DRAFT

Transportation System Plan

For the

City of Toledo

Presented to

City of Toledo, Oregon

Prepared by

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June 1995

Introduction

The City of Toledo, in conjunction with Lincoln County and the Oregon Department of Transportation (ODOT) initiated a study of the area transportation system in November 1994. This study was conducted in compliance with State legislation requiring local jurisdictions to produce a Transportation System Plan (TSP) as part of their overall Comprehensive Plan. Accordingly, this document provides the City of Toledo with those necessary recommendations for incorporation into its Comprehensive Plan.

Oregon Revised Statute 197.712 and the Land Conservation and Development Commission administrative rule known as the Transportation Planning Rule (TPR), requires all public jurisdictions to develop the following:

- A road plan for a network of arterial and collector streets.
- A public transportation plan.
- A bicycle and pedestrian plan.
- An air, rail, water and pipeline plan.
- A transportation finance plan.
- Policies and ordinances for implementing the transportation system plan.

In addition, the state rule requires local jurisdictions to adopt land use and subdivision ordinance amendments to protect transportation facilities, and to provide bicycle facilities between residential, commercial, and employment/institutional areas. The new state rule also requires that local communities coordinate their plans with county and state transportation plans.

PUBLIC INVOLVEMENT AND STUDY GOALS

In order to assist the city, county and state jurisdictions in meeting the requirements of the TPR, the partnering jurisdictions initiated this study in November 1994. A Project Management Team (PMT) was formed to guide the study process. The PMT was comprised of both technical and community representatives from various agencies, associations and businesses. This committee identified community issues, established project goals and objectives, evaluated transportation alternatives and, finally, developed the recommended elements of the TSP. The committee established a series of transportation system goals to provide direction and evaluation criteria to the study process. The goals developed by this committee include:

Transportation Circulation/Safety/Mobility

- Maintain vehicle capacity and increase safety on Business 20 within the City.
- Ensure sufficient capacity to accommodate future travel demand (vehicular, bicycle, pedestrian, et cetera) on Toledo arterials and collectors.
- Identify potential improvements to the local circulation system in an effort to encourage visitors to come into Toledo.
- Improve safety at the Highway 20/Business 20 intersections.
- Identify opportunities for an additional connection between Business 20 and Highway 20, roughly midway between the two existing intersections.
- Limit the development of new cul-de-sac streets to situations where continuation of the road at some time in the future is unlikely.

Coordination

- Identify methods to insure future coordination of transportation planning and project development activities with Lincoln County and ODOT.
- Identify the continued role of the public in decision-making on transportation projects.
- Develop a coordinated approach to the operation, development and maintenance of facilities jointly managed by the represented jurisdictions.

Community Goals

- Identify strategies to improve the aesthetic character of Toledo's transportation system and methods of implementation.
- Landscape transportation facilities to complement neighborhood character and amenities.
- Design transportation facilities to preserve and be consistent with the natural and built environment.
- Preserve key view corridors.

Economic Development Goals

- Identify facility management strategies to balance the need to serve statewide traffic on state highways with the need to support local business activities.
- Identify priority transportation projects needed to support the location of new business, expansion of existing businesses, and other community development objectives in Toledo.
- Maintain existing rail service to commercial and industrial sites.
- Ensure an adequate truck route network to reduce commercial/neighborhood conflicts.

Bicycles and Pedestrians

- Improve the bicycle and pedestrian transportation system for both internal circulation and linkages to regional travel.
- Encourage bicycle storage facilities and parking within development projects, in commercial areas and in parks.

Public Transportation

- Work with the Lincoln County Council on Aging to meet the needs of the transportation disadvantaged including improved dial-a-ride service.

Capital Improvements and Financing

- Fund growth-related traffic improvements through development fees or other methods that assign growth-related improvement needs to new development.
- Pursue a range of funding sources including Federal, State and local sources (e.g. loans, matching funds) for transportation improvements.

These goals have guided the City of Toledo in the development of its TSP through a process of identifying the transportation needs within the study area, analyzing and selecting the system improvements necessary to serve those needs, and establishing a set of transportation policies that will allow the system to adapt to future growth demands. Likewise, the partnering jurisdictions will use this process to balance the local needs of citizens with those of the region and state. This pro-active approach by the partnering jurisdictions in the planning process ensured a balanced future transportation system that will meet the needs of all concerned.

Chapter 1
Existing Conditions

Existing Conditions

1.1 OVERVIEW

The development of the Toledo Transportation System Plan began with an assessment of the existing transportation conditions within the study area. The study area, herein defined as the area within Toledo's Urban Growth Boundary, is illustrated in Figure 1. This chapter provides a summary of the existing transportation conditions within the study area boundary. The following items have been considered in providing this summary:

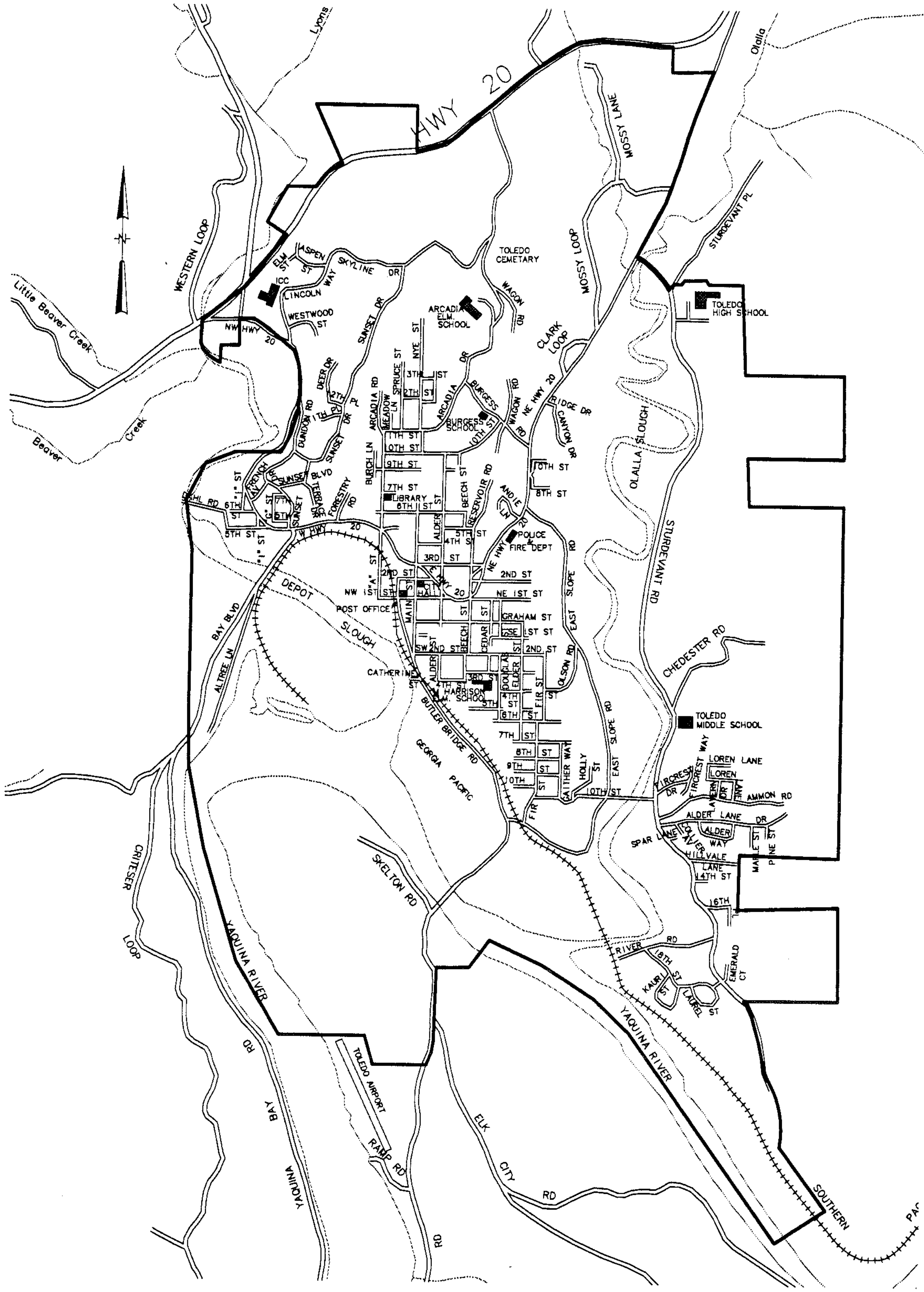
- Existing traffic control measures and physical characteristics and conditions of the transportation system.
- Existing traffic volumes (including auto, truck, pedestrian, and bicycle) at key intersections and along critical links of the transportation system.
- The existing multi-modal system, including public transportation services and ridership.
- Physical characteristics of the existing roads and private driveways accessing major facilities of the overall transportation system.
- The analysis of existing traffic operations (level of service) and safety characteristics of the transportation system.
- Jurisdictional boundaries, agreements, and responsibilities regarding facility control, operation, acquisition, and maintenance.

1.2 EXISTING TRANSPORTATION SYSTEM CHARACTERISTICS

The City of Toledo has historically been an industrial hub for Lincoln County. With the port facilities located 14.5 miles upstream from the Pacific Ocean, land access readily available by U.S. Highway 20, and the Willamette Valley Railroad branch rail line linking the area to the Willamette Valley, the city attracts and meets diversified transportation needs. The following is an inventory of the existing transportation modes and current conditions. This information will be used as the basis for predicting future transportation needs in the study area.

1.2.1 Roadway Classification System

Roadway facilities are the principal component of the existing transportation system, providing the primary means of mobility within the study area. These facilities are under the control of one of three jurisdictions: ODOT, Lincoln County, or the City of Toledo. Coordination of the operation, development, and maintenance of these facilities, among the represented jurisdictions,



CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 1
Study Area

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is a primary objective of this study. The existing roadway classifications are described below and illustrated in Figure 2.

State Facilities

U.S. Highway 20 is the only Principal Arterial (see section 3.2.1) within Toledo's UGB. It provides the primary access between Corvallis and Newport and the only state highway access into Toledo. Business Highway 20 is also a state facility and lies completely within both the Urban Growth Boundary and the City limits. It is the only Minor Arterial within the study area. On-street parking is allowed along Business 20 as it winds through town. The only traffic signal, excluding railroad crossings, in Toledo is located on Business Highway 20 at the intersection with "A" Street. There are also flashing warning yellow lights at the intersections of Business 20/Sturdevant Road and Business 20/Main Street. U.S. Highway 229 is a state facility providing access to Toledo although it lies entirely outside the UGB. According to the City of Toledo Public Facilities Plan, 1989, U.S. Highway 229 is a major collector.

County Facilities

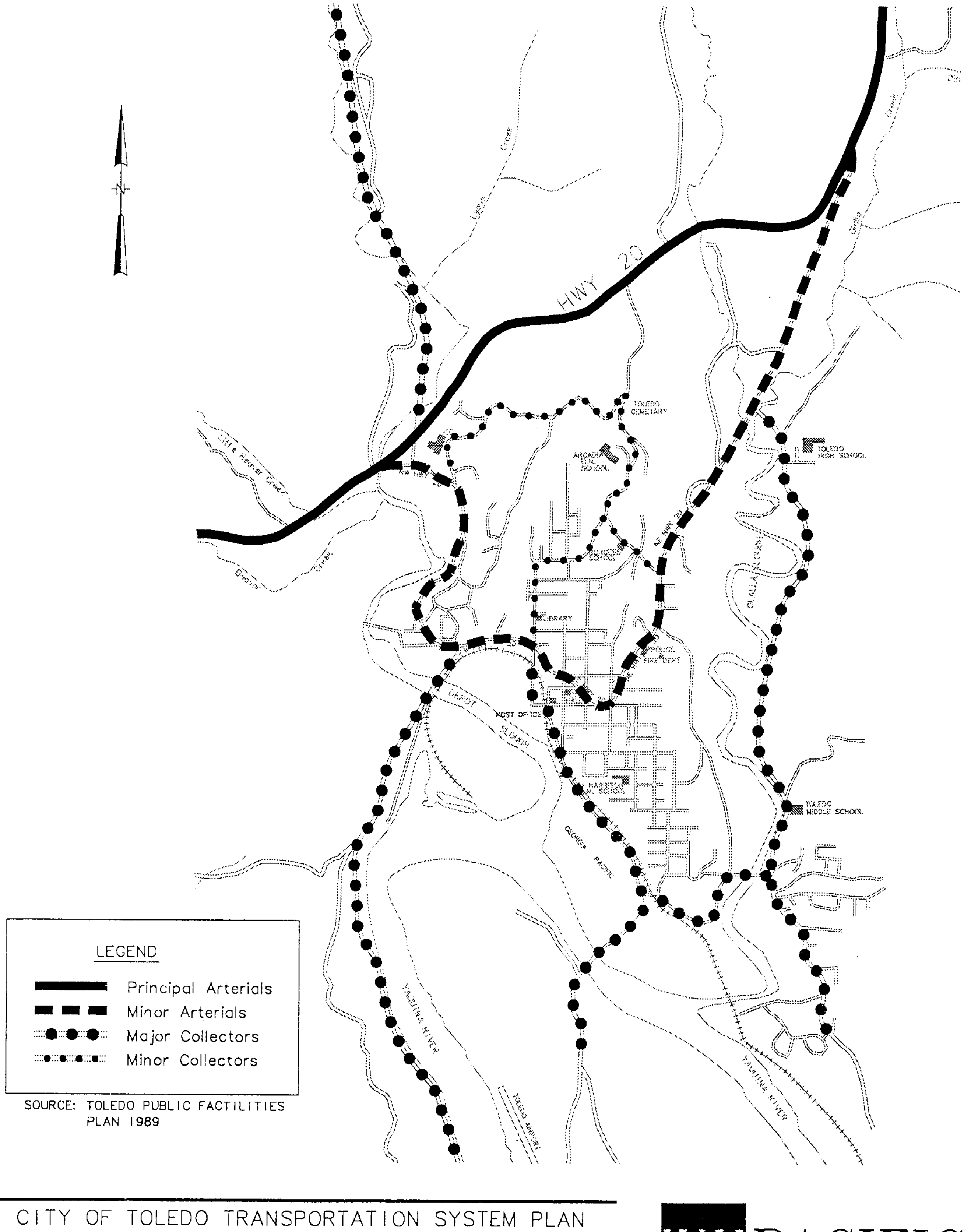
Lincoln County's functional classifications generally parallel those of the state: Principal Highways, Arterials, Collectors, and Local Streets. The County further refines the Collector class to Major and Minor Collector. The county maintains two Major Collectors in the study area: Sturdevant Road and South Bay Road to Newport. Sturdevant Road is one of the principal north/south roadways serving an urbanizing area north and east of the Olalla Slough. The county also maintains the following Minor Collectors: Lincoln Way, Skyline Drive, Cemetary Road and Arcadia Drive from Cemetary Road to U.S. Highway 20.

City Facilities

The City of Toledo classifies its streets as Arterial, Major Collector, Minor Collector, Local (commercial and residential). The city street system is based on a grid network, with Business 20 functioning as the backbone of the transportation system. All streets within the study area excluding those identified as state or county facilities are owned and maintained by the city. The city classifies the following streets as Major Collectors: Butler Bridge Road, East Slope Road from Butler Bridge Road to 10th Street, and 10th Street from East Slope Road to Sturdevant Road. The city classifies the following streets as Minor Collectors: Burgess Road, Arcadia Drive from Skyline Drive to 11th Street, 11th Street from Arcadia Drive to "A" Street, and "A" Street from 11th Street to Business Highway 20. The remainder of the city streets are considered Local Streets.

1.2.2 Existing Volumes and Level of Service

The existing transportation system is dominated by vehicular and truck traffic. Alternative modes such as transit, bicycles, and pedestrians are present but account for a substantially smaller portion



SOURCE: TOLEDO PUBLIC FACTILITIES PLAN 1989

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FIGURE 2
Existing Roadway Classification

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of the trips currently made within the study area. The existing 1994 weekday p.m. peak hour traffic volumes at key intersections and the average weekday daily traffic along critical roadway sections were measured in the study area. These traffic counts were used to conduct an operational analysis of each key intersection and determine existing levels of service. All level of service analyses referred to in this report were conducted in accordance with the methodology and procedures stated in the *1985 Highway Capacity Manual.* A description of the Level of Service (LOS), the criteria for determining LOS, and the methodology for measuring LOS is provided in Appendix A.

Of the nine key intersections identified, seven are located on either Highway 20 or Business Highway 20. This is because the two state facilities serve as the backbone of the transportation system within the study area. The two intersections outside ODOT jurisdiction and control are currently operating at level of service A. Levels of service for each intersection are identified below in Table 1 and illustrated in Figure 3. [Levels of service range from A (best) to F (worst)].

TABLE 1
Existing Levels of Service

Intersection	Level of Service (LOS)
U.S. Highway 20/Western Loop	D
U.S. Highway 20/Business Highway 20 (west)	E
U.S. Highway 20/U.S. Highway 229	C
U.S. Highway 20/Business Highway 20 (east)	B
Business Highway 20/"A" Street	B (1)
Business Highway 20/East Slope Road	A
Business Highway 20/Sturdevant Road	A
Butler Bridge Road/Main Street	A
Sturdevant Road/10th Street	A

(1) Signalized Intersecion.

