The Feasibility of Light Rail Transit For Spokane

WA-RD 66.1

March 1985

Washington State Department of Transportation
Planning, Research and Public Transportation Division
Research Office

The Feasibility of Light Rail Transit For Spokane

Prepared by
The TRANSPO Group, Inc.
23 - 148th Avenue S.E.
Bellevue, Washington 98007

Final Report

March 1985

Prepared for

Washington State Department of Transportation
Planning, Research and Public Transportation Division
Transportation Building
Olympia, Washington 98504

EXECUTIVE SUMMARY

With the recent acquisition of the Milwaukee Railroad right of way (ROW) by Spokane County, there has been renewed interest in establishment of passenger rail service in Spokane. In response to this interest, the Washington State Department of Transportation funded this study of Light Rail Feasibility in Spokane. The study effort was carried out as a cooperative effort among the Washington State Department of Transportation (WSDOT), the Washington State Transportation Center (TRAC) and a Steering Committee which included representatives of local agencies and members of COLT. The Steering Committee identified the corridors to be analyzed, established the evaluation criteria and participated in the evaluation.

The evaluation criteria were established during the early months of the study, and were based upon research into the reported characteristics of other North American Light Rail Transit (LRT) systems. These criteria included ranges for cost, environmental impact, route availability, and funding availability. The most important criterion was that set for minimum ridership forecasts. It was decided that, to be feasible, a very low capital cost LRT would require a minimum of 900 peak hour, peak direction riders. A higher quality, higher cost LRT would be feasible with a minimum of 1,700 riders.

Throughout the course of the study, extensive use was made of demographic forecasts prepared by the Spokane Regional Council (SRC). The target year for the feasibility study was 2000, and SRC had prepared regional forecasts of population and employment for that year. These forecasts indicated that the Spokane planning area (all of incorporated Spokane plus most of Spokane County) would experience growth between 1980 and 2000 of about 66,000 people and 13,000 jobs (with only 200 new jobs in the downtown). The lack of employment growth in the downtown indicates that new commuter travel demand will not focus upon the downtown, and thus, would be difficult for a line haul rail system to serve effectively.

Because of the availability of county-owned right of way in the Spokane Valley, the East Corridor was chosen as the highest priority corridor. Detailed examinations of the likely alignment of a Valley LRT were used to prepare capital cost estimates, which indicated that a Valley LRT could very reasonably be identified as a low-capital cost line. Ridership forecasts,

using SRC demographic forecasts and a micro-computer forecast modeling system, were generated for 2000. The results indicated that 6,580 daily and 610 peak hour, peak direction riders could be expected for an East Valley LRT. This forecast was considerably short of the minimum criterion of 900 peak hour, peak direction riders. Lack of minimum ridership was a fatal flaw in East Valley LRT feasibility. The Steering Committee therefore chose to devote remaining resources to a less-exhaustive examination of LRT feasibility in the next-highest priority corridor.

Spokane's North Corridor was the second-most likely LRT candidate. Right of way opportunities were not so attractive as those in the East, but more dense development and higher existing transit demand indicated a stronger potential for LRT ridership. Capital cost estimates indicated that a North Corridor LRT would be a medium cost investment. Ridership forecasts for the North Corridor were based upon the earlier computer modeling efforts, and the presumption that the LRT line could be placed in the Division Street corridor. The forecast resulted in 12,970 daily and 1,210 peak hour, peak direction riders, which was compared to the minimum criterion of 1,700 peak hour, peak direction riders for a medium cost system. The lack of sufficient ridership therefore became a fatal flaw for North Corridor LRT feasibility.

The conclusion of the Spokane LRT Feasibility Study is that light rail transit can not at this time be judged a feasible transportation alternative for Spokane. However, the study recommends that the Milwaukee Railroad ROW in Spokane Valley be preserved for some future transportation use.

ACKNOWLEDGEMENTS

For some years there has been much local interest in the re-establishment of rail passenger service in Spokane. Recently, an active citizens group known as COLT (Citizens on Light Rail Transit) were instrumental in gaining support for this feasibility study of LRT in Spokane.

The present study began in March of 1983, when WSDOT awarded a contract to the Washington State Transportation Center (TRAC). TRAC is a cooperative research organization supported by WSDOT, the University of Washington and Washington State University. A team of TRAC researchers from three state universities was organized under the direction of Associate Professor G. Scott Rutherford of the University of Washington, and began its efforts towards assessing the feasibility of LRT in Spokane.

A steering committee composed of transportation professionals and private citizens from Spokane was established to make policy decisions throughout the course of the study. This committee identified travel corridors of highest priority, and determined the criteria for final feasibility assessment. After preliminary results in early 1984 indicated low ridership potential in the highest priority corridor, the steering committee decided to channel remaining resources into a less rigorous analysis of the next highest priority corridor.

