bicycle and Pedestrian Program, Second Edition, Oregon Department of Transportation, June 1995.
- ⁴ Tri-Met Service Schedule, Tri-Met, Portland, Oregon, September 1998.
- ⁵ Clackamas County Pavement Conditions Categories, Clackamas County, Oregon, 1999.
- ⁶ Estacada, Oregon Community Assessment, E.D. Hovee & Company, Rural Development Initiatives, Inc., November 1994.
- ⁷ Transportation System Planning Guidelines, Transportation Development Branch, Oregon Department of Transportation, August 1995.
- ⁸ ITE Trip Generation Manual, 6th Edition, Institute of Transportation Engineers, Washington, D.C., 1998.
- ⁹ Highway Capacity Manual, 2nd Edition, Transportation Research Board, 1994.
- ¹⁰ Oregon Highway Plan, Oregon Department of Transportation, 1991.
- ¹¹ Manual of Uniform Traffic Control Devices, 1988 Edition, National Committee on Uniform Traffic Control Devices, Washington, D.C., 1988
- ¹² Kuntsler, James H., The Geography of Nowhere, Touchstone Book, New York, 1993.
- ¹³ Americans with Disabilities Act, Uniform Building Code.
- ¹⁴ Clackamas County Bicycle Plan, Clackamas County, Oregon, 1996.
- ¹⁵ Transit Choices for Livability, Tri-Met, 1998
- ¹⁶ Oregon Department of Transportation. *State Transportation Fiscal and Statistical Data for 1997*. September 1998.
- ¹⁷ Oregon Department of Transportation. *Financial Services Website*, <http://www.odot.state.or.us/fspublic>. May 1999.

Appendix A

Plan/Policy Review

Plan/Policy Review

OREGON TRANSPORTATION PLAN

The 1991 Oregon Transportation Plan (OTP) defines Goals, Policies, and Actions for the State over the next 40 years. It provides direction for the coordination of all travel modes and the relationship of transportation to land use, economic development, the environment, and energy use. The OTP further identifies a coordinated multimodal transportation system and a network of facilities and services for air, rail, highway, public transit, pipelines, marine transportation, bikeways, and other modes of transportation.

INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT (ISTEA)

The Intermodal Surface Transportation Efficiency Act (ISTEA) became law in 1991, authorizing federal highway and mass transit programs through September 30, 1997. Congress reauthorized legislation in 1998, under the title TEA 21. ISTEA/TEA 21 introduced a new and dramatically different focus on the objectives and role of our national surface transportation system: to enhance personal and commercial mobility and improve transportation safety. ISTEA/TEA 21 promulgated a federal surface transportation policy based on system outputs and performance, on bottom-line measures of the benefits justifying this significant federal investment.

The major programs funded under ISTEA/TEA 21 include:

- National Highway System
- Surface Transportation Program
- Bridge Program
- Safety

There are a number of other programs funded by ISTEA/TEA 21 including ITS (Intelligent Transportation Systems) and mass transit, but most of them will not apply to the Estacada area. Significantly, ISTEA/TEA 21 places restrictions on funding that would benefit single occupant vehicles. This has an impact on the future alternatives for Estacada's transportation system.

The findings, conclusions, and recommendations made in these plans have been respected and adhered to wherever possible and will continue to shape the formulation of the Estacada Transportation System Plan. Throughout this plan, numerous references will be made to the recommendations made in these various plans.

CLACKAMAS COUNTY TRANSPORTATION SYSTEM PLAN

The TSP for rural Clackamas County is currently under development. As such, no findings are available at the this time.

ESTACADA COMPREHENSIVE PLAN

The Estacada Comprehensive Plan outlines the following transportation objectives:

1. Provide good local access and circulation.
2. Move traffic quickly and safely.
3. Ensure pedestrian safety.
4. Encourage carpooling and bus ridership.

5. Discourage through-traffic from using residential streets.

The Comprehensive Plan classified streets into four categories: Arterial/Collector, Arterial Highway Local, Arterial Local, and Collector. The designations of each roadway facility within the UGB is shown in Figure 4. These designations are unconventional according to current transportation planning practices. For this reason, the designation of each roadway within the UGB was revised as part of the development of the TSP and a new classification system is proposed.

MASTER STREET PLAN

In 1974, CH2M Hill performed a detailed topographic survey of all of the roadways within the City, which is summarized in the Master Street Plan. The Plan provides information that can be used for future street and storm drainage projects, but does not identify future roadway connections.