As shown in the Table 1 above, the U.S. Highway 20/Business Highway 20 intersection at the west entrance to the city is operating at level of service E. All other intersections are operating at levels at or above D. The Oregon Department of Transportation has designated LOS "D" as acceptable and LOS "E" as marginally acceptable for unsignalized intersections. Business Highway 20/"A" Street is operating at level B and is the only signalized interesection. ODOT has designated LOS "E" as the minimum level acceptable for signalized intersections.

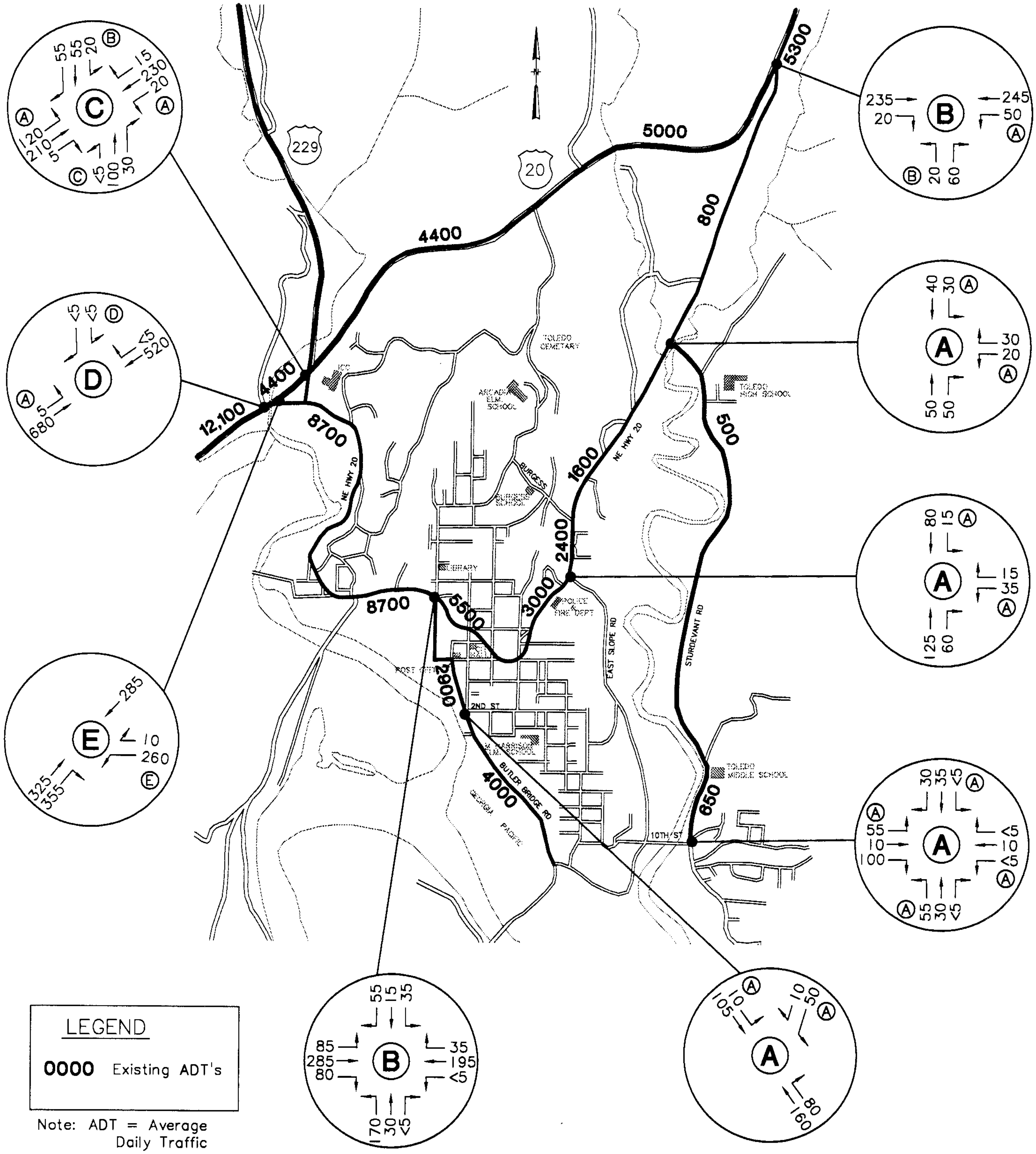

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FIGURE 3
Existing Traffic Volumes and LOS

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1.2.3 Existing Pedestrian Facilities

The existing sidewalk network is illustrated in Figure 4. Most pedestrian facilities are located in the commercial business areas and adjacent to government buildings such as City Hall. The remainder of the pedestrian facilities provide partial access to schools and the Georgia Pacific Industrial Park. Most existing sidewalks are 5 to 6 feet wide. No accidents involving pedestrians were reported during the 45-month period from January 1991 to September 1994.

1.2.4 Existing Bicycle Facilities

The City has a limited network of bicycle paths and does not provide any on-street bike lanes. The prevailing steep terrain and lack of a cohesive system hinders opportunites for commuting and recreational bicycling in Toledo. The City would like to see a bike path established along Sturdevant Road (a County road). Currently, the roadway provides north/south service to the urbanizing areas north and east of the Olalla Slough. A bike path along this road would connect these areas with the Toledo Middle and High Schools.

1.2.5 Traffic Control

The only signalized intersection, excluding railroad crossings, is located at the intersection of "A" Street and Business Highway 20. It is a four-way intersection with left turn pockets on Business Highway 20. The signal is maintained by the Oregon Department of Transportion while the electrical costs are funded by the City. Flashing warning lights are also located at the intersections of Business Highway 20/Sturdevant Road and Business 20/Main Street. These lights are maintained by ODOT.

1.2.6 Public Transit

Lincoln County provides two transit services to the city of Toledo: the East Feeder Line and Dial-a-Ride. The East Feeder Line is an inter-city service while the Dial-a-Ride functions as a local, on-call service coordinated by dispatcher. All service is provided using vans equipped with wheelchair lifts. The wheelchair staging area inside may also be used for bikes. Lincoln County is currently investigating opportunities to add bike racks to the vans. There are no ridership restrictions for either service.

The East Feeder Line, operated by Lincoln County, is a shuttle bus service between Siletz, Toledo and Newport. A 15-passenger van makes four round trips a day with six scheduled stops in Toledo. The service is not a fixed route and therefore makes several non-scheduled stops in Toledo as well. Trips to and from Siletz are $1.00 each way while trips to Newport are $2.00 each way. The service was initiated with three round trips a day in January 1993. Toledo's ridership for 1993 was 2,576 passengers. Toledo's ridership grew to 2,840 passengers in 1994. In response to requests for additional service, Lincoln County added a mid-morning roundtrip shuttle to the service in March 1995. Ridership on the shuttle is not restricted.

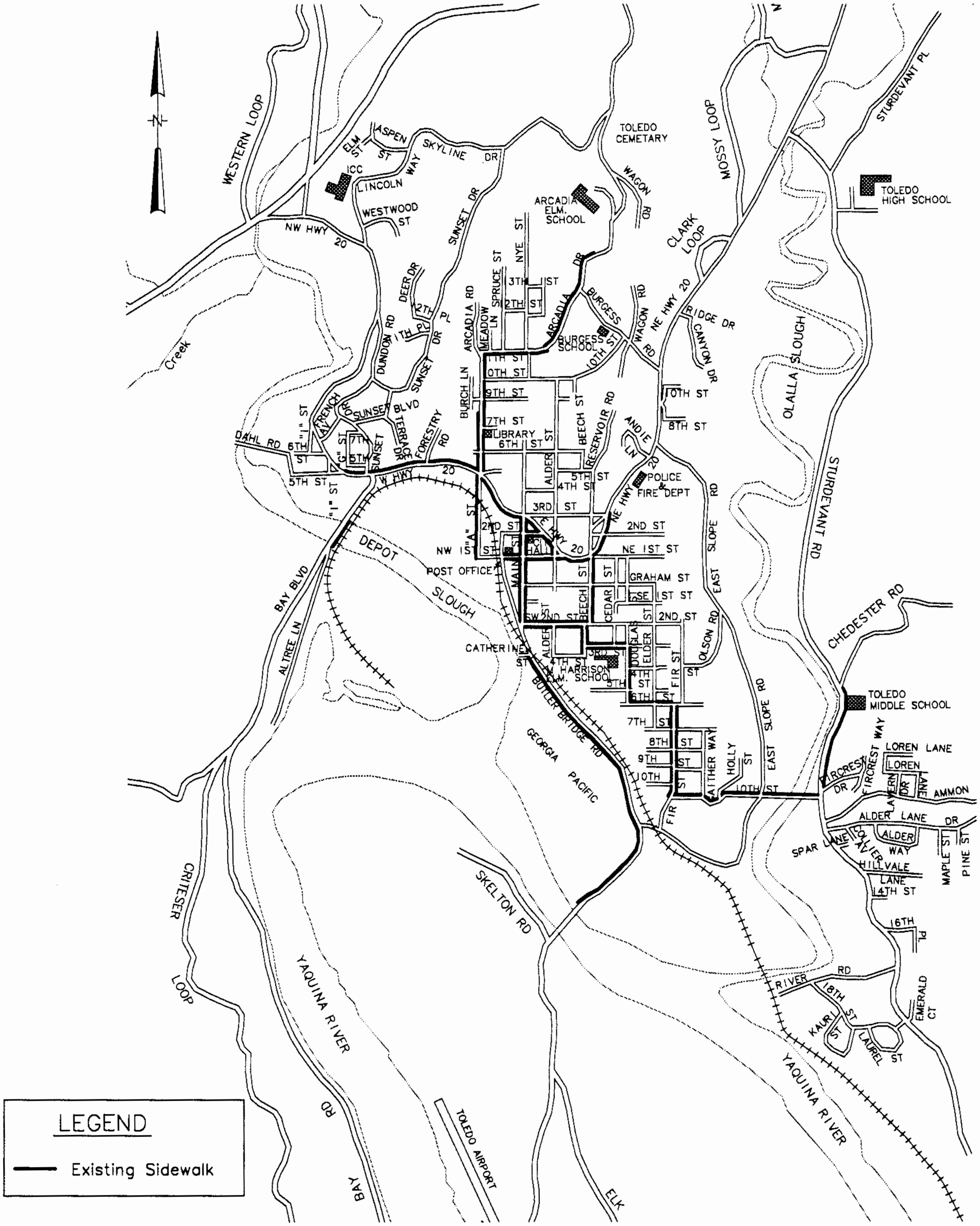

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FIGURE 4
Existing Sidewalk Inventory

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Dial-a-Ride is a demand responsive system operated by Lincoln County with the support of local volunteers. A local dispatcher coordinates rides for a 15-passenger van driven by a volunteer. Passengers pay 50 cents into or out of town per day. In 1994, there were 10,644 trips made on the Dial-a-Ride service in Toledo. This service includes two scheduled shopping trips a week and Meal Site access for seniors. With the exception of the Meal Site service, ridership is not restricted.

Both the East Feeder Line and the Dial-a-Ride services are funded by the Lincoln County General Fund, a Demonstration Grant from the State of Oregon, and matching funds from cigarette tax revenues. The Demonstration Grant will expire December 1996. Continuation of transit service in Toledo is subject to the availability of funds.

1.2.7 Air, Water, and Rail Services

The Port of Toledo is located 14.5 miles upstream of the Pacific Ocean along the Yaquina River. Access to the port is provided by an authorized 10-foot depth federally-maintained navigational channel. U.S. Highway 20 provides access to Corvallis and Newport while the Willamette Valley Railroad branch line provides access to the main line in Albany. The Port operations are divided into five categories: port docks and wharf property, Tokyo Slough property, public boat launch, Elk City dock, and salt marsh property. The port docks and wharf property are the most extensively developed areas with a variety of businesses, public services and permanent moorage spaces. The Tokyo Slough is 9.13 acres of vacant land and has the potential for several development opportunities. The public boat launch and the Elk City dock serve the boating public and may need additional dock at some time in the near future. The Salt Marsh property is 26.42 acres of environmentally sensitive land. Development of this site is unlikely.

The port's economic vitality is based on natural resources, primarily lumber products and marine-oriented services. The Port would like to encourage diversified economic development in Toledo. Based on the inventory of available land, the Port of Toledo is best suited for small to mid-sized industrial businesses. The three major challenges the Port faces in attracting those types of firms are finished building sites, additional land for future development and affordable housing. The Port is working cooperatively with the community to attain steady economic development and a reasonable level of financial self-sufficiency. Port facilities will also continue to play a key role in the coastal fishing industry.

The Oregon State Aeronautics Division maintains an airport adjacent to, but outside, the Urban Growth Boundary. The airstrip currently functions as a relief airport for Newport. There is no room to expand the facilities for commercial/commuter service, nor is there sufficient demand for passenger service. However, corporate air service is available. Closure of the airport is not being contemplated at this time. No other airports are located in the vicinity of the study area.

Air freight service to Toledo is provided via UPS and Federal Express. The nearest regional air cargo service carriers are located in Newport and Corvallis. National air cargo service is available in Eugene.

The Willamette Valley Railroad operates a freight branch line connecting Toledo with the Willamette Valley. This service is provided once a daily. No direct passenger service is provided to the City of Toledo. The nearest passenger terminal is located in Albany.

1.3 TRANSPORTATION ISSUES

Several issues were identified by the Project Management Team and the community during the analysis of the existing Toledo transportation system. These issues generally fell into one of three broad categories: safety, congestion and pedestrian/bicycle access. With the exception of pedestrian/bicycle access, most issues tended to be site-specific rather than system-wide problems. Each issue is identified by location in Figure 5 and discussed by category below.

Safety Issues

Safety issues pertained to inadequate sight distances, narrow roadways, substandard pavement conditions, and the need for protected movements at key intersections. Most safety issues occurred along Business Highway 20. Intersections along this highway with deficient sight distance and inadequate signage include: U.S. Highway 20 (west of Toledo), Arcadia Drive, Dunden Road and Beech Street. High truck volumes in the vicinity of the Toledo High and Middle Schools along Sturdevant Road are also a concern to the community.

Congestion Issues

Congestion issues were often the result of inadequate channelization at intersections; these issues are further complicated by challenging topographical constraints. Congestion generally occurred in the vicinity of the industrial parks adjacent to Depot Slough and the Yaquina River. High truck volumes and delays from trains at railroad crossings have created several large queues along Butler Bridge Road. Near-term expansion plans at the Georgia Pacific Industrial Park will result in a 10-20% increase in truck traffic volumes during off-peak hours.

Pedestian/Bicycle Access

Issues regarding multimodal access focused on a fragmented pedestrian network and the absence of on-street bike facilities. The existing pedestrian facilities are not continuous through the commercial/retail area and are frequently limited to one side of the street. Citizens identified a need to provide a cohesive bike and pedestrian plan that would connect the schools, residential areas and retail business centers.

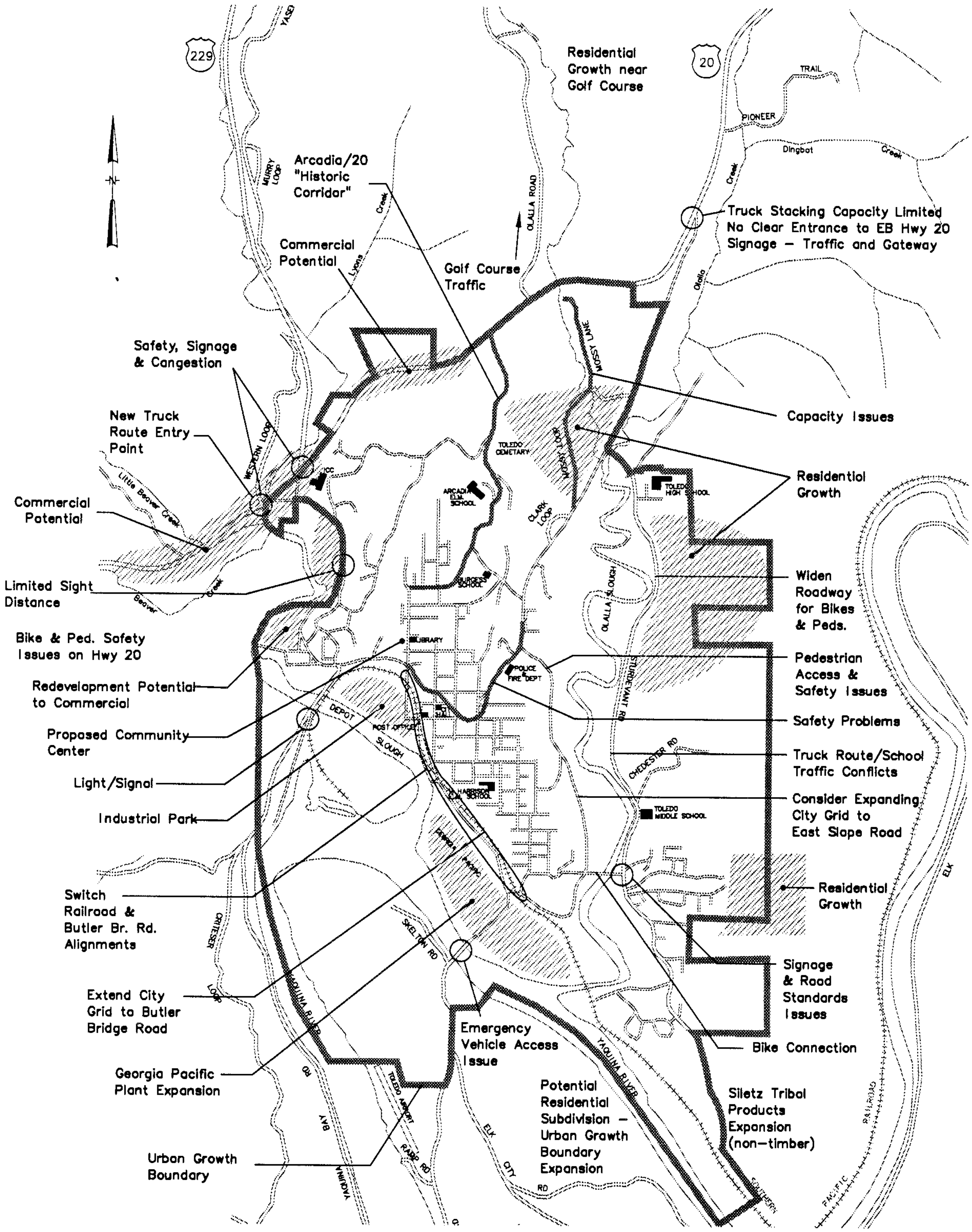

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FIGURE 5
Planning Issues

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Chapter 2

Future Conditions

Future Conditions

The long-term transportation needs of the City of Toledo will be driven by the economic environment and the potential for commercial, residential and industrial growth. The Port and the City at the Toledo Industrial Park (TIP) are in the process of creating an inventory of ready-to-build sites to attract small and mid-sized industrial firms and encourage a diversified economic base. In addition, the City has recently established public improvement design standards to guide residential development in the area. However, geographical and topographical constraints within the City and in the surrounding area limit some opportunities for growth.