Because of staff reassignments at TRAC, it was decided that a private transportation planning consulting firm, The TRANSPO Group, Inc., was retained to assist TRAC in completing the LRT feasibility study and preparing this report.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I
INTRODUCTION

With the recent acquisition of the Milwaukee Railroad right of way (ROW) by Spokane County, there has been renewed interest in establishment of passenger rail service in Spokane. In response to this interest and active lobbying by Citizens on Light Rail Transit (COLT), the Washington State Department of Transportation funded this study of Light Rail Feasibility in Spokane.

The purpose of this study was to determine whether or not there is a viable role for light rail transit (LRT) in Spokane over the next several decades. The study process took forecasts of future population, employment and household growth in the Spokane planning area prepared by the Spokane Regional Council (SRC, formerly Spokane Regional Planning Conference) and, using a computer modeling process, prepared estimates of potential LRT patronage on assumed LRT lines in two corridors of the region. These ridership forecasts were a primary criterion for the feasibility evaluation.

The study effort was carried out as a cooperative effort among the Washington State Department of Transportation (WSDOT), the Washington State Transportation Center (TRAC) and a Steering Committee which included representatives of local agencies (city, county and SRC) plus members of COLT. The Steering Committee identified the corridors to be analyzed, established the evaluation criteria and participated in the evaluation.

A Note on the Regional Growth Forecasts

From the standpoint of Light Rail Transit feasibility, the growth projections supplied by the SRC precluded any realistic expectation of support for a rail system in Spokane over the next 15-20 years. A review of the major elements of these forecasts -- regional population and employment -- illustrates the difficulty in justifying LRT in Spokane.

According to forecasts prepared by SRC, the Spokane metropolitan planning area is expected to grow by 20.5 percent over the next 15-20 years, from 322,700 persons in 1980 to 389,200 persons by 2000. This translates to an annual growth rate of less than 1 percent per year. Most of this growth will occur in the outlying suburban/rural areas, implying a typical urban sprawl scenario of low density, single family subdivisions expanding outward from the city center along major transportation corridors.

Total employment in the Spokane planning area is forecast by SRC to grow by only 13,000 jobs from 1980 (126,500 jobs) to 2000 (139,500 jobs)-- an overall increase of only 10.5 percent over 20 years, or about 0.5 percent annually. Downtown Spokane, the financial center of the Inland Empire, is projected to experience a net increase of only 173 jobs in this 20-year period.

SRC staff have said that the difference between the population and employment growth rates results from an expected shift in the age distribution of Spokane area residents. SRC expects most of the population growth to occur in the older age groups (aged 50+), i.e., retirees moving into the area, and in the younger age groups (less than 21 years old), i.e., new births; the primary work force population (21-50 years) is expected to remain relatively stable. Thus, SRC expects that many of the new residents of the area will be too old or too young for the work force.

New transportation system investments must focus on serving the needs of new suburban residents who live on the outskirts of the Spokane metropolitan area, but who may work, shop, recreate, etc. in new activity centers outside the current development area. Certainly there will be no need for any major system which focuses on downtown travel; with less than 200 new jobs in 2000 than in 1980, there will not be any new activities to attract new suburban residents. In fact, the most critical transportation needs in the Spokane Central Business District (CBD) will be to move more vehicles through (rather than to) the CBD to jobs and commercial activities outside the Spokane planning area.

The implications of these regional forecasts for LRT are clear. With low density suburban sprawl on the one hand, and a stagnant CBD on the other, LRT lacks a significant market of either trip producers (such as multifamily housing along a linear corridor) or trip attractors (new office and retail development in the CBD). The scattering of population and employment growth throughout the region can best be served by carpooling and traditional bus transit.

As the ensuing analysis will show, LRT ridership projections for the Spokane planning area fall short of minimum levels needed to support any fixed rail system in Spokane. The regional growth forecasts do not generate enough new trips which could be served by rail transit, even with the most favorable assumptions about the distribution of population and employment growth for the Spokane region.

The Report

The following chapters of this report are organized to summarize the study that has been underway since Spring of 1983, and to relate the important results of the analysis undertaken by study team members. Chapter II describes aspects of Spokane that have relation to the study, contains a discussion of the demographic forecasts that underlie the travel forecasts reported herein, and lists the people and events important during the progress of the work. Chapter III attempts to place Spokane LRT in a national perspective by comparing characteristics of Spokane to those of other cities planning or having LRT. Chapter III also includes a discussion of requirements for Federal funding for mass transit. Chapter IV includes description of the travel corridors in Spokane originally considered for study, and proceeds with explanation of the detailed analysis undertaken for Spokane's North and East Valley Corridors. This chapter also includes the results of ridership forecasts for Spokane LRT, an important criterion for feasibility. Chapter V is an exploration of several "what if" questions that would alter

the forecast ridership. Finally, Chapter VI contains conclusions and recommendations of the study team. A Technical Appendix is a companion to this report: it includes working papers, technical reports, meeting notes, etc., which document the details of the course of the study, but which are not of general interest.