NEIGHBORHOOD TRAFFIC MANAGEMENT

In September 1996, Lancaster Engineering performed a study of existing traffic volumes and speeds on Wade, Zobrist, and Shafford. According to the study, many of the residents perceived that through-traffic uses these streets to bypass congestion and delays on Broadway and Main. According to the report, the average daily traffic volume on each street is less than 500 vehicles per day, which is well within the acceptable limits for a local street. The study reported that the 85th percentile speed was 30 miles per hour on Wade Street, 32-33 mph on Shafford Street, and 24 mph on Zobrist Street. With the exception of Zobrist Street, the 85th percentile speeds are higher than the 25-mile per hour statutory speed zone. The study investigates several potential traffic calming solutions that could reduce speeds on Wade and Shafford and recommends the installation of speed humps on both streets. To date, speed humps have not been installed on any streets within the City.

ESTACADA SUBDIVISION ORDINANCE

In residential, industrial, and open space/public facility areas, the City of Estacada requires that a five-foot sidewalk be constructed adjacent to the street gutter. The area between the back of walk and the property line is reserved for utilities and public use. In commercial zones, up to ten-foot sidewalks are required adjacent to the curb.

NW ESTACADA INDUSTRIAL AREA TRAFFIC IMPACT STUDY (KITTELSON & ASSOCIATES, INC., 1998)

A transportation impact study was conducted in 1998 to assess the impacts associated with full buildout of the 59-acre Northwest Estacada Industrial Area. The 59-acre industrial area was recently rezoned from Exclusive Farm Use (EFU) to Light Industrial and is located to the northwest of the River Mill Road/Highway 224 intersection in Estacada, Oregon. The owner of an approximately 23.5-acre parcel in the northeast part of the industrial area is proposing to develop the Estacada Industrial Campus. The Industrial Campus is proposed to access Highway 224 via NW Park Avenue, which will be located 1,500 feet north of the River Mill Road intersection. As part of the development of the Industrial Campus, a local street system will be constructed that includes future connections to a conceptual roadway circulation system on the remaining 35.5-acre parcels in the industrial area. The conceptual circulation plan for the site identifies future connections to River Mill Road and Farmstead Road. The key findings of the study include:

- Access to Highway 224 should be provided to the site via the River Mill Road and the proposed NW Park Avenue intersections, as proposed in the current circulation plan. The proposed NW

Park Avenue meets the access spacing and traffic signal spacing requirements for a Category ~~X~~ highway, according to the Oregon Highway Plan.

- A local circulation system should be developed on the 59-acre site to provide for internal connectivity and emergency vehicle access to and within the site.
- A traffic signal will be warranted at the Highway 224/NW Park Avenue intersection when the industrial area builds out. In addition, a northbound left-turn lane and southbound right-turn lane should be constructed at this intersection to minimize conflicts between through and turning vehicles on Highway 224. Advance signing and/or flashing beacons should be installed on the highway to warn drivers of the traffic signal.
- As the industrial area builds out, the City of Estacada and ODOT should monitor traffic operations at the River Mill Road/Highway 224 to determine when a traffic signal will be warranted at this intersection.

ESTACADA RESIDENTIAL SUBDIVISION TRAFFIC IMPACT ANALYSIS (KITTELSON & ASSOCIATES, INC., 1998)

Kittelson & Associates, Inc. prepared a traffic impact study for buildout of a 450-unit single family subdivision located east of Cemetery Road and north of Coupland Road in Estacada. The primary findings of the study include:

All intersections currently operate at acceptable levels of service.

- The proposed site is estimated to generate 4,310 daily trips, of which 455 will occur during the weekday p.m. peak hour.
- The project is to be developed in phases scheduled to be completed in five and ten years, respectively, in which the 180 units associated with Phase I will generate an estimated 180 p.m. peak trips, and the 270 units in Phase II will generate 275 trips.
- With the addition of site-generated traffic from both phases of the development, all study intersections are forecast to operate acceptably in both year 2003 and 2008.
- The roadways that are used for access have adequate capacity to accommodate the increased traffic demand generated by the proposed development without mitigations.
- Sight distance measurements at the critical intersections analyzed indicates that sight distance standards are met, based on the prevailing speeds on the roadways. Moreover, Cemetery Road has no obstructions at or near the proposed driveway locations that would limit sight distance.
- The gravel roadway that currently extends northward from Coupland Road to Phase I of the proposed development should remain clear of obstructions to serve as an emergency access. A breakaway type gate may be considered to limit misuse of this auxiliary roadway during non-emergency times.
- Concurrent with development of Phase II of the proposed development, an additional access to Cemetery Road should be constructed. This access should intersect Cemetery Road at a point where a minimum of 350 feet sight distance is available.
- There is sufficient capacity on the system to accommodate a maximum of 680 single-family residential units on the subject property, without triggering the need for additional transportation improvements.