Future conditions were forecast based on identified potential for development, the operational analysis of the existing transportation system, field reconnaissance, and discussions with City, County and State staff. A twenty-year planning horizon (1995-2015) was chosen to identify future land use and transportation conditions. Developable lands were identified using the existing county and city zoning maps and recent aerial photographs and assessed for physical constraints such as topography or environmental concerns. Future traffic forecasts were based on anticipated population and buildout. No specific or preconceived transportation alternatives were defined for analysis.

2.1 POPULTATION AND EMPLOYMENT CHARACTERISTICS

The 1995 estimated population for the City of Toledo is 3,340 based on information provided by the Portland State University Center for Census Data Research. By the year 2015, it is estimated that the population will increase to approximately 5,473 at an annual growth rate of 2.5%, as determined by City staff. It is assumed that growth in employment will keep pace with population over time and will, thus, increase at approximately the same rate. For the purposes of predicting future land use needs and traffic volumes, this is a conservative estimate considering that Toledo's population grew at an annual rate of 0.9% between 1980 and 1989.

The current city limits encompasses approximately 1,500 acres and the Urban Growth Boundary (UGB) an additional 1,200 acres outside the city limit for a total area of approximately 2,700 acres. Existing urban services extend either to the UGB or are in close proximity.

Generalized zoning is illustrated in Figure 6. Most of Toledo's undeveloped land is characterized by brushy and forested areas and low-intensity agricultural uses such as pasture and grass hay production. Prevailing steep terrain and marginal soils hinder opportunities to expand beyond existing low intensity uses. Consequently, the City must look to areas outside the city limits but within the Urban Growth Boundary to accomodate future needs. Of the 1,200 acres identified within the UGB and outside the city limit, 905 acres are designated for residential use, 35 acres for commercial use, and 260 for industrial use. The 905 acres designated as residential include 205 acres which have been mapped as wetlands and are within the flood plain, 85 acres of public lands, 138 acres with topographical constraints, and another 110 acres already built and committed

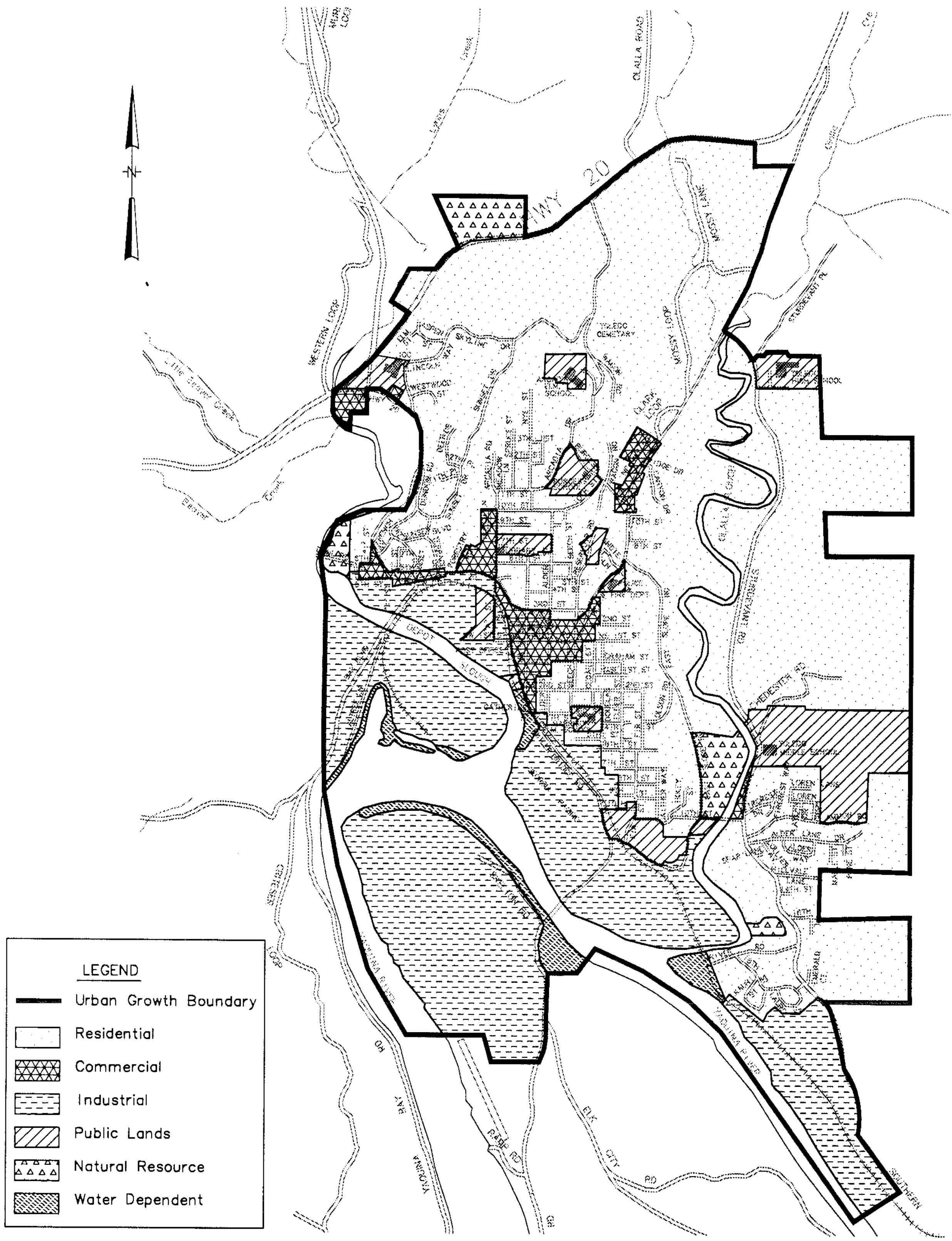

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FIGURE 6
Generalized Zoning Designations

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to residential use. The result is approximately 367 acres within the UGB and 61 acres within the city limit, for a total of 428 developable acres to accomodate the future population growth. Approximately 35 percent of this total buildable residential acreage would be necessary to accomodate the new population, assuming existing densities and household size are maintained over time. The 260 industrial acres include approximately 46 acres in wetlands and/or the flood plain, 70 acres with topographical constraints and 38 acres already built, leaving 106 vacant industrially zoned acres. Combined with the 15 vacant industrially zoned acres within the City, there is a total of 121 acres available for industrial development. Toledo has approximately 33 acres in commercial use now and one additional vacant acre zoned for commercial use. Assuming that employment grows proportionally with population and the mix of employment remains relatively constant, the inventory of existing vacant land should be adequate to accomodate anticipated projections for the year 2015.

2.2 2015 LEVEL OF SERVICE ANALYSIS

An operational analysis of the projected volume forecasts for the key intersections was conducted to determine LOS under the future (2015) conditions. This analysis was conducted using the same methodology as under existing conditions. Figure 7 illustrates the resulting levels of service at the key intersections and average weekday daily traffic for critical links. Table 2 compares both existing and future levels of service.

TABLE 2
Existing and Future (2015) Levels of Service

Intersection	Existing LOS	Future LOS
U.S. Highway 20/Western Loop	D	E
U.S. Highway 20/Business Highway 20 (west)	E	F
U.S. Highway 20/U.S. Highway 229	C	F
U.S. Highway 20/Business Highway 20 (east)	B	D
Business Highway 20/"A" Street	B (1)	B (1)
Business Highway 20/East Slope Road	A	A
Business Highway 20/Sturdevant Road	A	A
Butler Bridge Road/Main Street	A	A
Sturdevant Road/10th Street	A	A

(1) Signalized Intersecion.

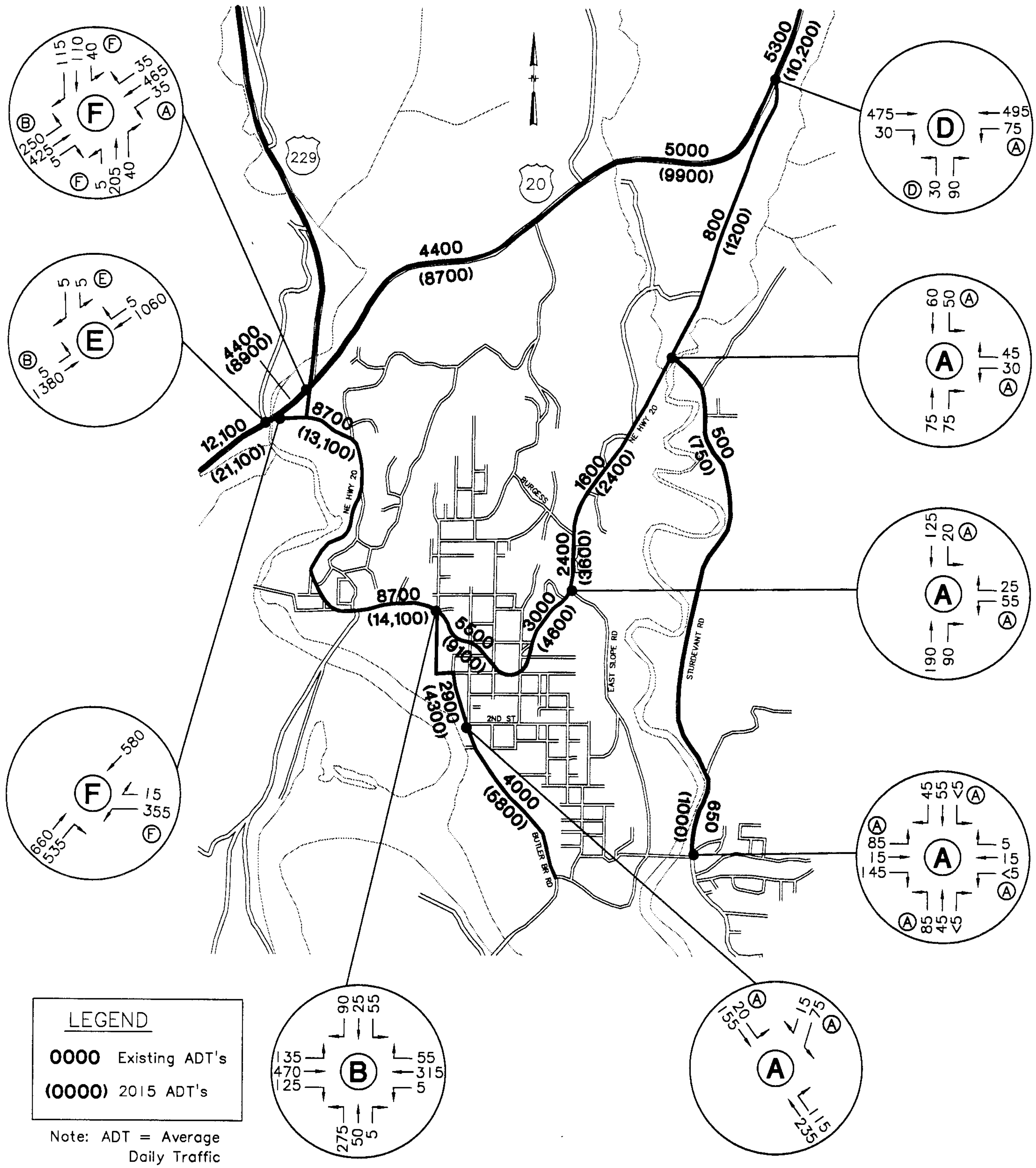

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FIGURE 7

2015 Weekday PM Peak Hour (No-Build) Traffic Volumes and LOS

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As shown in Table 2, the Highway 20/Business Highway 20 and Highway 20/Highway 229 intersections deteriorated to LOS "F" and the U.S. Highway 20/Western Loop intersection deteriorated to LOS "E". Based on the analysis, roadway and intersection capacity improvements will be required at these intersections to accommodate future traffic loads. The identified transportation improvements are described in Chapter 3. All other intersections remained at or above LOS "D".

2.3 TOLEDO TRANSPORTATION SYSTEM CONCLUSIONS

As a whole, the Toledo transportation system functions well in its present condition. With the exception of the U.S Highway 20/Business Highway 20 west intersection, the system is expected to maintain acceptable levels of service through the year 2015. Although congestion points along Business Highway 20 and Butler Bridge Road are present on a daily basis, most deficiencies are site-specific. The only system-wide component identified for improvement is the Pedestrian and Bicycle Facilities Plan. To ensure an efficient transportation system in the future, it is important to anticipate deficiencies within the transportation system before they become critical and to avoid reliance on any one mode of travel. A complimentary and interconnected pedestrian/bicycle/roadway system will reduce the potential for such a reliance and enhance the overall operation of the transportation system.

Business Highway 20

Business Highway 20 serves as an entrance to the City from both the east and the west. The Project Management Team has identified recurring safety concerns and inadequate signage at both entrances. High turning volumes at the west entrance further excerbate the problem, making improvements and realignment of the intersection a high priority for the community. Sections of Business 20 through town are also in need of widening or maintenance. Of particular concern are the intersections with "A" Street, Lincoln Way and Main Street. Improvements may include widening of the roadway to provide proper channelization and/or signalization of the intersections.

Georgia Pacific Industrial Park/Butler Bridge Road

Capacity issues along Butler Bridge Road are generated by high truck volumes and delays at railroad crossings. Butler Bridge Road is part of an identified truck route and provides access to the Georgia Pacific Industrial Park. Based on recent expansion plans, Georgia Pacific anticipates an increase in recyclable loads from approximately 500 tons/day to 1000 tons/day. Railroad crossings along Butler Bridge Road in the vicinity of the industrial park create intermittent delays to vehicles throughout the day. These delays are not significant enough to warrant roadway improvements.

Bicycle and Pedestrian Facilities Network

The City has a limited network of bicycles paths and does not provide on-street bike lanes at this time. Prevailing steep slopes and lack of continous bikeways make bicycle riding a challenging prospect in Toledo. The community also identifed concerns for pedestrian safety. The existing sidewalk network is fragmented through the downtown retail area and does not safe provide access to all schools and residential areas. Street improvements at the local, county and state levels should incorporate intermodal facilities to create a cohesive and practical bicycle and pedestrian network.

Chapter 3

Preferred Transportation System Plan

Preferred Transportation System Plan

This chapter describes the alternatives and strategies considered in developing the Preferred Transportation System Plan for the City of Toledo. Both short-term and long-range improvement strategies have been examined for efficiency and cost-effectiveness. Wherever possible, recommendations that foster a multi-modal approach were selected in compliance with the Transportation Planning Rule.

This chapter addresses both site-specific improvements and system-wide enhancements. Section 3.1 describes alternatives and recommendations for site-specific problems at five locations: Business 20/"A" Street; Business 20/Alder Street/NW 1st Street; East Slope Road/10th Street; U.S. 20/East Business Loop 20; and, U.S. 20/West Business Loop 20/Highway 229/Western Loop. Section 3.2 addresses roadway classifications and system-wide improvements to multimodal access. Planning level cost estimates, potential funding sources, and financing mechanisms for all recommendations are discussed in Chapter 4.

3.1 ALTERNATIVES CONSIDERED

Although the existing transportation network for the city is likely to be sufficient to serve transportation demands to the horizon year 2015, selected improvements that would increase the safety and efficiency of the system have been identified and analyzed. The transportation deficiencies identified in the study area focused on Business Highway 20 and site-specific safety and congestion concerns. Alternatives for each problem location are described below along with the final recommended improvement.

3.1.1 Business 20/"A" Street

This is the only signalized intersection within the urban area of Toledo. It is expected that this intersection will remain well below capacity in the 20-year future and operate at a reasonable Level of Service. The constraints experienced at this intersection which require mitigation involve issues of safety; specifically, sight distance. The "A" Street approaches to the intersection must ascend a grade to vertically align with Business 20. Little or no at-grade landing is provided for either of these approaches. The result is diminished sight distance on each "A" Street approach which forces opposing traffic to peer over the crest of the intersection to determine if it is safe to proceed. This is exacerbated by the permitted phasing which allows these opposing movements to occur simultaneously.