CHAPTER II

THE STUDY

Existing Conditions in Spokane

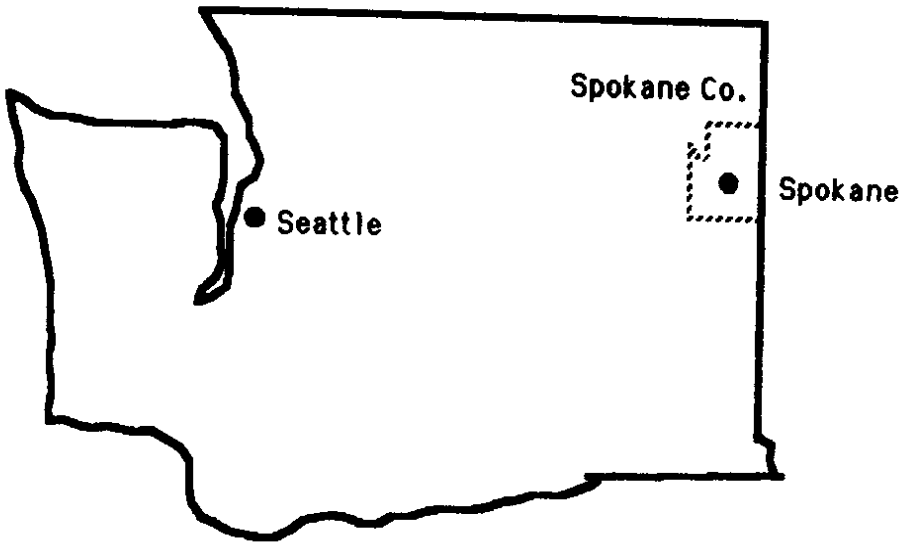
The City of Spokane, Washington is located in Spokane County on the east-central border of the state (see Figure 1). In 1980, Spokane had a population of 171,300 and about 71,000 employees. (1980 Census of Population and Housing, U.S. Department of Commerce). The City is the core of a U.S. Census Standard Metropolitan Statistical Area (SMSA) with a 1980 population of approximately 342,000 and an employment of 152,000.

Spokane is often called the capital of the Inland Empire, because it is the dominant city in the Eastern Washington/Northern Idaho/Western Montana area known as the Inland Empire. As such, it functions as the retail, financial and service center for over a million people in an area of 80,000 square miles (Central Business District Plan, City Plan Commission, Spokane, 1978). Employment opportunities in the Spokane region come from all major occupational categories and all major sectors of the economy; this has provided a stable and diverse regional economic base. Although the Spokane metropolitan area has several outlying shopping centers, the downtown has remained the major center of commercial activity (Central Business District Plan).

Figure 2 illustrates major elements of the Spokane planning area. Development and travel in the region are greatly influenced by the City's location on the Spokane River, which provides topographical constraints and barriers.

Gonzaga University, Whitworth College and a community college are located in Spokane, and Eastern Washington University is in Cheney about 12 miles to the southwest. Spokane International Airport, Fairchild Air Force Base and the Medical Lake community are major attractions west of the city.

Transportation in the Spokane region is largely oriented to highway travel. The major facility is I-90, providing regional travel across eastern Washington as well as local freeway access to Spokane's CBD. In 1981, average daily traffic volumes exceeded 52,000 vehicles per day (vpd) adjacent to the CBD. The primary Non-freeway facilities providing for east-west travel from



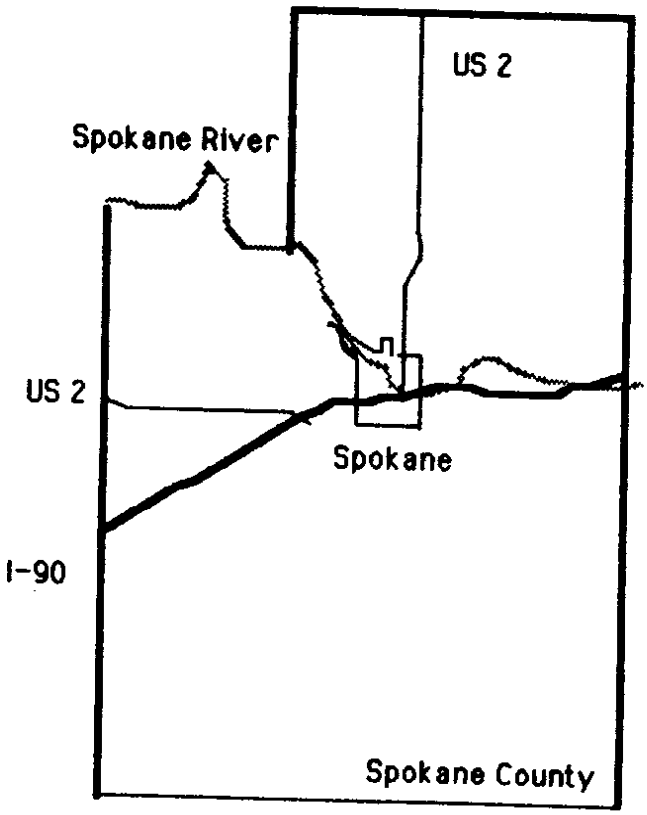


Figure 1. Location.