Appendix B

Level of Service Methodology

Level of Service Methodology

LEVEL OF SERVICE CONCEPT

Level of service (LOS) is a concept developed to quantify the degree of comfort (including such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles) afforded to drivers as they travel through an intersection or roadway segment. Six grades are used to denote the various LOS from A to F.¹

SIGNALIZED INTERSECTIONS

The six LOS grades are described qualitatively for signalized intersections in Table B1. Additionally, Table B2 identifies the relationship between level of service and average stopped delay per vehicle. Using this definition, LOS D is generally considered to represent the minimum acceptable design standard.

Table B1
Level of Service Definitions (Signalized Intersections)

Level of Service	Average Delay per Vehicle
A	Very low average stopped delay, less than five seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	Average stop delay is in the range of 5.1 to 15.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for a LOS A, causing higher levels of average delay.
C	Average stop delay is in the range of 15.1 to 25.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
D	Average stopped delays are in the range of 25.1 to 40.0 seconds per vehicle. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle length, or high volume/capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	Average stop delay is in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high volume/capacity ratios. Individual cycle failures are frequent occurrences.
F	Average stop delay is in excess of 60 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation. It may also occur at high volume/capacity ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay values.

¹ Most of the material in this appendix is adapted from the Transportation Research Board, *Highway Capacity Manual*, Special Report 209 (1994).

Table B2
Level of Service Criteria for Signalized Intersections

Level of Service	Stopped Delay per Vehicle (Seconds)
A	≤ 5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	> 60

UNSIGNALIZED INTERSECTIONS

Unsignalized intersections include two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections. The *1994 Highway Capacity Manual* provides new models for estimating total vehicle delay at both TWSC and AWSC intersections. Unlike signalized intersections, where LOS is based on stopped delay, unsignalized intersections base LOS on total vehicle delay. A qualitative description of the various service levels associated with an unsignalized intersection is presented in Table B3. A quantitative definition of LOS for unsignalized intersections is presented in Table B4. Using this definition, LOS E is generally considered to represent the minimum acceptable design standard.

Table B3
Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Delay per Vehicle to Minor Street
A	<ul style="list-style-type: none"> Nearly all drivers find freedom of operation. Very seldom is there more than one vehicle in queue.
B	<ul style="list-style-type: none"> Some drivers begin to consider the delay an inconvenience. Occasionally there is more than one vehicle in queue.
C	<ul style="list-style-type: none"> Many times there is more than one vehicle in queue. Most drivers feel restricted, but not objectionably so.
D	<ul style="list-style-type: none"> Often there is more than one vehicle in queue. Drivers feel quite restricted.
E	<ul style="list-style-type: none"> Represents a condition in which the demand is near or equal to the probable maximum number of vehicles that can be accommodated by the movement. There is almost always more than one vehicle in queue. Drivers find the delays approaching intolerable levels.
F	<ul style="list-style-type: none"> Forced flow. Represents an intersection failure condition that is caused by geometric and/or operational constraints external to the intersection.

Table B4
Level of Service Criteria for Unsignalized Intersections

Level of Service	Average Total Delay per Vehicle (Seconds)
A	< 5.0
B	5.1 to 10.0
C	10.1 to 20.0
D	20.1 to 30.0
E	30.1 to 45.0
F	> 45.0

It should be noted that the LOS criteria for unsignalized intersections are somewhat different than the criteria used for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, there are a number of driver behavior considerations that combine to make delays at signalized intersections less onerous than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, while drivers on the minor street approaches to TWSC intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized intersections than signalized intersections. For these reasons, it is considered that the total delay threshold for any given LOS is less for an unsignalized intersection than for a signalized intersection. **While overall intersection LOS is calculated for AWSC intersections, LOS is only calculated for the minor approaches and the major street left turn movements at TWSC intersections.** No delay is assumed to the major street through movements. For TWSC intersections, the overall intersection LOS is defined by the movement having the worst LOS (typically a minor street left turn).