This intersection provides a direct connection between U.S. 20-Business 20 and the largest and most active industrial area of the city via the south approach of "A" Street. These industrial uses are expected to continue and potentially grow over the 20-year future. The north approach of "A" Street serves the library, an elementary school, and a limited residential area which has minimal potential for additional growth. Therefore, the volume and type of traffic each approach serves is significantly different and will continue to be so in the future.

Alternative A:

Modify the phasing of the traffic signal at this intersection to provide split phasing for the "A" Street approaches. The intersection would have sufficient capacity and low delay to accommodate the added lost time due to this phasing without adversely impacting the operation of the intersection. This phasing would provide full protection to all critical movements at the intersection and eliminate the negative impact of the limited sight distance. The lack of sufficient at-grade landing would remain; however, the need for the landing is minimized due to the signal. This would be the lowest cost and most expeditious improvement which could be effected to address the constraints of the intersection.

Alternative B:

Implement the signal phasing modification identified in Alternative A and provide sufficient at-grade landing for each approach of "A" Street to the intersection. A 50 foot landing is considered acceptable for low speed approaches at right angles to an intersection. The north approach would require approximately 200 feet of roadway reconstruction, providing a 150 foot approach at approximately a four percent grade and a 50 foot at-grade landing. The south approach is constrained by the existing railroad crossing located approximately 200 feet south of the intersection. Reconstruction to provide a 50 foot at-grade landing on the south approach would result in a -12 to -14 percent grade to return to the railroad crossing grade.

The cost of such an improvement would not be warranted when considered in comparison with Alternative A. In addition, the -12 to -14 percent grade likely to result on the south approach would likely be marginally acceptable.

Alternative C:

Reconstruct the Business 20 approaches to vertically align with "A" Street and widen the "A" Street approaches to provide left-turn lanes at the intersection. Modify the signal timing to provide protected phasing for the left-turn movements from the "A" Street approaches. This would be the most difficult and costly alternative to construct. Although the west approach of Business 20 is relatively flat (approximately 2 to 3 percent grade), the east approach continues an ascending grade to approximately 10 percent as it exits the intersection. Lowering the elevation of Business 20 to match "A" Street would require considerable excavation of both Business 20 approaches. This would result is a significantly steeper grade (14+ percent) for the east Business 20 approach, at a construction cost even greater than Alternative B.

Recommendation: Alternative A

3.1.2 Business 20/Alder Street/NW 1st Street

Business 20 bisects the local grid system of streets at an awkward angle (approximately 120°) adjacent to this intersection. Business 20 climbs a cross slope at a grade of approximately 8 percent and begins a vertical curve to the left as it approaches Alder Street from the west. Alder Street descends an approximately 5 percent grade from the north through the Business 20 intersection and intersects with NW 1st Street approximately 75 feet south of Business 20. Sight distance is severely limited for the Alder Street approaches due to the poorly aligned vertical and horizontal curves; and is exacerbated by the super elevation used on Business 20. Vehicles travelling east on Business 20 and turning south on Alder Street are unable to sight the Alder/1st Street intersection until they have completed the turn and are within 50 feet of the intersection. This would potentially be an insufficient distance to avoid a conflicting movement from 1st Street. Southbound vehicles on Alder Street cannot sight over Business 20 to the south approach of Alder Street and have minimal sight distance of the east approach of Business 20 due to being on the inside of the curve. Anecdotal information has suggested that downhill speeds on the east approach of Business 20 are well in excess of the posted limit (25 mph).

Alternative A:

Provide signage on the east approach of Business 20 as an advanced warning of a limited sight distance intersection ahead and prohibit southbound cross street movements from Alder Street. Monitor traffic speeds on Business 20 to control excessive speeding. This would be a low cost alternative.

Alternative B:

Implement Alternative A and provide a detection loop on the west approach of 1st Street to Alder Street. Provide warning signs on both sides of Alder Street facing the Business 20 intersection with flashing yellow lights connected to the detection loop. The signs would warn of cross traffic ahead and would be positioned to be seen as traffic turns from Business 20 to the south approach of Alder Street. This would also be a low cost alternative.

Alternative C:

Modify N.W. 1st Street to be one-way westbound between Alder Street and Main Street. This simple modification would alleviate some of the confusion and congestion at the intersection. Further, it would eliminate the potential of an eastbound vehicle being stopped on the 20+ percent grade that N.W. 1st Street must overcome between Main Street and Alder Street. Signing and striping for the remaining intersection would be simplified, improving conditions for both local and pass-through traffic. This would be a low cost improvement.

Alternative D:

Close the access of N.W. 1st Street to Alder Street, allowing only local circulation from Main Street. The result would be a simple four-legged intersection of Business 20 and Alder Street, with common signing and striping features. The Alder Street approaches would continue to be stop sign controlled. This would be a low cost improvement.

Recommendation: Short-term: Alternative B
Long-term: Alternative C

3.1.3 East Slope Road/10th Street

This intersection is located in the southeastern section of the city, adjacent to a city park and the Olalla Slough. The north approach of East Slope Road and west approach of 10th Street to the intersection are stop sign controlled. The south approach of East Slope Road and the east approach of 10th Street are uncontrolled. Significant trucking activity is accommodated through this intersection as a part of the identified Truck Route for the city. This intersection is poorly aligned, lacks adequate channelization, and does not provide appropriate safe haven for pedestrian movements; based on its proximity to the park.

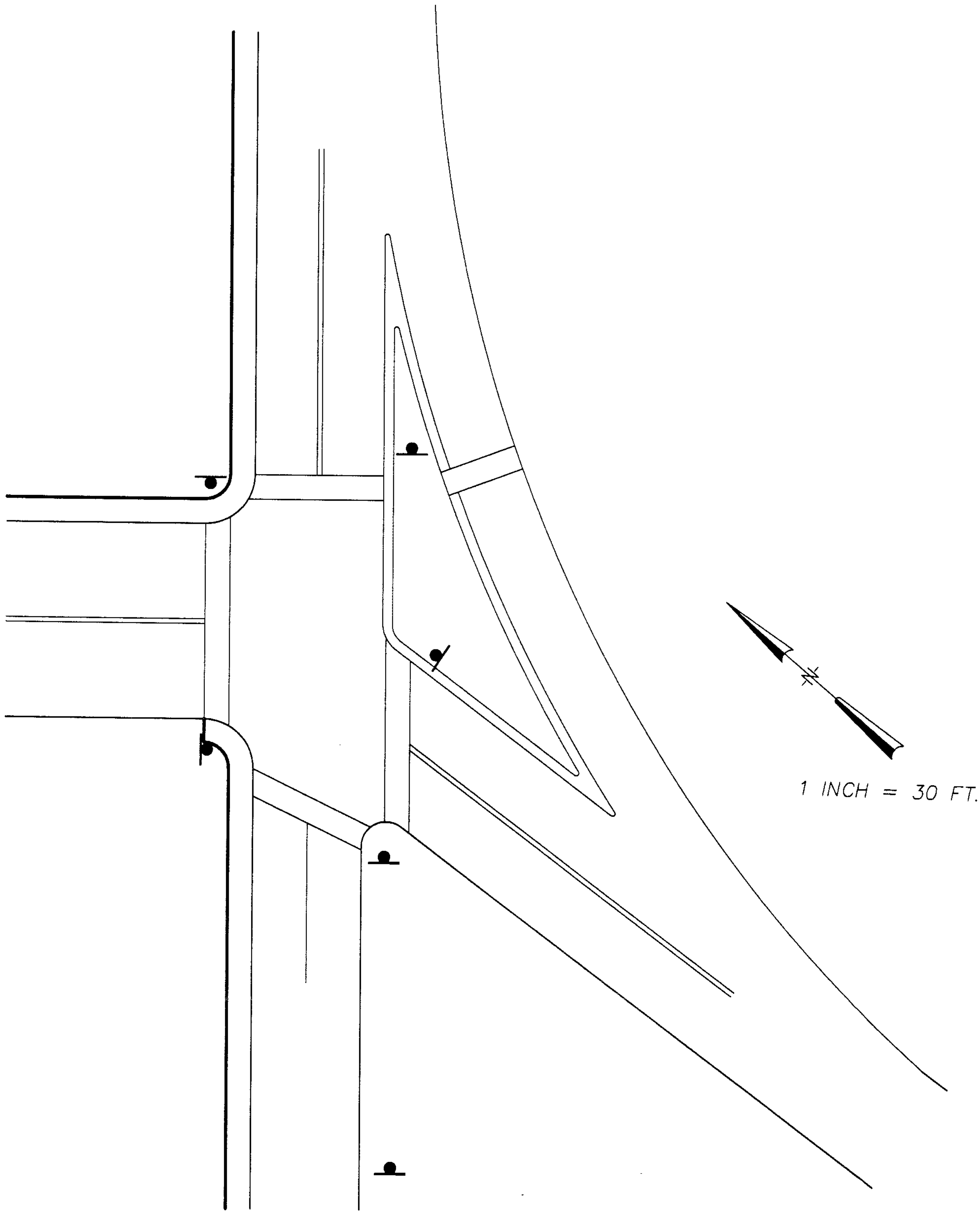
The issue of major concern at this intersection would be the location and identification of safe pedestrian crossings to the park. Presently, one crossing is marked at a location approximately 90 feet east of the intersection; near the west end of the Olalla Slough Bridge. This location has good visibility for westbound approaching vehicles, but very poor visibility for eastbound approaching vehicles from East Slope Road. These eastbound movements are uncontrolled through the intersection and, therefore, approach the pedestrian crossing at full speed (25 mph).

Alternative A:

Move the designated crosswalk to a point immediately west of and adjacent to the intersection. Provide advanced signing on East Slope Road and the east approach of 10th Street indicating a pedestrian crosswalk is ahead. Provide channelization (via striping) which defines the traffic flow pattern for the intersection and emphasizes the place at which pedestrians and motorists interact. This would be a low cost improvement.

Alternative B:

Formalize the intersection into a common four-legged intersection with stop sign controls on two or all four of the legs (as shown in Figure 8). The south East Slope Road approach would require minor reconstruction to align at the intersection. Sidewalks and crosswalks would be provided such that crossings to and from the park could be made safely and with minor interference to the operation of the intersection. This would be a low cost improvement.



CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 8
East Slope Road/10th Street
Alternative B

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Alternative C:

Sever the direct connection of the west approach of 10th Street to the intersection. Create a "T" intersection of the west approach of 10th Street to East Slope Road, with 10th Street being stop sign controlled. Create another "T" intersection of the east approach of 10th Street to East Slope Road, with the north approach of East Slope and the east approach of 10th Street being stop sign controlled. Provide sidewalks and crosswalks to accommodate pedestrian movements and signage on East Slope Road and the east approach of 10th Street indicating a pedestrian crossing is ahead. This would be a moderate cost improvement.

Recommendation: Alternative B

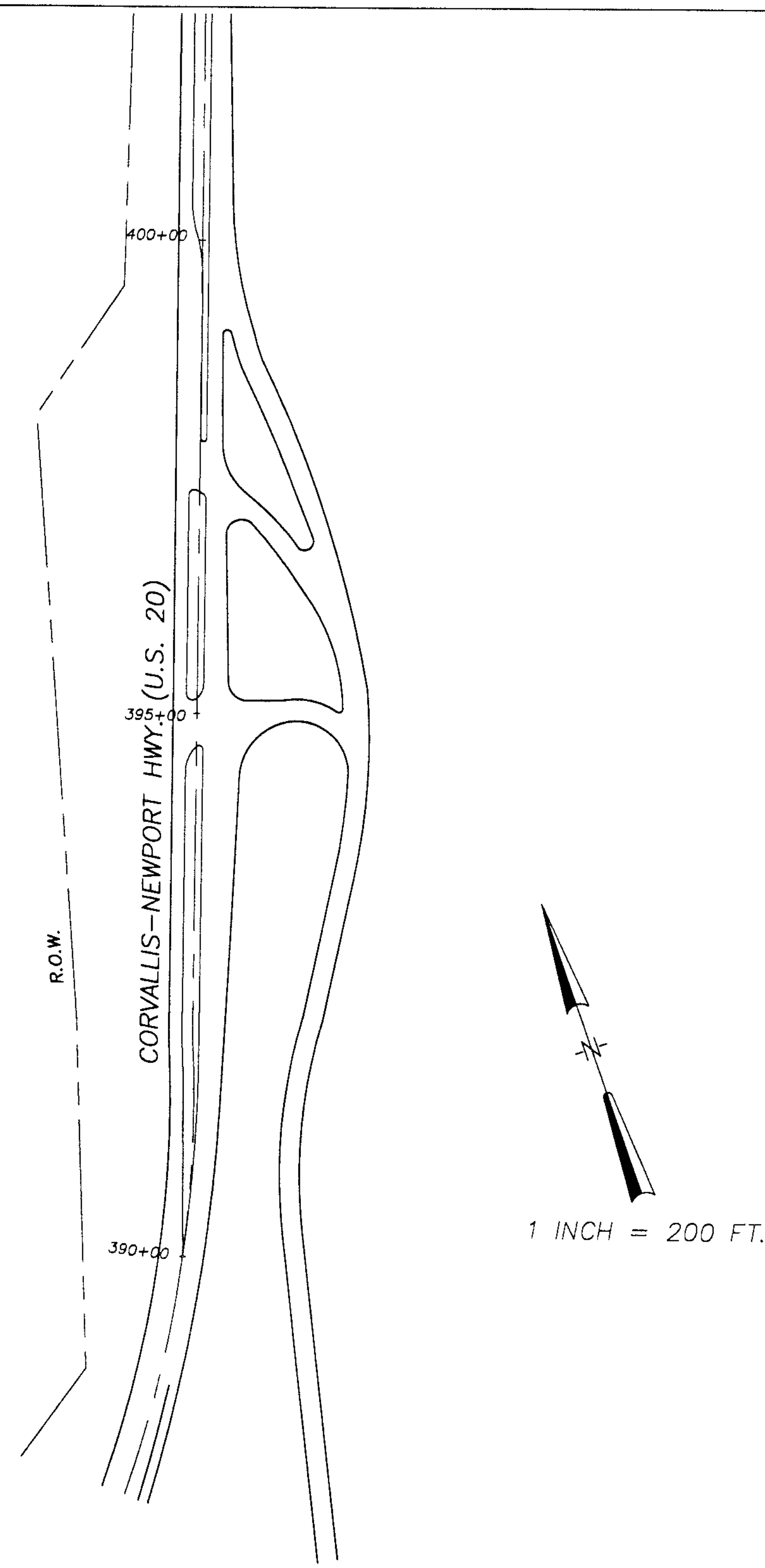
3.1.4 U.S. 20/East Business Loop 20

This intersection of two state facilities lies outside the Urban Growth Boundary for the City of Toledo, but acts as one of the two most important access points to the area. The 20-year forecast of traffic volumes at this intersection would not exceed the acceptable operating threshold for an unsignalized intersection. A review of the accident records maintained by ODOT provides no indication of safety problems at this intersection. Anecdotal information regarding accidents and near misses indicated the potential for safety problems to exist which have not yet manifested themselves in higher than normal accidents rates. Field reconnaissance identified deficiencies in the construction and treatment of the intersection which would require mitigation.

Business Loop 20 approaches the highway from the southwest at a significant skew to the alignment of the highway. The business loop must negotiate a grade of approximately six percent to vertically align with the highway. The actual paved area provided for the intersection is expansive, providing minimal signing and striping to direct traffic. Vertical curvature constrains sight distance for westbound to southbound movements from the highway to the business loop. In addition, a depression in the roadway base in the area occupied by the westbound-to-southbound left-turn storage lane exacerbates the sight distance and driver perception problems of this intersection. Lighting is provided for this intersection. The existing design of this intersection is depicted in Figure 9.

Alternative A:

Provide additional signage indicating exit/entrance points, yields and stops. Maintain a higher level of striping for this intersection such that at all times and under all conditions (day/night, wet/dry) the channelization can be seen and understood as shown in the existing "as built" drawings on file with ODOT for this intersection. This would be a low cost improvement.



CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 9
U.S. 20/East Business Loop 20
Existing Configuration

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Alternative B:

Implement Alternative A and provide raised channelization, potentially with low level vegetation for beautification, to better identify and define the routes for permitted movements to be made at the intersection (as shown in Figure 10). This would also provide a safe location for additional signing to improve driver understanding of the intersection layout. Determine if the roadway base has been compromised in the area of the westbound-to-southbound left-turn storage lane and repair accordingly to remove the roadway depression. This would be a moderate cost improvement.

Recommendation: Short-term: Alternative A
Long-term: Alternative B

3.1.5 U.S. 20/West Business Loop 20/Highway 229/Western Loop

These three state facilities intersect in such a way as to create three separate intersections forming a triangle within which is located a Dairy Queen fast food restaurant. All three intersections are presently stop sign controlled. Figure 11 illustrates the existing "as built" configuration of these three intersections. U.S. 20 runs in a southwest to northeast direction, with Business Loop 20 running generally in an east/west direction and Highway 229 running north/south. In addition, Western Loop (a county facility) intersects with U.S. 20 within the influence of the U.S. 20/Business 20 intersection.

The capacity of the three state facility intersections will be compromised within the 20-year future, based on the traffic volume projections for this study (these are the only capacity-related deficiencies identified within the area within the 20-year future). The heaviest vehicular movements are on U.S. 20, travelling between Newport and Corvallis. However, the following critical turning movements must be accommodated with consideration of any improvements to these intersections:

- Eastbound-to-southbound right turn from U.S. 20 to Business 20
- Eastbound-to-northbound left turn from U.S. 20 to Highway 229
- Northbound-to-westbound left turns from Business 20 to U.S. 20
- Southbound-to-eastbound left turns from Highway 229 to U.S. 20
- Northbound-to-westbound left turns from Highway 229 to U.S. 20

Alternative A:

Install a traffic signal at the U.S. 20/Highway 229 intersection and reconstruct the south leg of Highway 229 to intersection with U.S. 20 at a near 90° angle (see Figure 12-A). Provide exclusive lanes for the northbound lefts, throughs, and rights from Highway 229.