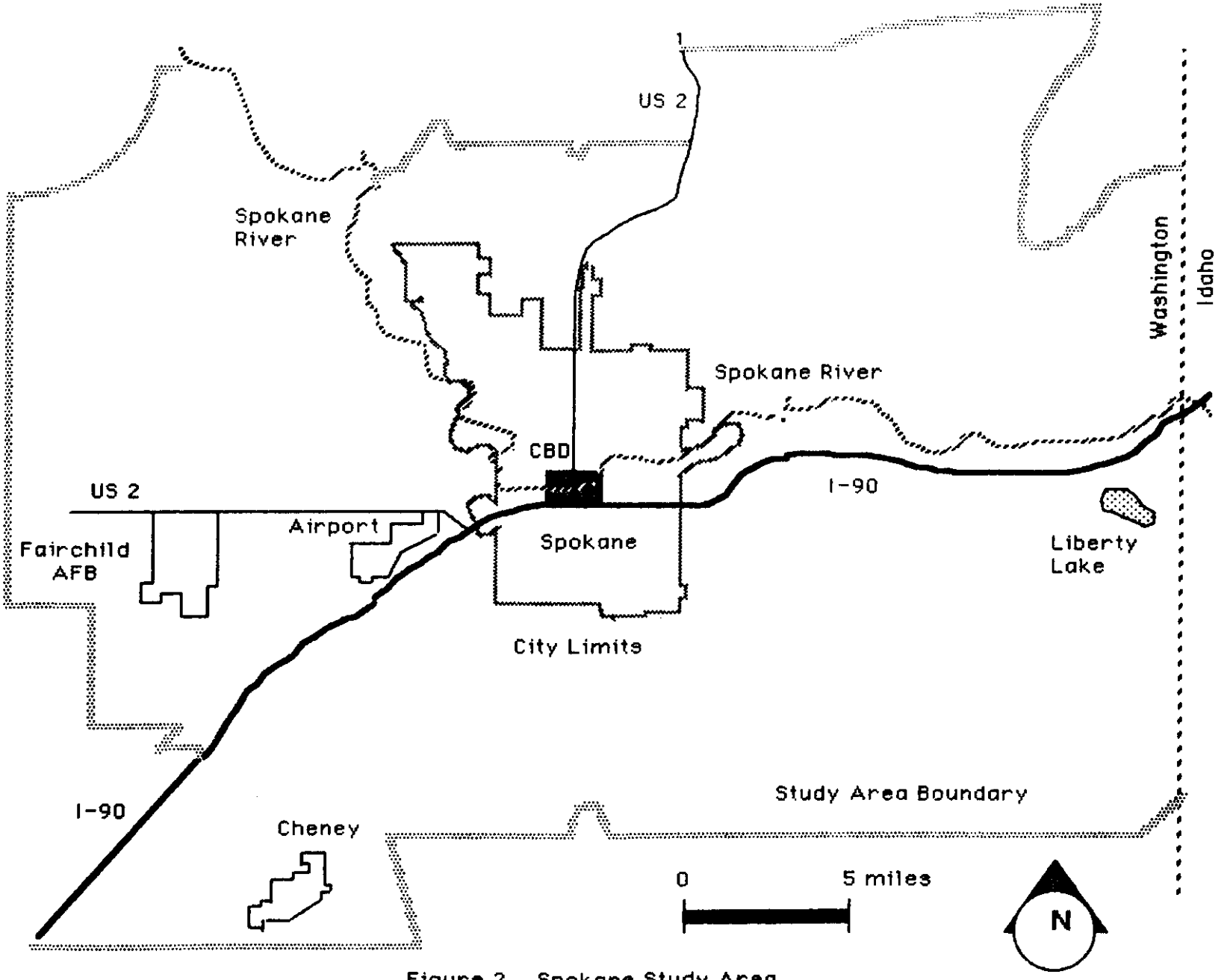


Figure 2. Spokane Study Area.

the CBD into the East Valley are Sprague, Broadway and Trent Avenues. West of the CBD, State Route (SR) 2 is a major regional facility, connecting Spokane to Fairchild Air Force Base and Spokane International Airport. The main north-south regional facility is SR 2, called Division Street within the city limits. South of the city, SR 195 provides connections to Pullman and nearby Moscow, Idaho.

Within the city, a fairly regular arterial grid serves crosstown traffic needs. Several important facilities parallel Division Street; these include Ash, Maple, Monroe, Wall, Nevada and Crestline Streets and the Market/Greene/Freya corridor, all of which carry considerable traffic between the north city limits and I-90. North-south travel is less prominent south of I-90; Grand Boulevard and the Ray/Thor Street corridor are most important. Major east-west arterials include Francis, Wellesley, Garland and Mission Avenues to the north, and 29th Avenue to the south.

Spokane's CBD extends from I-90 on the south to the Spokane River on the north, and from roughly Cedar Street on the west to Division Street on the east. Vehicular travel within this core area takes place on a primarily one-way street grid. Traffic from the north enters the CBD via one of four bridges over the Spokane River: the Maple Street Toll Bridge, Monroe Street, Washington Street and Division Street. (A new river crossing is under construction at Hamilton Street, about 10 blocks east of the CBD.)