Appendix C

Potential Funding Sources

Table C-1
Estacada Transportation System Plan
Summary of Road-Related Transportation Funding Programs: Federal Sources

Program Name	Description
Community Development block Grants (CDBG)	Community Development Block Grants (CDBG) are administered by the Department of Housing and Urban Development (HUD) and potentially be used for transportation improvements in eligible areas.

Table C-1 (Continued)
Estacada Transportation System Plan
Summary of Road-Related Transportation Funding Programs: State Level

Program Name	Description
OR Transportation Infrastructure Bank	As a pilot program for the USDOT, the Oregon Transportation Commission has made \$10 million available from projects that will not be contracted in FY 1996. The OTIB will make loans for transportation projects and will offer a variety of credit enhancements. Initial loans must be for improvements on federal aid highways, repayments go into an account that will be made available for any mode. Ability to repay will be a key factor in all loans.
Traffic Control Projects	<p>The State maintains a policy of sharing installation, maintenance, and operational costs for traffic signals and luminaire units at intersections between State highway and city streets (or county roads). Intersections involving a State highway and a city street (or county road) which are included on the state-wide priority list are eligible to participate in the cost sharing policy.</p> <p>ODOT establishes a statewide priority list for traffic signal installations on the State Highway System. The priority system is based on warrants outlined in the Manual for Uniform Traffic Control Devices. Local agencies are responsible for coordinating the statewide signal priority list with local road requirements.</p>

Table C-1 (Continued)
Estacada Transportation System Plan
Summary of Road-Related Transportation Funding Programs: State Level

Program Name	Description
State Highway Fund	<p>The State Highway Fund composed of gas taxes, vehicle registration fees, and weight-mile taxes assessed on freight carrier. In 1994, the state gas tax was \$0.24 per gallon. Vehicle registration fees were \$15 annually. Revenues are divided as follows: 15.57 percent to cities, 24.38 percent to counties, and 60.05 percent to ODOT. The city share of the State Highway Fund is allocated based on population.</p> <p>ORS 366.514 requires at least one percent of the State Highway Fund received by ODOT, counties and cities be expended for the development of footpaths and bikeways. ODOT administers the bicycle funds, handles bikeway planning, design, engineering and construction, and provides technical assistance and advice to local governments concerning bikeways.</p>
Special Public Works Fund (SPWF)	<p>The State of Oregon allocates a portion of revenues from the state lottery for economic development. The Oregon Economic Development Department provides grants and loans through the SPWF program to construct, improve and repair infrastructure to support local economic development and create new jobs. The SPWF provides a maximum grant of \$500,000 for projects that will help create a minimum of 50 jobs.</p>
Transportation Access Charges	<p>The most familiar form of a transportation access charge is a bridge or highway toll. Transportation access charges are most appropriate for high-speed, limited access corridors; service in high-demand corridors; and bypass facilities to avoid congested areas.</p> <p>Congestion pricing, where drivers are charged electronically for the trips they make based on location and time of day, is the most efficient policy for dealing with urban congestion. It not only generates revenue for maintenance and improvements, but also decreases congestion and the need for capital improvements by increasing the cost of trips during peak periods.</p> <p>The Oregon Revised Statutes allow ODOT to construct toll bridges to connect state highways and improve safety and capacity. The Statues also allow private development of toll bridges. Recent actions by the Oregon legislature provide authority for developing toll roads. State authority for congestion pricing does not exist; new legislation would be required.</p>
Immediate Opportunity Fund (IOF)	<p>Financed at a level of \$5 million per year to a maximum of \$40 million through FY96. The fund is to support specific economic developments in Oregon through the construction and improvement of roads and is restricted for use in situations that require a quick response and commitment of funds. It is anticipated that the maximum amount available for a single project is \$500,000 or 10 percent of the annual program level. This fund may be used only when other sources of financial support are unavailable or insufficient and are not a replacement or substitute for other funding sources.</p>
OR Transportation Infrastructure Bank	<p>As a pilot program for the USDOT, the Oregon Transportation Commission has made \$10 million available from projects that will not be contracted in FY 1996. The OTIB will make loans for transportation projects and will offer a variety of credit enhancements. Initial loans must be for improvements on federal aid highways, repayments go into an account that will be made available for any mode. Ability to repay will be a key factor in all loans.</p>
Traffic Control Projects	<p>The State maintains a policy of sharing installation, maintenance, and operational costs for traffic signals and luminaire units at intersections between State highway and city streets (or county roads). Intersections involving a State highway and a city street (or county road) which are included on the state-wide priority list are eligible to participate in the cost sharing policy.</p> <p>ODOT establishes a statewide priority list for traffic signal installations on the State Highway System. The priority system is based on warrants outlined in the Manual for Uniform Traffic Control Devices. Local agencies are responsible for coordinating the statewide signal priority list with local road requirements.</p>