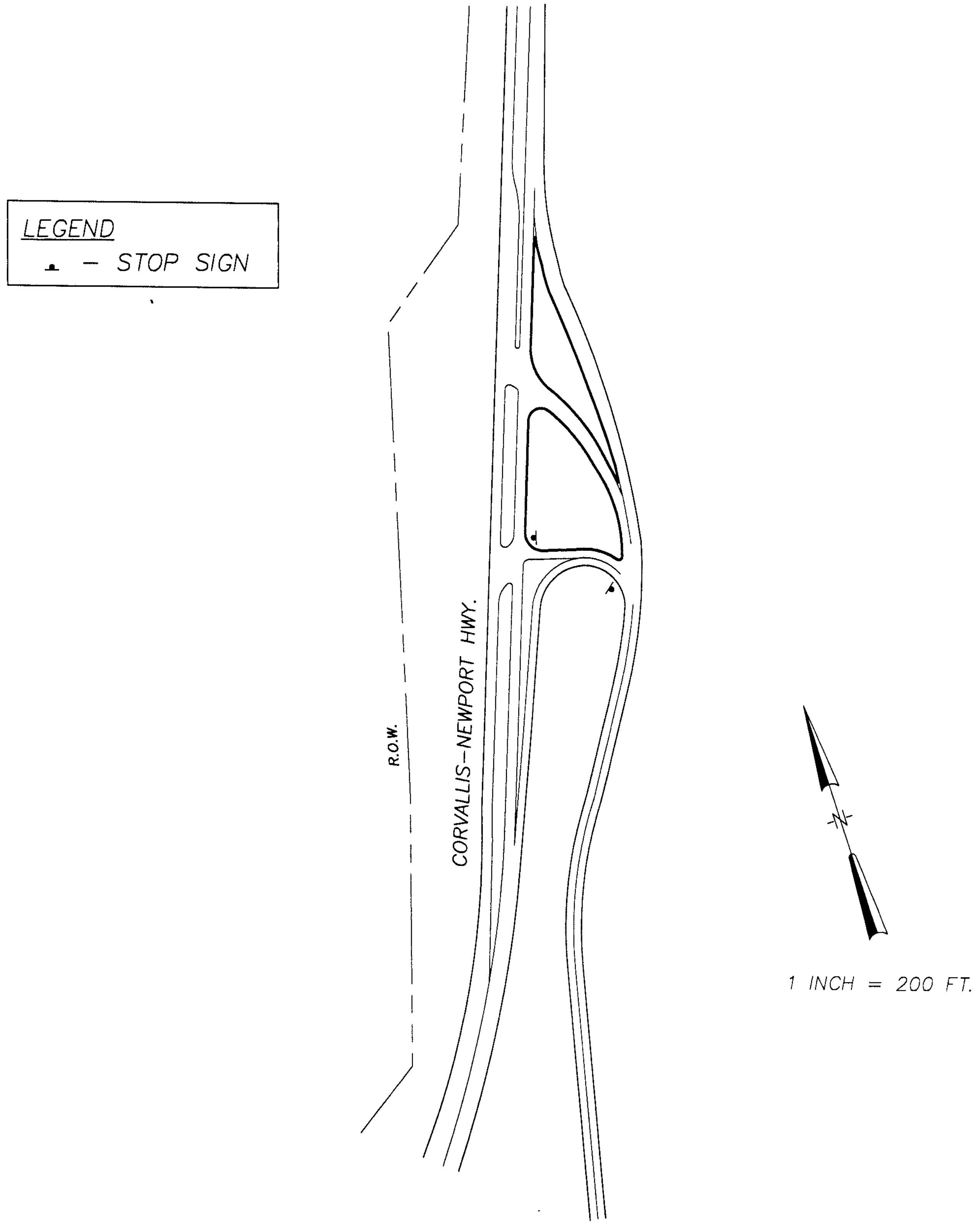

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FIGURE 10
U.S. 20/East Business Loop 20
Alternative B

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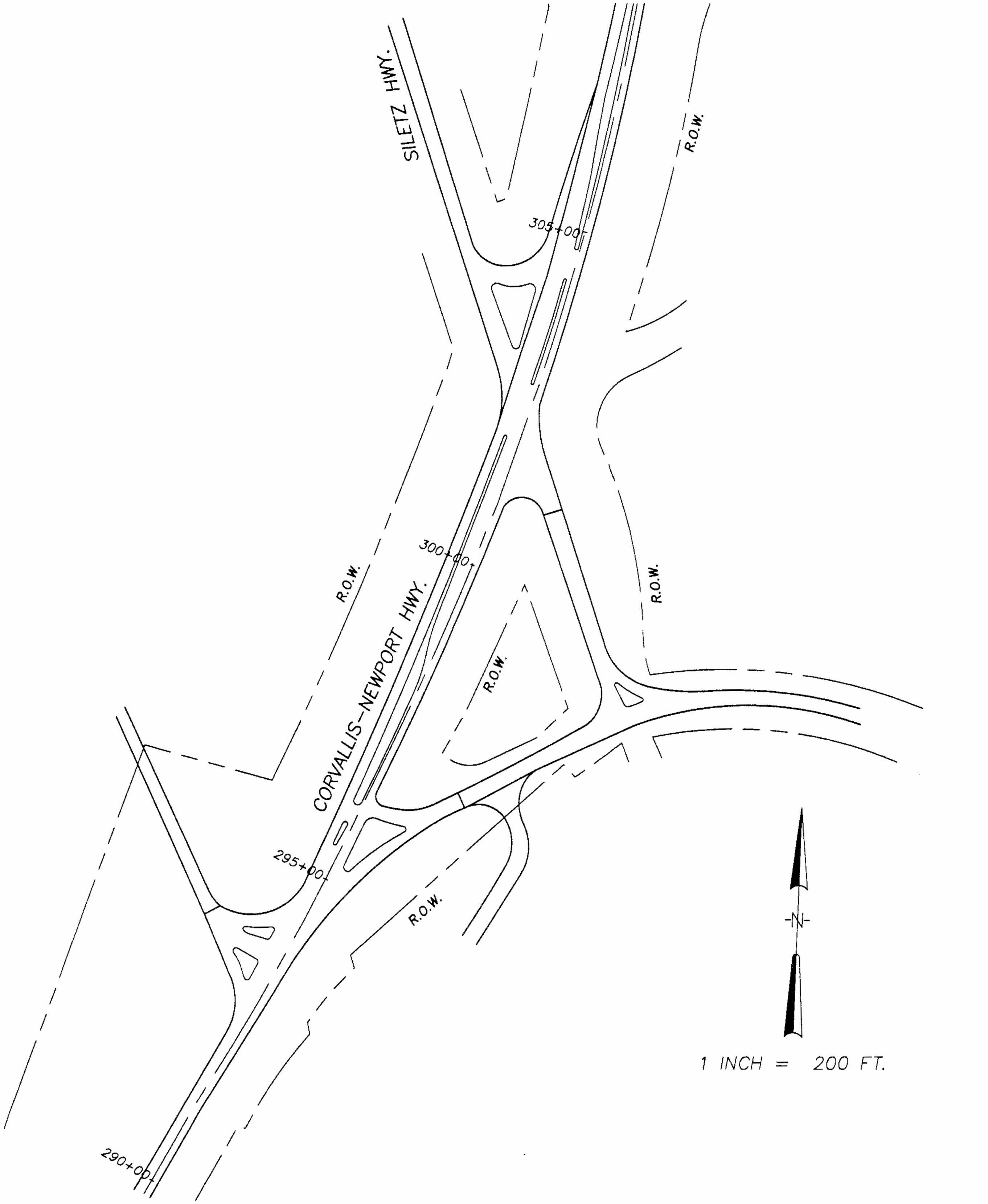

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FIGURE 11
U.S. 20/W. Bussiness 20/Hwy. 229
Existing Configuration

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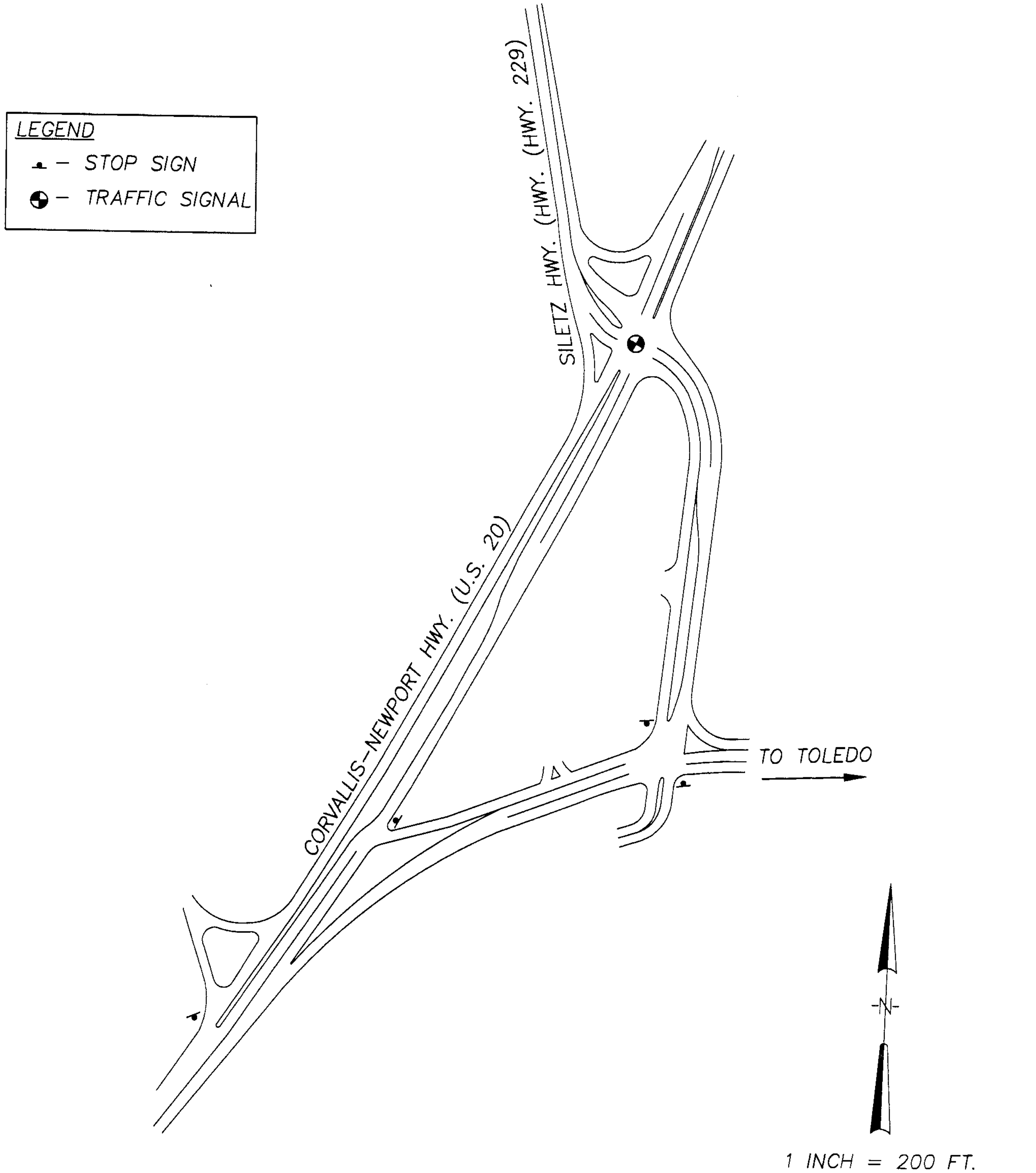

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FIGURE 12-A
U.S. 20/W. Business 20/Hwy. 229
Alternative A

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Restripe the southbound approach to accommodate similar approach lanes. Maintain the eastbound-to-northbound free right turn lane from U.S. 20 to Highway 229 and develop the complimentary westbound-to-southbound right turn lane on U.S. 20.

Construct a left turn acceleration lane on U.S. 20 for the northbound-to-westbound left turn from Business 20. Widen U.S. 20 to provide sufficient distance to merge the left turning traffic with westbound through traffic on U.S. 20. Prohibit left turns out of Western Loop to U.S. 20 and provide signing on Western Loop directing traffic to Highway 229 for access to U.S. 20 eastbound.

Relocate the private driveway access located on the southwest side of Business 20, between U.S. 20 and Highway 229, to align as the fourth leg of the Business 20/Highway 229 intersection. Stop sign control this leg and the Highway 229 leg of the intersection. Also, provide a free right turn lane on Business 20 to northbound Highway 229 at this intersection.

The advantage of this alternative is that it maintains the general operational characteristics of the existing configuration. The critical Business 20 to U.S. 20 northbound left turns continue to be facilitated and further protected by the recommended modifications. This same movement is also provided as a protected movement at the U.S. 20/Highway 229 signalized intersection. The disadvantage of this alternative is that the Western Loop intersection must be modified to prohibit southbound left turns. This minor volume movement (approximately 5 vehicles during the p.m. peak hour in the year 2015) would be forced out of direction to Highway 229 to gain eastbound access to U.S. 20.

Alternative B:

The same traffic signal installation and reconstruction of Highway 229 would be incorporated into Alternative B. The variation would be in the treatment provided at the U.S. 20/Business 20 intersection.

The Business 20 approach to U.S. 20 would be modified to serve one-way traffic southbound away from U.S. 20 (see Figure 12-B). Only eastbound traffic from U.S. 20 and southbound left turning traffic from Western Loop would have access to this portion of Business 20. Business 20 would widen to two southbound lanes beyond the influence of U.S. 20 and provide a left turn lane to the Dairy Queen as well as a left turn lane to Highway 229 northbound. South of the Highway 229 intersection Business 20 would return to two-way traffic.

Access to the properties southwest of Business 20 in the one-way section would be provided at the re-aligned driveway entrance located as the fourth leg of the Business 20/Highway 229 intersection.

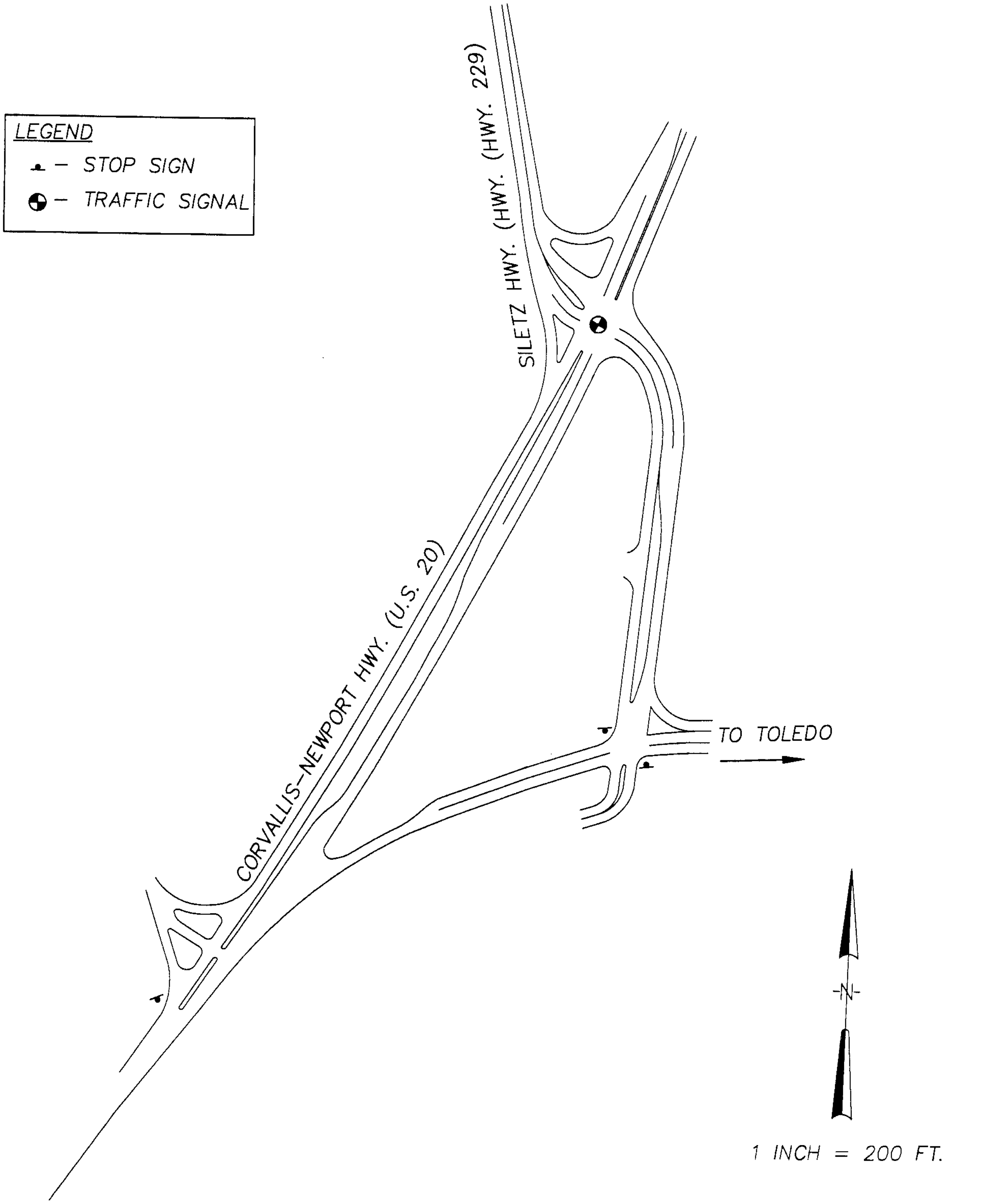

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FIGURE 12-B
U.S. 20/W. Business 20/Hwy. 229
Alternative B

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The benefit of this alternative is the simplification of the U.S. 20/Business 20 intersection. U.S. 20 traffic would only be influenced by the side street traffic associated with Western Loop. The disbenefit would be the additional traffic volumes in the form of critical side street left turn movements which the U.S. 20/Highway 229 signalized intersection would be required to accommodate.