Pedestrian travel within the CBD focuses upon a rather unique system of skybridges and overhead walkways. Major retail and financial buildings are connected to a network of completely enclosed and climate-controlled walkways; skybridges allow pedestrians to cross streets without exposure to Spokane's extreme climate.

Figure 3 illustrates the remaining element of Spokane's transportation system: bus service provided by Spokane Transit Authority (STA). STA is operated under a tax base provided by a Public Transportation Benefit Area (PTBA). Route coverage is essentially radial, and the system is operated with timed transfers every 30 minutes in the CBD. The central intersection for CBD transfers is Howard and Riverside; buses have a 2-to-5 minute dwell time in this area to allow transfers.

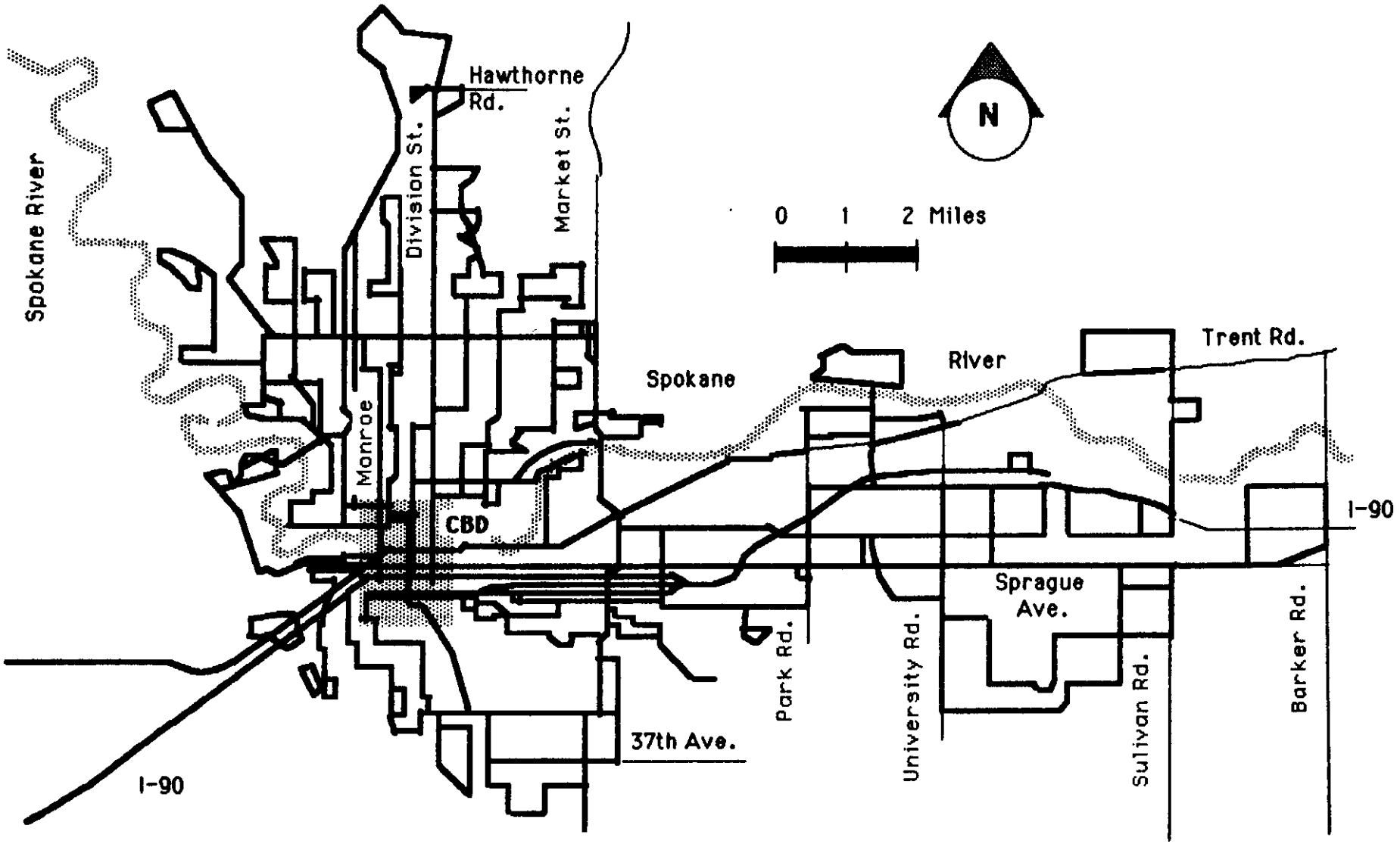


Figure 3. Existing Transit System.

In 1982, STA operated 90 peak hour buses, provided 990 route-miles of service, and carried approximately 7,000,000 passengers (Transit Monitoring Program: Summary Report for June-December 1982, Spokane Regional Planning Conference, January 1983). Average weekday ridership, for the entire system, was about 24,000 per day during the latter half of 1982.