Table C-1 (Continued)
Estacada Transportation System Plan
Summary of Road-Related Transportation Funding Programs: Local Sources

Program Name	Description
Special Assessments/Local Improvements Districts	<p>Special assessments are charges levied on property owners for neighborhood public facilities and services, with each property assessed a portion of total project cost. They are commonly used for such public works projects as street paving, drainage, parking facilities and sewer lines. The justification for such levies is that many of these public works activities provide services to or directly enhance the value of nearby land, thereby providing direct and/or financial benefit to its owners.</p> <p>Local Improvement Districts (LIDs) are legal entities established by the City to levy special assessments designed to fund improvements that have local benefits. Through a local improvement district (LID), streets or other transportation improvements are constructed and a fee is assessed to adjacent property owners.</p>
Systems Development Charges (Impact Fees)	<p>Systems Development Charges (SDCs) are fees paid by land developers intended to reflect the increased capital costs incurred by a municipality or utility as a result of a development. Development charges are calculated to include the costs of impacts on adjacent areas or services, such as increased school enrollment, parks and recreation use, or traffic congestion.</p> <p>Numerous Oregon cities and counties presently use SDCs to fund transportation capacity improvements. SDCs are authorized and limited by ORS 223.297 - 223.314.</p>
Local Gas Tax	<p>A local gas tax is assessed at the pump and added to existing state and federal taxes. Tillamook, The Dalles and Woodburn are Oregon cities that have a local gas tax. Multnomah and Washington Counties also have gas taxes.</p>
Local Parking Fees	<p>Parking fees are a common means of generating revenue for public parking maintenance and development. Most cities have some public parking and many charge nominal fees for use of public parking. Cities also generate revenues from parking citations. These fees are generally used for parking-related maintenance and improvements.</p>

Table C-1 (Continued)
Estacada Transportation System Plan
Summary of Road-Related Transportation Funding Programs: Local Sources

Program Name	Description
Street Utility Fee	Most city residents pay water and sewer utility fees. Street user fees apply the same concept to city streets. A fee would be assessed to all businesses and households in the city for use of streets based on the amount of use typically generated by a particular use. For example, a single-family residence might, on average, generate 10 vehicle trips per day compared to 130 trips per 1,000 square feet of floor area for retail uses. Therefore, the retail use would be assessed a higher fee based on higher use. Street services fees differ from water and sewer fees because usage cannot be easily monitored. Street user fees are typically used to pay for maintenance more than for capital projects.
Vehicle Registration Fees	Counties can implement a local vehicle registration fee. The fee would operate similar to the state vehicle registration fee. A portion of the County fee would be allocated to the City.
Property Taxes	Local property taxes could be used to fund transportation, although this is limited by Ballot Measure 5 and 47.
Revenue Bonds	Revenue Bonds are bonds whose debt service is financed by user charges, such as service charges, tolls, admissions fees, and rents. If revenues from user charges are not sufficient to meet the debt service payments, the issuer generally is not legally obligated to levy taxes to avoid default, unless they are also based by the full faith and credit of the insuring governmental unit. In that case, they are called indirect general obligation bonds. Revenue bonds could be secured by a local gas tax, street utility fee, or other transportation-related stable revenue stream.