Recommendation: Carry forward both alternatives as recommendations for ODOT to consider during the U.S. 20 corridor study (expected to occur in late 1995 or early 1996).

3.2 PREFERRED TRANSPORTATION SYSTEM PLAN

The Preferred Transportation System Plan incorporates recommendations classifications and multimodal access. The following elements are addresse Transportation System Plan:

- Roadway Classification Plan
- Public Transportation Plan
- Pedestrian Facility Plan
- Bicycle Facility Plan

3.2.1 Recommended Roadway Classification System

The transportation system within the City of Toledo is facilitated by a hierarchy of streets. The roadway classifications within this system are defined below. Each classification takes into account capacity of the system needed based on traffic volumes, surrounding land uses and trip purposes. Application of the classifications to the existing street network are listed with the definitions and illustrated in Figures 13 and 14.

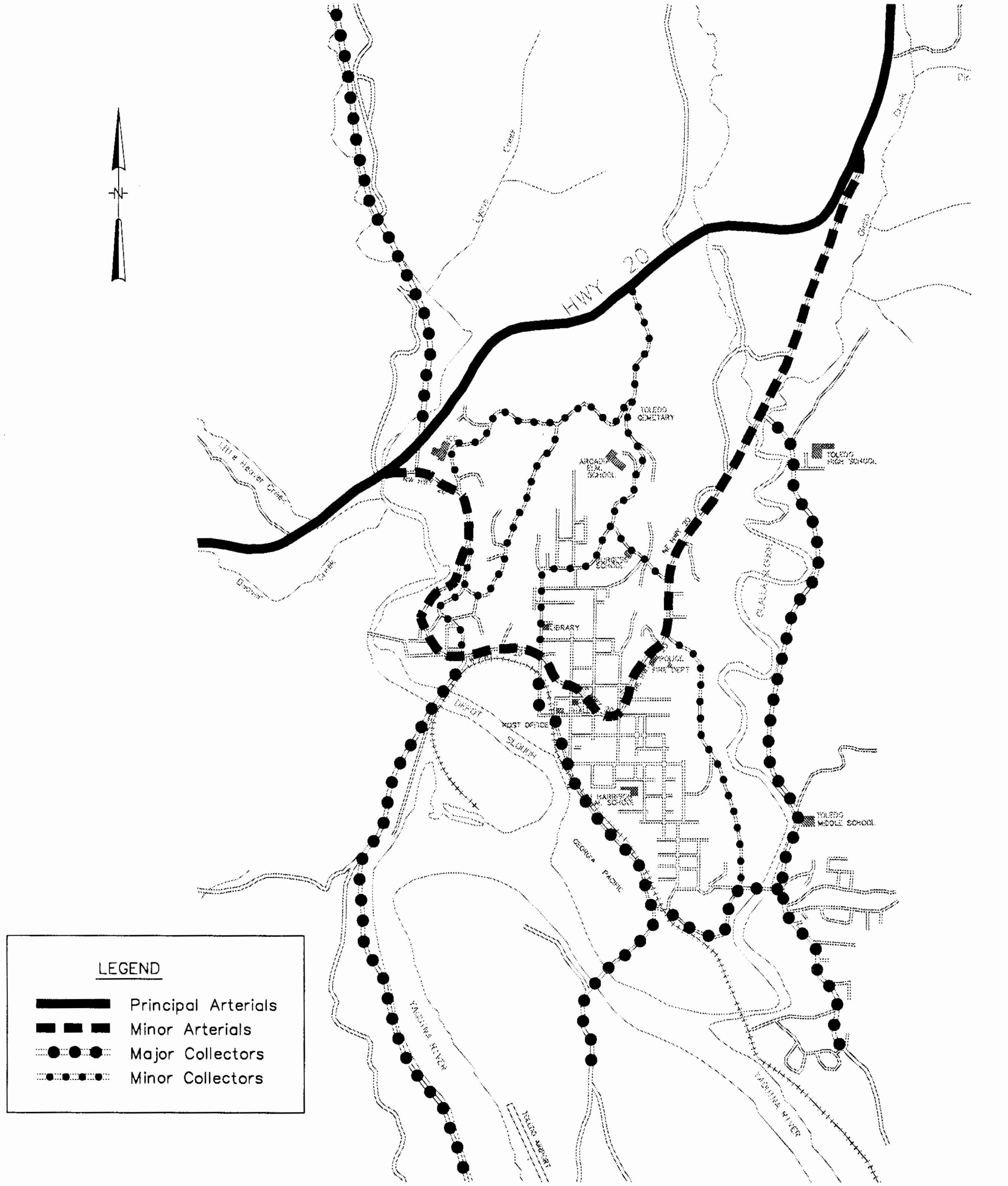
I. Principal Arterial (Statewide Highway)

The primary function of highways in this level is to provide connections and links to larger urban areas, ports and major recreation areas that are not directly served by interstate highways. Statewide highways provide links to the interstate system and alternate links to other states. A secondary function is to provide links and connections for intra-urban and intra-regional trips. Connections are primarily with roadways that serve areas of regional significance or scope.

Statewide routes generally serve centers of 5,000 or more population; have route lengths of 50 miles or more, do not parallel other statewide routes within 25 miles; connect at each end with interstate routes, statewide routes or major recreational areas; and, carry at least 500 vehicles per day.

The management objective is to provide for safe and efficient high-speed continuous-flow operation in rural areas and high to moderate-speed operations with limited interruptions of flow in urban and urbanizing areas (Oregon Highway Plan, 1991). Bike lanes should be provided on Principal Arterials.

Recommended Principal Arterials: U.S. Highway 20



CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 13
Recommended Roadway Classification

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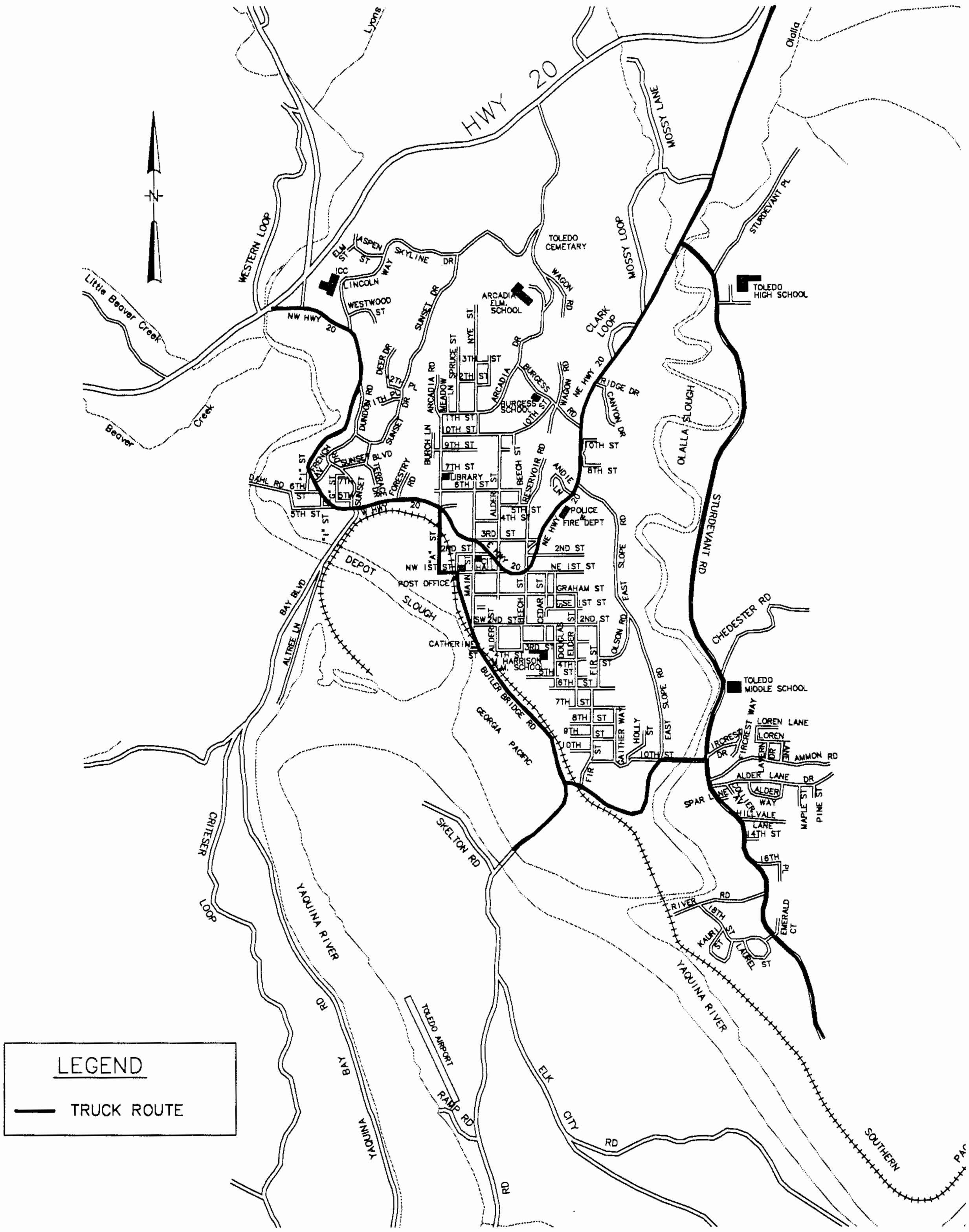

CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 14
Recommended Truck Routes

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II. Arterial

An Arterial is intended to serve as a primary route for travel within and between community subareas. Access to an Arterial is normally from the Collector road system. Individual accesses should be managed to minimize degradation to capacity and traffic safety. Sidewalks and bike lanes should be provided on an Arterial.

Recommended Arterials: Business Highway 20

III. Major Collector

A Major Collector is intended to serve traffic from local streets or minor collectors to the arterial system. Individual accesses, while more frequent than on arterials, should be managed to minimize degradation to capacity and traffic safety. Sidewalks and bike lanes should be provided on a Major Collector.

Recommended Major Collectors: Sturdevant Road (south from Business Highway 20 through town), 10th Street (Sturdevant Road to East Slope Road), East Slope Road (10th Street to Butler Bridge Road), Butler Bridge Road (south from NW 1st Avenue through town), NW 1st Avenue (Butler Bridge Road to "A" Street), "A" Street (NW 1st Avenue to Business Highway 20), and the Siletz Highway (north from U.S. Highway 20).

IV. Minor Collector

A Minor Collector is intended to provide access to abutting properties and to serve local access needs of neighborhoods, including limited through traffic. New development that generates a significant amount of traffic should be discouraged from locating on Minor Collectors that also serve residential areas. Sidewalks and bike lanes should be provided in accordance with the Sidewalks and Bicycle Facility Plan (see Section 3.2.3 and 3.2.4)

Recommended Minor Collectors: East Slope Road (Business Highway 20 to 10th Street), Arcadia Drive/Road (U.S. Highway 20 to Business Highway 20), Burgess Road (Arcadia Drive to Business Highway 20), Skyline Drive (Arcadia Drive to Business Highway 20), Sunset Drive (Skyline Drive to Business Highway 20), and Dundon Road (Sunset Drive to Business Highway 20).

V. Local Street

A Local Street is intended to provide direct property access. A Local Street is not intended to serve through traffic. Sidewalks should be provided in accordance with the Sidewalk Facility Plan and Toledo's Subdivision Ordinance.

Recommended Local Streets: All streets not identified in the previous categories.

VI. *Truck Route*

A Truck Route is signed as the primary access for trucks to the industrial area in Toledo. Future improvements on streets signed as a Truck Route should take into consideration the heavy volume of trucks, special needs for traffic control, road geometry, access during construction, and possible traffic/pedestrian/bicycle conflicts.

Recommended Truck Routes: Business Highway, Sturdevant Road, Butler Bridge Road, 10th Street (Sturdevant Road to East Slope Road), East Slope Road (10th Street to Butler Bridge Road),1st Street (Butler Bridge Road to "A" Street), "A" Street (NW 1st Street to Business Highway 20) and Business Highway 20 ("A" Street to U.S. Highway 20).

Typical sections for the functional classifications are shown in Figure 15. These sections parallel those depicted in the City of Toledo Public Improvement Design Standards, 1995. As can be seen, the City has included provisions for bicycle/pedestrian facilities to ensure a comprehensive, multi-modal network of streets that promotes non-auto oriented travel.

3.2.2 Recommended Transit Plan

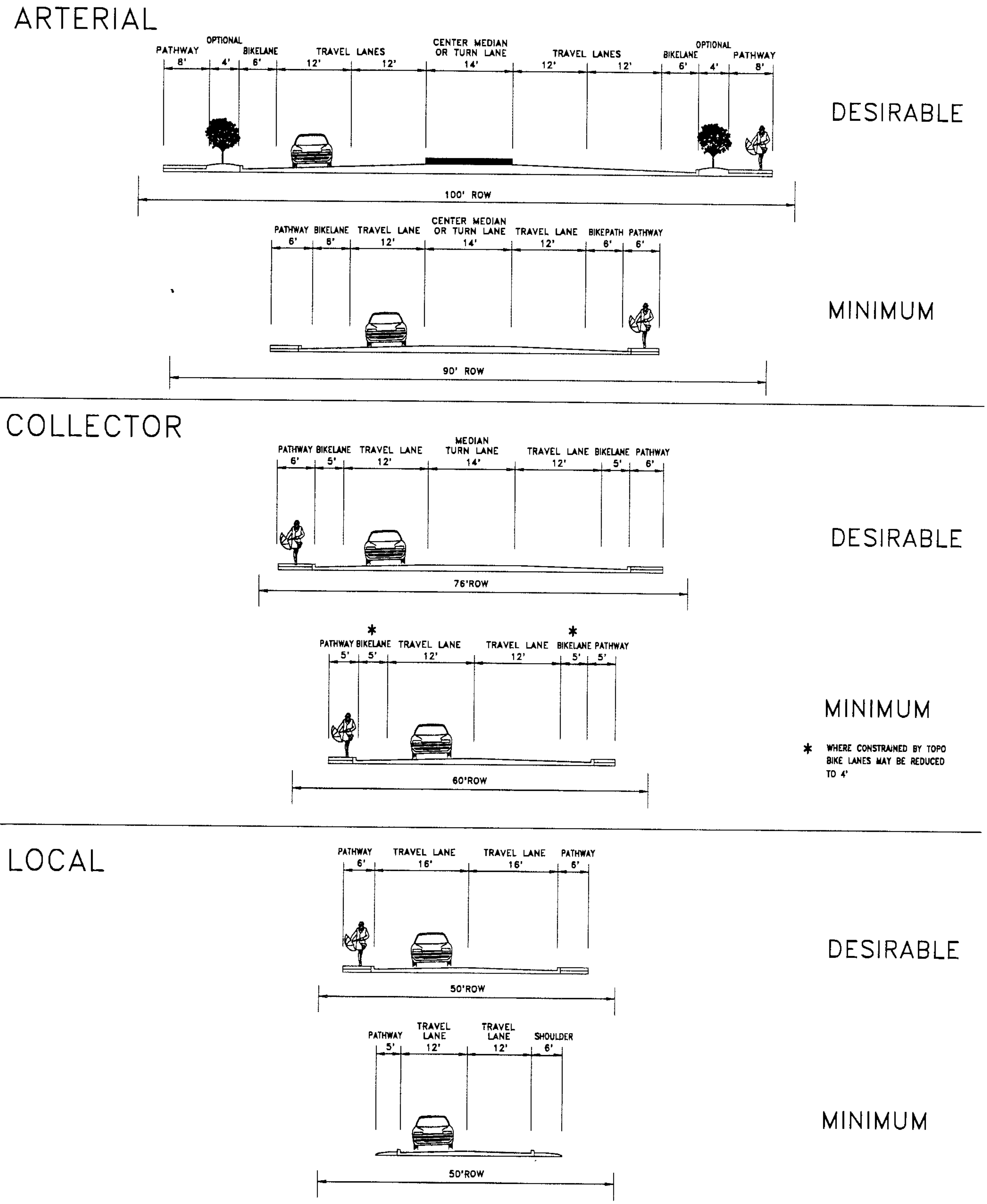
The existing East Line Feeder and Dial-a-Ride systems provided by Lincoln County are expected to adequately serve travel demand through the planning horizon. The East Line Feeder service is an inter-city scheduled route with six stops in Toledo and non-schedule stops on a demand-basis. The Dial-a-Ride service is a completely demand-responsive intra-city service.