The Problem

This study addressed the issue of whether or not Light Rail Transit (LRT) is feasible to serve a part of the future travel demands in the Spokane metropolitan area. While the study process looked at forecasts of overall population and employment growth and resulting total travel for year 2000 in the Spokane area, the focus was on estimating potential ridership for an LRT line in one or more major corridors in the area.

According to forecasts prepared by the Spokane Regional Council (SRC), the Spokane planning area will experience relatively modest growth over the next 15-20 years. Population is expected to grow from 322,700 persons in 1980 to 389,200 persons in year 2000; this represents an annual growth rate of less than 1 percent per year over the two-decade period. Employment in the region is forecast to grow at an even slower rate (0.5 percent per year) during that time, resulting in the addition of only 13,000 new jobs in the region between 1980 and 2000. The regional growth estimates are summarized in Table 1. The year 2000 forecasts were obtained from SRC in December 1983, and were modified in March 1984 with information from SRC.

The evaluation of LRT feasibility was based in part upon the expected distribution of future travel in the Spokane region. As illustrated in Figure 4, the City of Spokane and most of the surrounding county were divided into four broad corridors emanating from the Spokane Central Business District (CBD). The area shown corresponds to the planning area used by SRC for transportation planning purposes. This analysis looked at the potential for LRT in each of these major corridors.

Table 2 illustrates expected changes in population and employment for each of the four major corridors and for the Spokane CBD. Table 2 also shows the forecasted changes in productions and attractions for each corridor; these are transportation planning measures that are related to population and

Table 1. Regionwide Growth, 1980 to 2000.*

	1980	2000	Increase (%)
Employment	126,500	139,520	10.3
Population	322,715	389,180	20.6
Households	122,890	155,340	26.5

* Totals are for planning area only, not for Spokane County

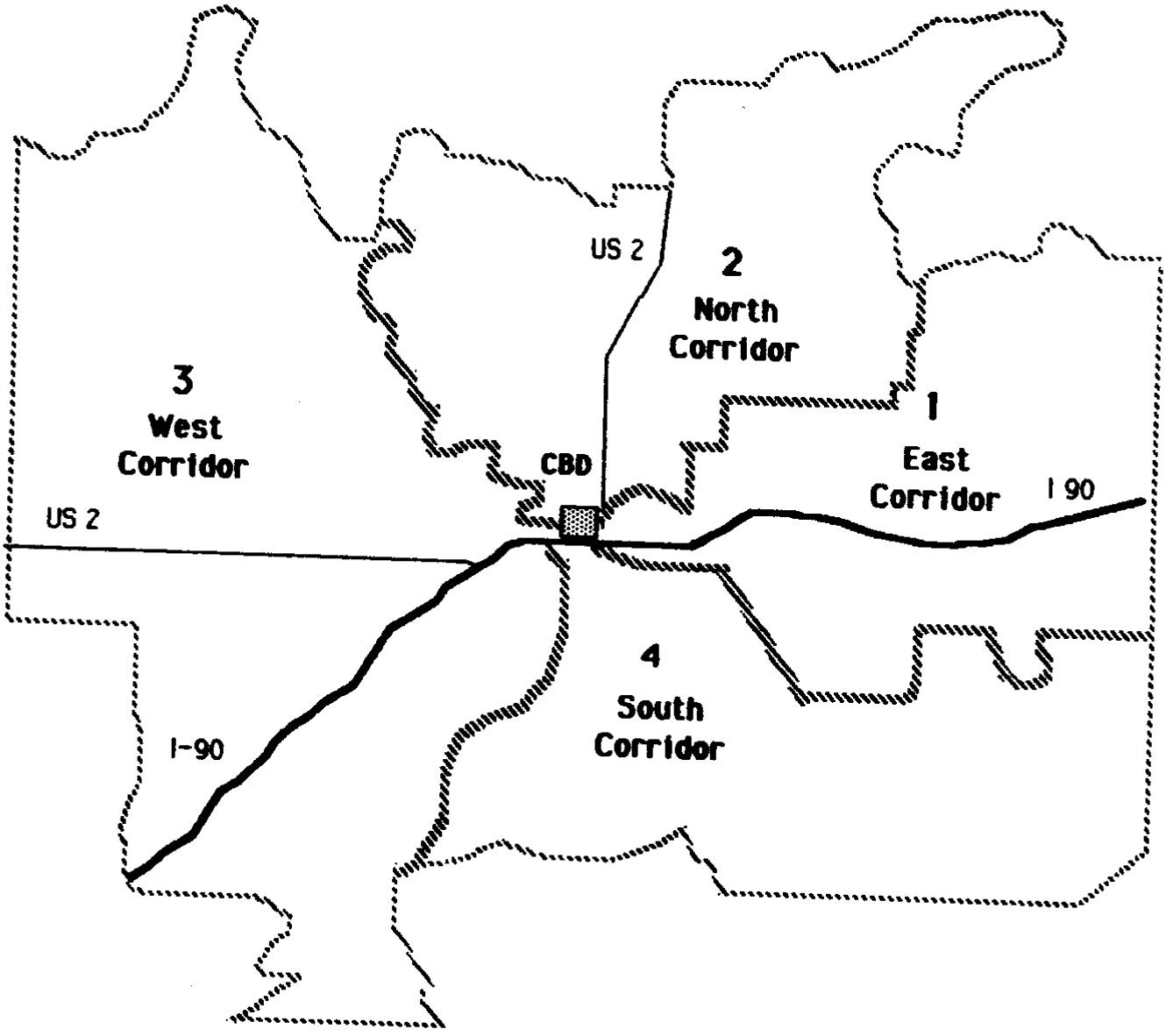


Figure 4. Spokane Region: LRT Feasibility Study Corridors.