Table C-2
Currently Used Revenue Sources For Cities (millions of 1995 dollars)

Facility	Revenue Source	Importance (not 100%)	3-Year Trend	Dedication	Rate
Streets/Bridges / Sidewalks/ Bike Lanes	Oregon Highway Trust Fund	51% of total road or \$89.	Growing about 1.75% per year.	Constitutionally limited to funding activities that benefit autos & trucks.	24¢/gal. for gas; \$30/biennium registration fee.
	General Fund Transfers	9% or \$15.	Varies but assume growth @ 3%/yr. But not used by all cities.	May be used for any purpose.	Varies widely
	Special Property Tax Levies	5% or \$7.	Increasing, only used by about 18 cities.	May be used for purpose described in election.	Varies widely.
	Improvement District Assessments	7% or \$12.5.	Varies but increases when local development increases.	May be used for construction of adjacent streets-sidewalks.	Varies with construction cost & local ordinances.
	Systems Development Charges/Traffic Impact Fees	4% or \$7.	Varies but increases when local development increases, only used by about 2 dozen cities.	May be used for construction of new streets.	Varies with construction cost & local ordinances. Rates generally higher in Portland Metro area
	Utility Franchise Fees	3% or \$4.	Grows roughly w/population and inflation.	Is a general revenue used by some cities for streets.	Statutory limit of 5% of utility gross receipts.
	Interest Earnings	4% or \$6.	Varies w/current interest rates.	Have same Constitutional limits as Highway Fund.	Used as general street revenue.
	Local Gas Tax	0.44% or \$0.7	Unchanged	Have same Constitutional limits as Highway Fund.	Used by Tillamook, The Dalles, and Woodburn.
	Private Contributions	3% or \$4.3	Varies widely	Usually contributions are related to specific development street impacts.	Negotiated individually.

Table C-2: (Continued)
Currently Used Revenue Sources For Cities (millions of 1995 dollars)

Facility	Revenue Source	Importance (not 100%)	3-Year Trend	Dedication	Rate
	Misc. - permit fees, finds, fines, parking, Motel Tax, other	8% or \$14.5.	Gradual growth.	General revenues used for streets.	Varies widely by City.
	Federal - FHWA+HUD	3% or \$5.6.	Relatively stable	Used mainly for new construction w/some rehab.	Based on federal allocation to Oregon.
	Misc. State Revenues - mainly Lottery funds.	2% or \$3.	Varies, no trend.	Used mainly for economic development capital improvements.	Specific grants to individual cities each year.
Off-street Bike Paths	Misc. general funds & ISTEA	??	Varies from year to year.	ISTEA & General Funds used for construction, General Funds used for maintenance & repair.	Varies from year to year.

**Table C-3
Estacada Transportation System Plan
Currently Used Revenue Sources in Oregon**

Transit Service Type/Function	Funding Source	Status
Urban Public Transportation (Portland & Eugene) (operating & capital)	<ol style="list-style-type: none"> 1. Local Payroll Tax - operating 2. Federal grants - capital 3. Federal grants - operating 4. Fares & advertising 	<ol style="list-style-type: none"> 1. Major Source - \$100 million/yr. Growing - Sensitive to Economic Conditions 2. Major source - \$10 million/yr - Stable 3. Minor source - \$5 million/yr - Declining 4. Minor source - Growing w/ridership
Urban Public Transportation (Salem, Corvallis, Medford, K-Falls)	<ol style="list-style-type: none"> 1. Property tax (typically a taxbase or stand-alone levy w/in \$10 cap for local gov't services) 2. Federal grants - capital 3. Federal grant - operating 4. Fares & advertising 	<ol style="list-style-type: none"> 1. Major Source - Growing Slowly 2. Major Source - \$2 million/yr. - Stable 3. Major Source - \$2 million/yr. - Declining 4. Minor Source - Growing w/ridership
Small City & Rural (Astoria, Union County, etc.) (operating & capital)	<ol style="list-style-type: none"> 1. Federal grants - capital & operating 2. Local Property Tax (typically w/in city or county operating levy) 3. Fares, donations & advertising 	<ol style="list-style-type: none"> 1. Major Source - Declining 2. Major Source - Stable 3. Minor Source - Stable
Mobility for Seniors & People with Disabilities - (operating & capital)	<ol style="list-style-type: none"> 1. Special Transportation Fund (2¢ state cigarette tax) - operating & capital 2. Social Service Agency grants / contracts - operating 3. Local Property Tax (typically w/in city or county operating levy) 4. Federal grants - capital & operating 5. Fares, donations advertising 	<ol style="list-style-type: none"> 1. Major Source - \$5 million/yr. - Declining 2. Major Source - Declining 3. Minor Source - Stable 4. Major Source - Declining 5. Minor - Stable
Intercity Bus (operating & capital)	<ol style="list-style-type: none"> 1. Major Interstate Routes: Fares 2. Branch & feeder routes: Private capital, Fares 	<ol style="list-style-type: none"> 1. Sole Source - Declining 2. Private