It is recommended that Lincoln County continue to provide the Dial-a-Ride program for Toledo and maintain stops in Toledo on the East Line Feeder service. Further, it is recommended that the City support Lincoln County in its efforts to secure funding of the services.

3.2.3 Recommended Sidewalk Facility Plan

Figure 16 illustrates the recommended Sidewalk Facility Plan. The Plan would provide a comprehensive sidewalk network by providing continous facilities between the retail area, schools and entrances to residential neighborhoods. In some areas, such as retail centers, sidewalks would be provided on both sides of the street and have wider widths to encourage tourism activity and enhance the image of Toledo as a pedestrian friendly environment. Continuous pedestrian access between schools and residential areas would be provided on at least one side of the street to promote a safe environment for children.

In compliance with the City of Toledo Public Improvement Design Standards, new sidewalks along Business Highway 20 would be 8 feet wide. All other facilities would be 6 feet with a minimum of width of 5 feet. In situations where a proposed sidewalk would connect existing walks, the minimum width would be 5 feet or the width of the existing walk, whichever is greater. Typcial roadway sections with sidewalk facilities are illustrated in Figure 15.



CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 15

Recommended Urban Street Standards
Typical Cross Sections

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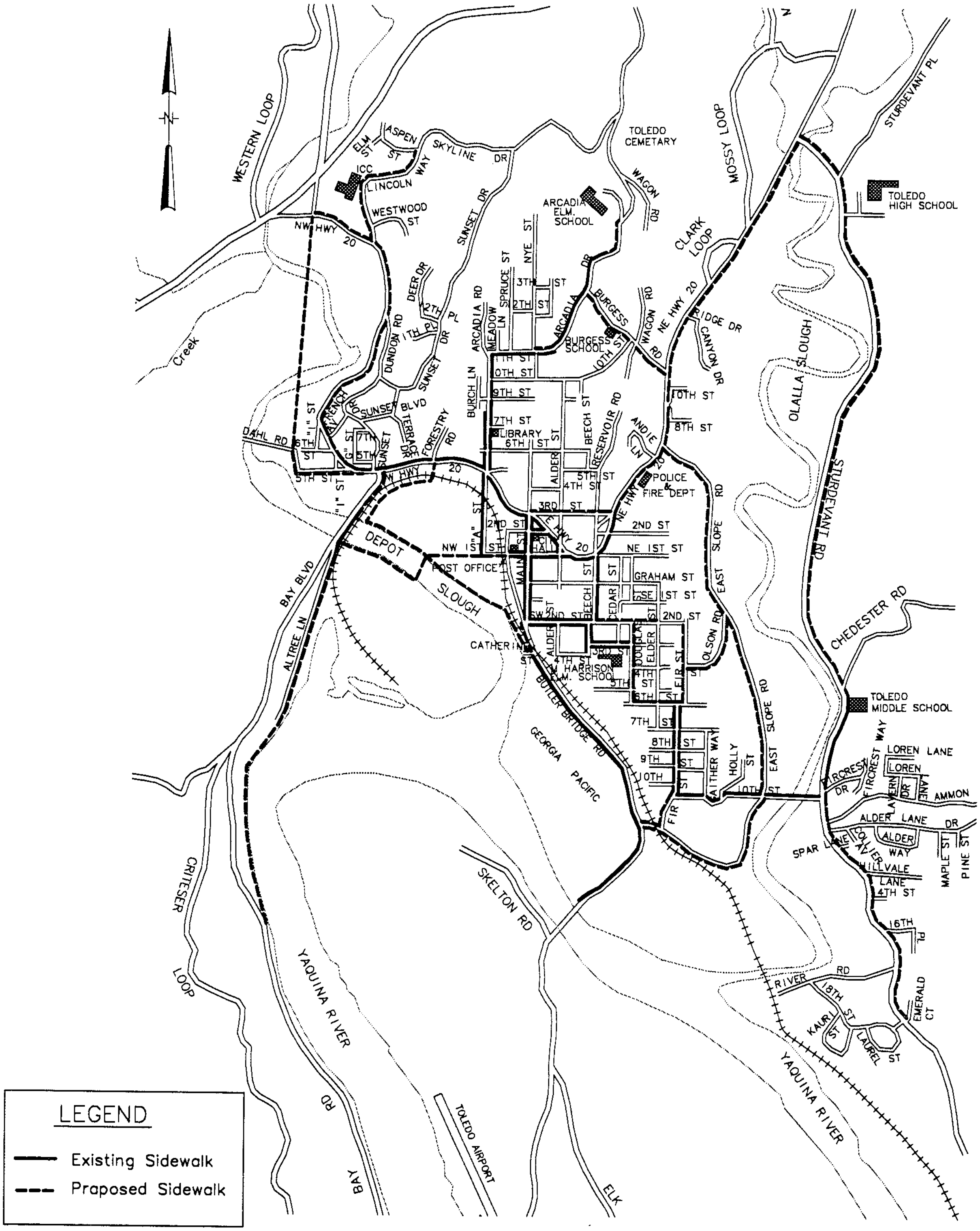

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FIGURE 16
Recommended Sidewalk Facility Plan

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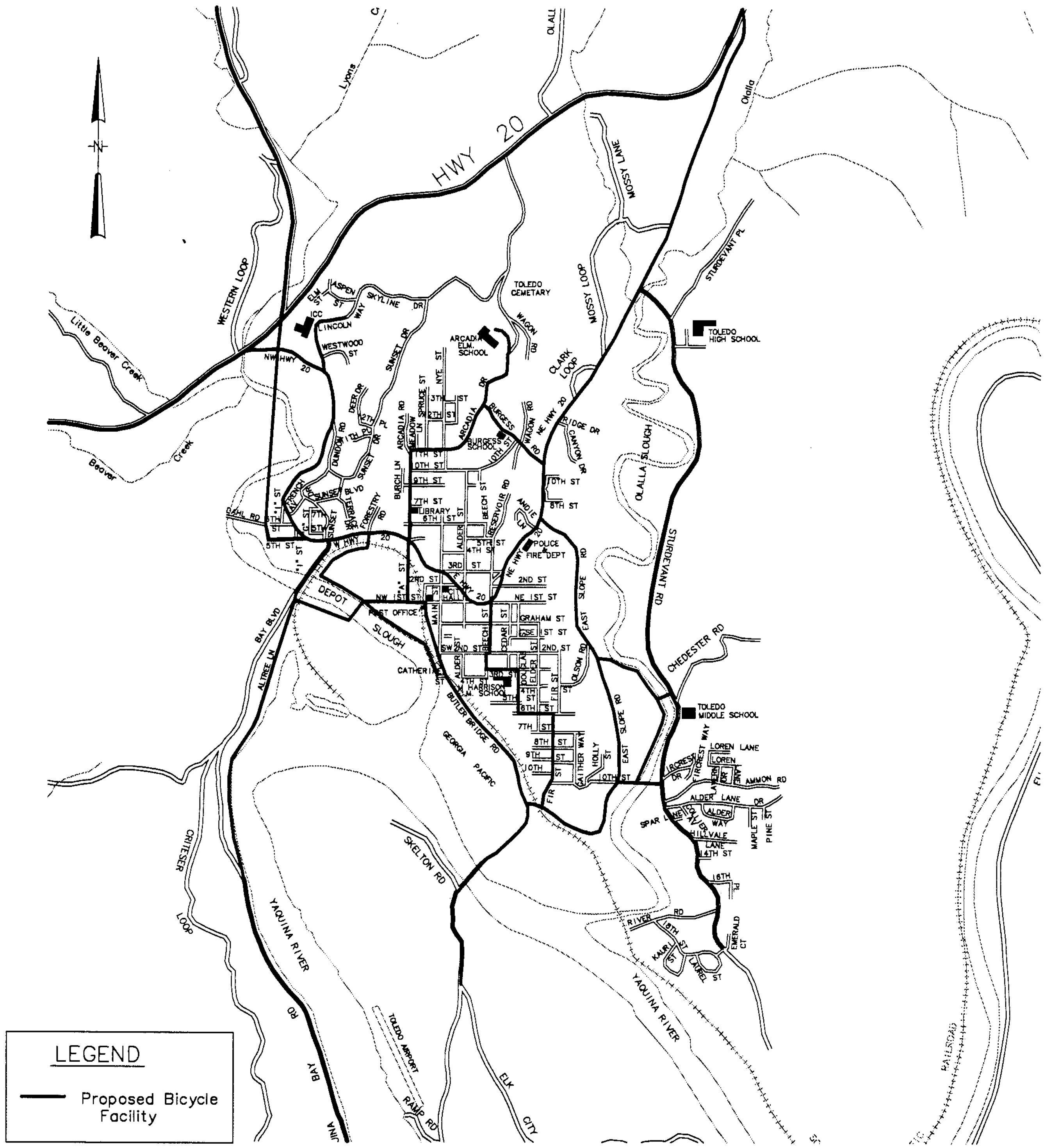
3.2.4 Recommended Bicycle Facility Plan

Figure 17 illustrates the recommended Bicycle Facility Plan. The plans calls for approximately 26 miles of bike lanes to be added to existing streets in Toledo. This network of bike paths will provide access to the major business, residential and institutional areas in Toledo. Of particular importance would be the addition of bike lanes to Sturdevant Road. The area north and east of Sturdevant Road is becoming increasing urbanized. With the expected residential growth and both the Middle and High Schools located on the road, both the City and the County would like it to be a high priority bicycle corridor.

On-street bike lanes along Business Highway 20 would be 6 feet wide. All other bike facilities would be 5 feet wide. If topographical constraints preclude a 5 foot lane, a minimum 4 foot lane may be used.



Note: The present transportation system does not provide for bicycles on streets in Toledo.

CITY OF TOLEDO TRANSPORTATION SYSTEM PLAN

FIGURE 17
Recommended Bicycle Facility Plan

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Chapter 4

Transportation Finance Program

Transportation Finance Program

The City of Toledo has conducted a thorough inventory of the existing transportation system and an analysis of future demands on the system. Although the present transportation system is expected to meet the needs of the community through the horizon year 2015, site-specific problems have created persistent safety and efficiency concerns. In addition, multimodal facilities, such as pedestrian and bicycle paths, are taking an increasing prominent place in the transportation system and will warrant additional facilities to safely accomodate future demand. In response, the City of Toledo has evaluated alternatives and opportunities to enhance the transportation system and identified a series of capital improvements as part of the Recommended Transportation System Plan. This chapter summarizes the planning level cost estimates associated with each improvement strategy and possible funding sources.

4.1 Planning-Level Cost Estimates

Planning-level cost estimates were generated for pedestrian facilities, bicycle facilities and recommended alternatives as described in Chapter 3. Given the constraints of a planning-level analysis (no surveys or detailed engineering designs), these estimates have been based on generic roadway assumptions; no adjustments were made for site-specific conditions such as topographical constraints, existing pavement widths, right-of-way acquisitions and bridge costs. To facilitate prioritization of improvements and allow for manual adjustments to estimates based on varying roadway conditions, all costs are identified by the associated street location and roadway classification.

Sidewalk Facility Assumptions: The costs associated with the recommended sidewalk facility plan are listed in Table 3. The estimates are broken down by curb and sidewalk costs and based on the current market price ($7 per linear foot of curb and $19 per square yard of sidewalk). The unit price for sidewalks assumes a 4 inch thick sidewalk on 2 inches of aggregate base. Curb costs were not applied to off-street paths. A conservative 40% contingency cost has been applied to the subtotals for engineering fees, inflation and unforeseen circumstances. The estimates do not include right-of-way costs or structures such as bridges over Depot Slough for the off-street paths.

Bicycle Facility Assumptions: The costs associated with the recommended bicycle facility plan are listed in Table 4. The estimates are based on generic roadway conditions assuming a 1 foot paved shoulder and minimal elevation changes within the right-of-way limits. Both on-street and off-street bike lanes are assumed to have 6 inches of asphalt over 12 inches of rock. This is an extremely conservative design assumed for the purpose of estimating costs without accounting for varying topography along the recommended paths. Since the off-street bike paths are adjacent to pedestrian facilities, striping is still necessary to delineate the two facilities. A conservative 40% contingency cost has been applied to the subtotals for engineering fees, inflation and unforeseen circumstances. The estimates do not include right-of-way costs or structures such as bridges over Depot Slough for the off-street paths.

TABLE 3
Pedestrian Facility Cost Estimates

	Length	Width	Curb Cost	Sidewalk Cost	Subtotal	+ 40% Contingency	Total
ARTERIALS							
Business 20	9,300	8	65,100	157,100	222,200	88,880	311,080
MAJOR COLLECTORS							
E. Slope Rd. (S. of 10th)	2,300	6	16,100	29,100	45,200	18,080	63,280
Sturdevant	11,050	6	77,350	140,000	217,350	89,940	304,290
Butler Bridge Road	400	6	2,800	5,100	7,900	3,160	11,060
NW 1st Street	550	6	1,750	3,200	4,950	1,980	6,930
MINOR COLLECTORS							
E. Slope Rd. (N. of 10th)	4,700	6	32,900	59,500	92,400	36,960	129,360
Burgess Road	1,450	6	10,150	18,400	28,550	11,420	39,970
Arcadia Drive	1,500	6	3,500	6,300	9,800	3,920	13,720
Lincoln Way	1,750	6	12,250	22,200	34,450	13,780	48,230
OTHER							
Local	17,100	6	56,000	101,300	157,300	62,920	220,220
Off-Street	8,500	6	-	107,700	107,700	43,080	150,780
						TOTAL:	**$ 1,314,110**

TABLE 4
Bicycle Facility Cost Estimates

	Lane Length	Path Width	Road Cost	Striping Cost	Subtotal	+ 40% Contingency	Total
ARTERIALS							
Business 20	30,500	6	535,200	7,000	542,200	216,880	759,080
MAJOR COLLECTORS							
E. Slope Rd. (S. of 10th)	4,600	5	67,300	1,100	68,400	27,360	95,760
Sturdevant	25,000	5	365,600	5,800	371,400	148,560	519,960
10th Street	1,500	5	21,900	300	22,200	8,880	31,080
Butler Bridge Road	15,000	5	219,300	3,500	222,800	89,120	311,920
Bay Blvd.	8,100	5	118,400	1,900	120,300	48,120	168,420
"A" Street (S. of Bus. 20)	2,050	5	30,000	500	30,500	12,200	42,700
NW 1st Street	1,250	5	18,300	300	18,600	7,440	26,040
U.S. 229 (S. of U.S. 20)	900	5	13,200	200	13,400	5,360	18,760
MINOR COLLECTORS							
E. Slope Rd. (N. of 10th)	9,400	5	137,500	2,200	139,700	55,880	195,580
Burgess Road	2,900	5	42,400	700	43,100	17,240	60,340
Arcadia Drive	6,500	5	95,100	1,500	96,600	38,640	135,240
Lincoln Way	2,750	5	40,200	600	40,800	16,320	57,120
NW 1st Street	1,250	5	18,300	300	18,600	7,440	26,040
OTHER							
Local	17,100	5	250,100	3,900	254,000	101,600	355,600
Off-Street	8,500	5	124,300	2,000	126,300	50,520	176,820
						TOTAL:	**$2,980,460**

Recommended Alternatives: The costs and term of improvement associated with the recommended alternatives described in Chapter 3 are listed below in Table 5. The estimates are based on the planning level schematic designs. No surveys nor detailed engineering analyses were conducted. It is anticipated that a more rigorous design process will be undertaken prior to implementation of any of the improvements. These preliminary estimates are intended to provide ball-park figures for prioritization and identification of appropriate funding sources.

TABLE 6
Cost Estimates for the Recommended Alternative

Location of Improvement	Term of Improvement	Estimated Cost
BUSINESS 20/"A" STREET		
Recommended Alternative	Immediate	< $1,000
BUSINESS 20/ALDER ST./NW 1ST ST.		
Recommended Alternative	1 to 5 years	$5,000
Recommended Alternative	10 to 20 years	< $1,000
EAST SLOPE ROAD/10TH STREET		
Recommended Alternative	1 to 5 years	$6,000
U.S. 20/EAST BUSINESS LOOP 20		
Recommended Alternative	1 to 5 years	< $1,000
Recommended Alternative	10 to 20 years	$70,000
U.S. 20/W. BUSINESS LOOP 20/HWY. 229	10 to 20 years	$465,000
Recommended Alternative A [1]	10 to 20 years	$400,000
Recommended Alternative B [1]		

[1] Both alternatives are recommended to be carried forward for consideration by ODOT.

4.2 FUNDING SOURCES

Funding for transportation improvement projects typically comes from three sources: Federal, State, and Local governments. A description of the funding sources from each of those three categories follows. In some cases, funds may come from one level of government (such as Federal) to be spent by another level of government (i.e., State).

For each of the funding alternatives listed below, there will be a brief description, a listing of the existing application (i.e., who is presently using this method), and a short discussion of the potential for implementing the alternative in Toledo. No effort has been made to screen the list based upon their political feasibility. The intent is to provide an overview of a number of alternative revenue sources that may be available to fund future transportation improvements in Toledo. It may also be that some of the funding mechanisms have been or are more typically dedicated to maintenance or street repair rather than capital improvements. The decision on how the funds are spent is ultimately a policy issue.

4.2.1 Federal Funding Mechanisms

Intermodal Surface Transportation Efficiency Act (ISTEA)

Description: In 1991 Congress passed and the President signed the Intermodal Surface Transportation Efficiency Act (ISTEA). The act emphasizes flexibility in funding transportation solutions and establishes a series of funding categories for implementation. Funding through the ISTEA Act is targeted to improvements which demonstrate beneficial impacts towards implementing a region's transportation systems plan, enhance the multi-modal nature of the transportation system, and meet local land use, economic, and environmental goals. Previously, federal aid funding was targeted to highways based upon their function or classification (i.e., Federal Aid Primary and Secondary funds were targeted to those roads on designated FAP or FAS routes).