Table 2. Changes in Employment, Population and Travel, 1980 to 2000.

Corridor	Employment 1980	Employment 2000	% Increase	Dwelling Units 1980	Dwelling Units 2000	% Increase
East	40,085	50,705	26.5%	34,320	45,640	33.0%
North	41,920	42,480	1.3	52,770	64,040	21.4
West	11,280	12,310	9.1	10,860	14,010	29.0
South	10,355	11,045	6.6	22,900	29,640	29.4
CBD	22,860	23,030	0.5	2,045	2,015	-1.5
Region Total	126,500	139,570	10.3%	122,900	155,350	26.4%

Corridor	Productions 1980	Productions 2000	% Increase	Attractions 1980	Attractions 2000	% Increase
East	308,690	356,420	15.5%	324,220	392,030	20.9%
North	415,120	441,730	6.4	374,900	396,220	5.7
West	87,270	104,090	19.3	85,290	98,340	15.3
South	168,830	194,270	15.1	91,020	105,840	16.3
CBD	39,870	41,920	5.2	144,340	145,980	1.1
Region Total	1,019,780	1,138,430	11.6%	1,019,770	1,138,410	11.6%

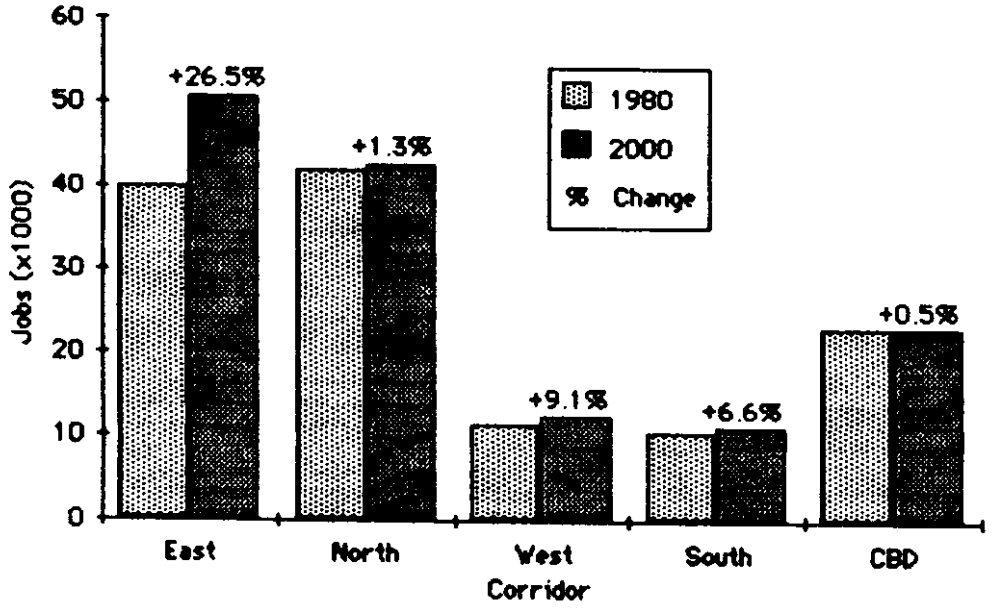
employment. Figure 5 presents part of this information graphically, comparing 1980 and 2000 population and employment forecasts on a corridor-by-corridor basis. The numbers atop the bars in Figure 5 indicate percentage increase between 1980 and 2000 for each corridor.

As the bars in Figure 5 indicate, the East Corridor will experience the greatest growth over the next 15-20 years. The East Corridor is projected to account for 35 percent of all new households and 82 percent of all new jobs in the Spokane planning area between 1980 and 2000. The relative pace of growth in the corridor is evidenced by the single family residential subdivisions which have sprung up in the East Corridor in the early 1980s, the expansion of strip commercial development along Sprauge, and recent announcements of major employers moving into the corridor such as the Hewlett-Packard plant in the Liberty Lake area.