Funding categories created by ISTEA are intended to provide an area with more discretion in allocating federal transportation funds to projects from highway improvements to transit improvements, management systems, and non-vehicular modes such as bicycle and pedestrian improvements.

Existing Application: Transportation improvement projects within the Toledo area are potentially eligible for funding through a number of categories under the ISTEA Act. These categories include:

1. National Highway System (NHS): Highways in this category include all Interstate routes and major urban and rural principal arterials. Highway 20 is identified on the National Highway System.

2. Surface Transportation Program (STP): Funding through this category may be used on any roads (including NHS) that are not functionally classified as local or rural minor collectors. These roads are now collectively referred to as Federal-aid routes. Transit capital improvement projects are also eligible for funding through this category.

Potential: The ISTEA program is expected to continue and will provide the opportunity to fund selected improvements which meet the program criteria. The greatest potential for use of ISTEA funds is on Hwy. 20.

4.2.2 State Funding Mechanisms

1. State Motor Vehicle Fund

Description: The State of Oregon collects the following fuel and vehicle fees for the State Motor Vehicle Fund:

State Gas Tax	$ 0.24 per gallon
Vehicle Registration Fee	$15.00 per year

In addition, a weight mile tax is assessed on freight carriers to reflect their use of state highways. The revenue from the fund is used by ODOT and distributed to cities and counties throughout the state with each city's distribution based on a city's share of statewide population, and the county distribution based on a county's share of statewide vehicle registration.

Existing Application: Both ODOT Region 3 and Lincoln County receive funds from the State Motor Vehicle Fund. The City of Toledo has budgeted $153,000 (including a 1% gas tax) for FY 95/96.

ODOT uses their allocation from the State Motor Vehicle Fund for maintenance and capital purpose. The State Transportation Improvement Program (STIP) describes the capital projects to be funded by ODOT. Local jurisdictions such as Lincoln County and Toledo typically use their allocation of the State Motor Vehicle fund for street maintenance.

The state distributes the State Motor Vehicle Fund local share to cities and counties based on a per capita rate (cities) and share of vehicle registration (counties).

Potential: As population and vehicle registration grow, the total revenue from the State Motor Vehicle Fund will rise. However, if the fees (tax per gallon) stay at current levels, there may be a reduction in buying power due to inflation unless this is offset by greater population growth. The current legislature (1995) is considering recommendations for increases in both the state gas tax and vehicle registration fees.

The current policies on how Lincoln County and Toledo use their respective shares of State Motor Vehicle Fund for street maintenance programs could be changed and the funds could be used for capital improvements. However, unless those maintenance dollars were replaced with funds from another source, this would be a classic case of "robbing Peter to pay Paul" and would seriously undermine the city's program of perpetual maintenance on city streets which is inadequately funded at the present time.

2. Special Public Works Funds (SPWF) - Lottery Program

Description: The State of Oregon, through lottery proceeds passed through the Economic Development Department, has in the past provided grants and loans to local government to construct, improve and repair public infrastructure in order to support local economic development and create new jobs.

Existing Application: SPWF funds have been used in a number of cities for the construction of water, sewer, and limited street improvements. Although the program is capable of funding transportation improvements, its use for that purpose has been limited.

Potential: SPWF funds are limited to those situations in which it can be documented that the project will contribute to economic development of a community and the creation of family wage jobs. The potential must be evaluated on a case by case basis to determine if a particular project might be eligible for funding under this program. From a practical standpoint, these funding requirements make it fairly limited in its potential.

3. Immediate Opportunity Fund

Description: The Oregon Department of Transportation funds the Immediate Opportunity Fund through an annual $5 million allotment from the State Motor Vehicle Fund.

Existing Application: These funds are set aside to provide ODOT the opportunity to respond quickly to transportation improvments that demonstrate a significant benefit to economic development and job creation. There is rigid criteria that must be met to demonstrate the immediate economic benefits of providing a transportation improvement funding through this fund.

Potential: Given the commitment by Georgia Pacific to expand their plant opertation in Toledo, there may be the potential to approach ODOT with a request to fund certain improvements to Hwy. 20 to enhance the truck access to the new facilities.

4.2.3 Local Funding Mechanisms

The following programs are used by cities in the funding of transportation improvements. As noted above, it may be that some of the programs listed below will be appropriate for funding capital or maintenance programs for transportation projects in Toledo.

1. General Obligation Bonds (G.O. Bonds) - Tax Revenue Outside Ballot Measure 5

Description: Bonds are sold by a municipal government to fund transportation (or other types of) improvements, and are repaid with property tax revenue generated by that local government. Voters must approve G.O. Bond sales.

Existing Application: Cities all over the state use this method to finance the construction of transportation improvements. For smaller jurisdictions, the cost of issuing bonds vs the amount which they can reasonably issue creates a problem. Underwriting costs can become a high percentage of the total cost for smaller issues. According to a representative of the League of Oregon Cities, the State is considering developing a Bond Pool for smaller jurisdictions. By pooling together several small bond issues, they will be able to achieve an economy of scale and lower costs.

G.O. bonds fall outside of the limitations of Ballot Measure 5 but require voter approval.

Potential: Within the limitations outlined above, G.O. bonding may be an alternative for funding local transportation improvements.

2. Property Taxes Within the Limit of Ballot Measure 5

Description: Local property tax revenue (city or county) could be used to fund transportation improvements.

Existing Application: Revenue from property taxes ends up in the local government general fund where it is used for a variety of uses. Precedents for the use of property taxes as a source of funding for transportation capital improvements can be found throughout the state. However, with the limitations resulting from Measure 5, use of property taxes for transportation capital improvements will continue to compete with other general government services under the funding limitation set by Measure 5 for general government services (i.e., within the $10.00 limitation).

Potential: The potential for increased funding from property tax revenue is limited by Ballot Measure 5 and by competition from others who draw funds from the general fund.

3. Revenue Bonds

Description: Revenue Bonds are those bonds sold by a city and repaid with "revenue" from an enterprise fund which has a steady revenue stream such as a water or sewer fund. The bonds are typically sold to fund improvements in the system which is producing the revenue.

Existing Application: Revenue bonds are a common means to fund large high cost capital improvements which have a long useful life. A sewage treatment plant is a good example where the high construction cost over a short period makes it difficult to pay for from operating funds, yet a long term revenue stream from sewer revenues makes the sale of bonds a viable alternative which spreads the cost of the facility improvement over a long period of time.

In 1989 the City of Independence sold revenue bonds to fund street improvements with vehicle fuel tax revenues pledged as the method of repayment.

Potential: The City could sell revenue bonds with any one of several revenue streams pledged to repay the bonds. The bond underwriters will look at the reliability of the revenue stream when rating the bonds and assigning an interest rate.

4. Transportation System Development Charges (SDC)

Description: A transportation system development charge (SDC) is a sliding scale fee which is charged all new development to pay for transportation improvements which will be 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.

Existing Application: Numerous cities and counties within Oregon presently charge transportation system development charge (SDC) - Washington County, Clackamas County, Eugene, Springfield, Medford, and Lake Oswego are some who are currently using SDC's. Gresham is currently considering implementing a transportation SDC as is Salem. They are sometimes called a traffic impact fee or TIF.

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 of determining the amount which may be charged by a SDC, the types of eligible projects for funding, and annual review provisions.

The following items are some typical features of a SDC.

- They are collected based upon a developments impact on the transportation system.
- The proceeds from the collection of the fees are used to fund a portion of the projects needed to increase the transportation system capacity.
- The fee should be reasonable and affordable so as to not prohibit or displace future development to an area without the fee.
- Where possible, the fee should be implemented on an area wide basis to avoid variances in the costs associated with development within a community.
- Projects eligible for funding by a SDC are a part of an adopted Capital Improvements Program.

Potential: The use of a transportation SDC is an alternative for use to fund growth related transportation improvements but due to the anticipated modest growth levels in Toledo, would not likely generate a significant number of dollars.

5. Local Gas Tax

Description: Toledo or Lincoln County could implement a local gas tax that would be in addition to the state gas tax it currently receives.

Existing Application: Five jurisdictions within Oregon have a local gas tax - the City of Woodburn ($0.01/gallon), Washington Co. ($0.01/gallon), Tillamook ($0.015/gallon), The Dalles ($0.01/gallon), and Multnomah Co. ($0.03/gallon). The local gas taxes have raised the following amounts:

Woodburn	One Cent/Gallon	$ 112,490	(1993)
Tillamook	One & A Half Cents/Gallon	$ 98,000	(1991)
The Dalles	One Cent/Gallon	$ 291,000	(1991)
Multnomah County	Three Cents/Gallon	$7,466,643	(1993)
Washington County	One Cent/Gallon	$1,602,209	(1993)

The Washington County gas tax is shared with cities within the County on a per capita basis. The cities of Tillamook and The Dalles are responsible for collection of their local gas tax. The remaining jurisdictions rely upon the State Department of Motor Vehicles for collection and then distribution back. The State charges an administrative fee for collection.

Potential: The existing fuel tax revenue received from the State Motor Vehicle Fund is used for street maintenance. If a local tax were added, Toledo could target those funds to either maintenance or capital improvements.

6. Local Vehicle Registration Fee

Description: Like a local gas tax, Toledo or Lincoln County could implement a local vehicle registration fee. This would operate similar to the existing statewide vehicle registration fee.

Existing Application: There are presently no cities or counties in Oregon that charge a local registration fee. This option has been discussed by Marion County in the past with the decision made not to pursue it. The Portland Metropolitan region is discussing this option as a potential source of funding for an Arterials Streets Program.

Potential: State wide, the number of vehicles registered is 2,555,000, vs a Statewide population of 2,979,000. This yields a ratio of .86 vehicles per person. If this ratio is applied to Toledo, the estimated number of vehicles in the City would be roughly 3,010. Based upon that number of vehicles, a registration fee of $5.00 would generate $15,050 on an annual basis.

Collection of a local vehicle registration fee might be accomplished through the State of Oregon Department of Motor Vehicles. It is likely that the state would charge a small administrative fee to recover the administrative costs of collecting and distributing a local fee.

7. Street Utility Fee

Description: The principal behind a street utility fee is that a street is a utility used by the citizens and businesses of a city just like a water pipe or a sewer that supplies a connection to a home or business. A fee would be assessed to each business and household by the city based on average use of city streets generated by the individual. As an example, a single family home typically generates 10 trips per day so the fee is based upon that amount of use. A small retail/commercial use typically generates 130 trips per day per 1000 sq. ft. of size, so the fee for the retail/commercial use is significantly greater than the single family residence.

Existing Application: This fee is being used in Medford, where it is raising approximately $1.3 million dollars a year. The amount of the fee is based upon the land use classification which relates to trip generation. A single family residence (generating 10 trips per day) pays $2.00 per month. The street utility fee was implemented in 1991 in Medford and has been challenged in court and sustained on two occasions. The revenue generated by the fee is used for operations and maintenance of the street system. The City of Roseburg has contemplated such a fee in the past. Roseburg presently has a similar fee for storm water charges which they use for operations and maintenance as well as capital construction of storm drainage facilities. The Roseburg storm drainage utility fee has also been challenged and sustained by the courts.

Potential: This approach has met with mixed political success throughout the state. Smaller jurisdictions such as Forest Grove have attempted to implement a street utility fee and found that it was politically unacceptable. An administrative system would have to be put in place to implement this system.

8. Local Improvement District (LID)

Description: Through a local improvement district (LID), a street or other transportation improvement is built and the adjacent benefitted (i.e., local) properties are assessed a fee to pay for the improvement.

Existing Application: LID programs have wide application, including in Toledo. The LID method is used primarily for local or collector roads, although arterials have been built using LID funds in certain jurisdictions.

Potential: Depending upon the funding source, this method may come under the tax limitation of Ballot Measure 5. If G.O. bonds are sold to provide funding with the LID revenues used to repay the bond, the bond sale would require voter approval or would need to come under the Ballot Measure 5 tax limitation. The usual method of repayment of an LID, is through direct assessments to property owners who benefit from the improvement. Some type of LID program could be set up and funded through G.O. bonds and would then become self funding as projects were paid for by adjacent property owners.

Appendix A

Level of Service Definitions

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]

Table A1
Level of Service Definitions

Level of Service	Average Delay per Vehicle to Minor Street
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 stopped 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 cucle 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 noticable. 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 noticable.
E	Average stopped delays are 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 occurances.
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 rations below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also contribute to such high delay levels.

[1] Most of the material in this appendix is adapted from the Transportation Research Board, *Highway Capacity Manual*, Special Report 209 (1985).

Signalized Intersections

The six LOS grades are described qualitatively for signalized intersections in Table A1. Additionally, Table A2 identifies the relationship between level of service and average stopped delay per vehicle. Using this definition, a "D" LOS is generally considered to represent the minimum acceptable design standard.

Table A2
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	40.0 to 60.0
F	> 60.0

Unsignalized Intersections

The calculation of LOS at an unsignalized intersection requires a different approach. The *1985 Highway Capacity Manual* includes a methodology for calculating the LOS at two-way, stop-controlled intersections. For these unsignalized intersections, LOS is defined using the concept of "reserve capacity" (i.e., that portion of available hourly capacity that is not used). A qualitative description of the various service levels associated with an unsignalized intersection is presented in Table A3. A quantitative definition of LOS for an unsignalized intersection is presented in Table A4.

Table A3
General Level of Service Descriptions for Unsignalized Intersections

Level of Service	Average Delay per Vehicle to Minor Street
A	• Nearly all drivers find freedom of operation. • Very seldom is there more than one vehicle in the queue.
B	• Some drivers begin to consider the delay an inconvenience. • Occasionally there is more than one vehicle in the queue.
C	• Many times there is more than one vehicle in the queue. • Most drivers feel restricted, but not objectionably so.
D	• Often there is more than one vehicle in the queue. • Driver feel quite restricted.
E	• Represents a condition in which demand is near or equal to the probable maximum number of vehicles that can be accomodated by the movement. • There is almost always more than one vehicle in the queue. • Drivers find the delays approaching intolerable levels.
F	• Forced flow. • Represents an intersection failure condition that is caused by geometric and/or operational constraints external to the intersection.

Table A4
Level of Service Criteria for Unsignalized Intersections

Reserve Capacity (pcph)	Level of Service	Expected Delay to Minor Street Traffic
≤ 400	A	Little or no delay
300-399	B	Short traffic delays
200-299	C	Average traffic delays
100-199	D	Long traffic delays
0-99	E	Very long traffic delays
*	F	*

* When demand volume exceeds the capacity of the lane, extreme delays will be encountered, with queuing that may cause severe congestion and affect other traffic movements in the intersection. This condition usually warrants intersection improvement.

The reserve capacity concept applies to an individual traffic movement or to shared lane movements. Once the LOS, capacity, and expected delay of all the individual movements have been calculated, an overall evaluation of the intersection can be made. Normally, the movement having the worst LOS defines the overall evaluation, but this may be tempered by engineering judgement. An "E" LOS is generally considered to represent the minimum acceptable design standard.

Experience with the unsignalized analysis procedures indicates this methodology is conservative in that it tends to overestimate the magnitude of any potential problems. This is especially true for minor-street, left-turn movements. For example, the *Highway Capacity Manual* methodology does not take into account the effects of vehicle flow platoons that result from upstream signalization. Vehicles traveling in platoons tend to create greater gaps in the traffic flow, which sometimes provide additional capacity for the side closest to the signal. Therefore, the results of any unsignalized intersection analysis should be reviewed with this thought in mind. Generally, LOS E for the minor-street, left-turn movement is considered to be acceptable for unsignalized intersection, although it also indicates that the need for signalization should be investigated.

All-Way Stop Controlled Intersections[2]

There is no accepted procedure for a level-of-service analysis of an all-way, stop-controlled intersection. The procedure used for determining LOS for a four-way or three-way stop-controlled intersection differs from that described for unsignalized intersections. This methodology, which is being reviewed by the Unsignalized Intersection Committee of the Transportation Research Board, uses a capacity estimation method based on headways observed at all-way, stop-controlled intersections in the western United States. The procedure incorporates several important variables, including volume distribution, number of lanes on each approach, and the percentage of right and left turns at the intersection. Intersection performance is measured in parameters similar to signalized intersections: delay, volume-to-capacity ratio, and Level of Service using a scale of "A" through "F". Approach delay on any given leg of the intersection is calculated using the following equation:

$$D = \exp\left(3.8 * (SV/C)\right)$$

Where D = vehicle delay on a given approach (sec/veh)

SV = subject approach volume (vehicle per hour [vph])

C = calculated approach capacity (vph)

exp = base of natural logarithms

In this equation, the quantity SV/C is simply the volume-to-capacity ratio on the approach under consideration. Table A5 presents LOS criteria for all-way, stop-controlled intersections.

Table A5
Level-of-Service Definitions (All-way, Stop-Controlled Intersections)

Level of Service	Average Delay per Vehicle to Minor Street
A	< 5 Seconds
B	5 to 10 Seconds
C	10 to 20 Seconds
D	20 to 30 Seconds
E	30 to 45 Seconds
F	> 45 Seconds

2 Kyte, Michael, *Estimating Capacity and Delay at an All-Way Stop-Controlled Intersection*. University of Idaho, Department of Civil Engineering Research Report September 1989.