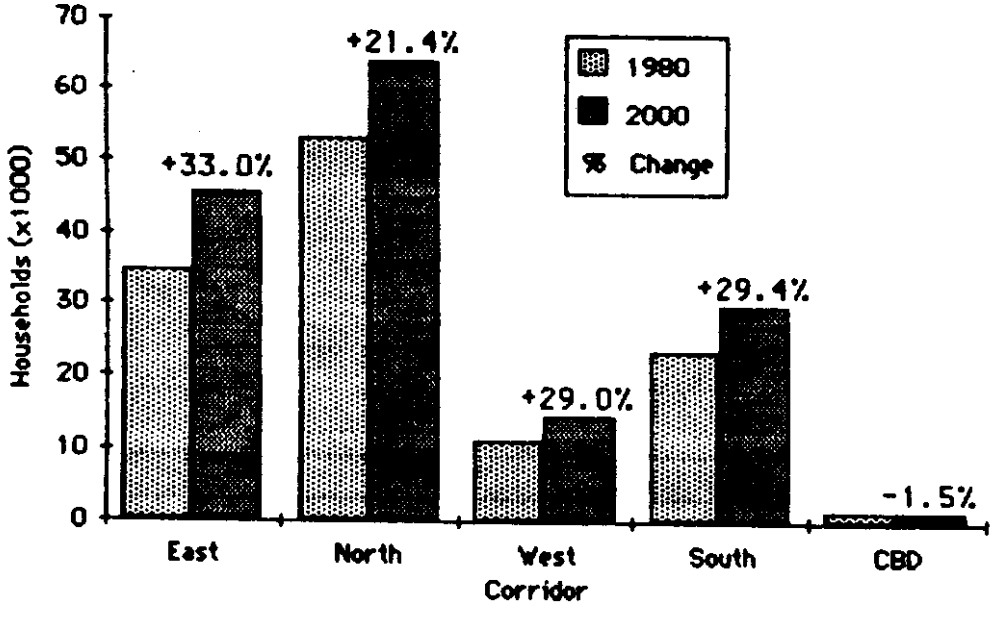
Another one-third of the residential development in the Spokane planning area will occur in the North Corridor north of the Spokane River. This long established residential section of the City of Spokane will continue to spread northward toward the foothills with development occuring along Division Street (SR 2). This corridor, which already contains 43 percent of the region's households, will experience a 21 percent increase between 1980 and 2000. However, SRC forecasts less than 600 new jobs in the North Corridor over the 1980-2000 period, creating a significant need for travel out of the corridor to other parts of the region for work, shopping and recreational activities.

According to SRC's forecasts,other areas of the region will experience much less growth than the North and East Corridors. Downtown Spokane will remain essentially stagnant, with less than 200 new jobs between 1980 and 2000. While the West and South Corridors will experience large percentage increases in households and moderate percentage increases in employment, the relative magnitude of these corridors compared to the North and East Corridors will still be rather small, as clearly illustrated in the bar charts in Figure 5.

Travel Forecasts. In order to evaluate the implications of SRC's growth scenario on regional transportation needs, the number of people and jobs discussed above were translated into total daily person trips for the region. Figures 6 and 7 and Table 2 illustrate the increases in travel that are expected to accompany the increases in population and employment in each corridor. "Productions" and "attractions" are terms used by transportation



EMPLOYMENT GROWTH



POPULATION GROWTH (Households)

Figure 5. Employment and Population Growth, 1980 to 2000.

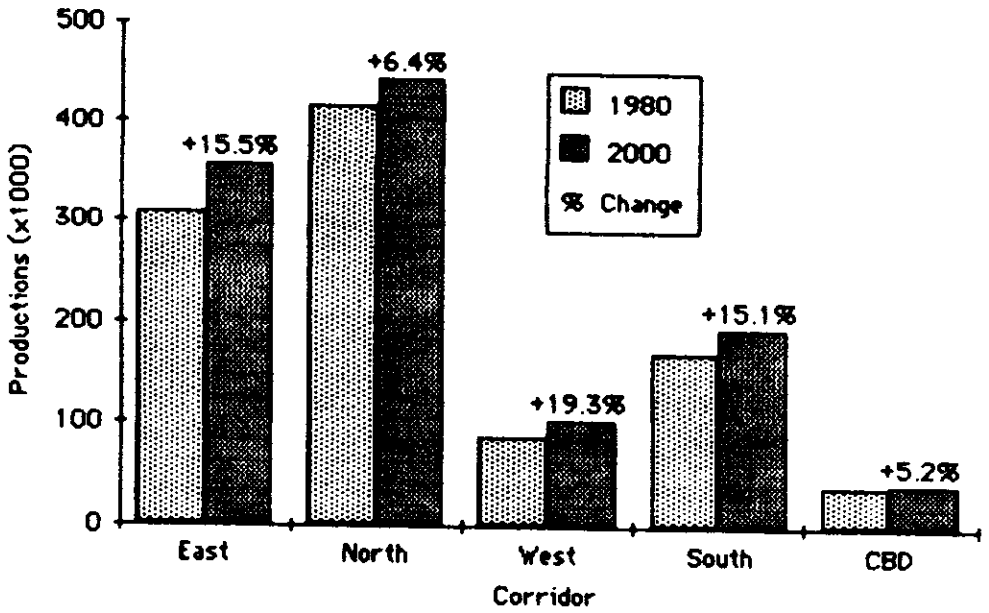


Figure 6. Daily Trip Productions.

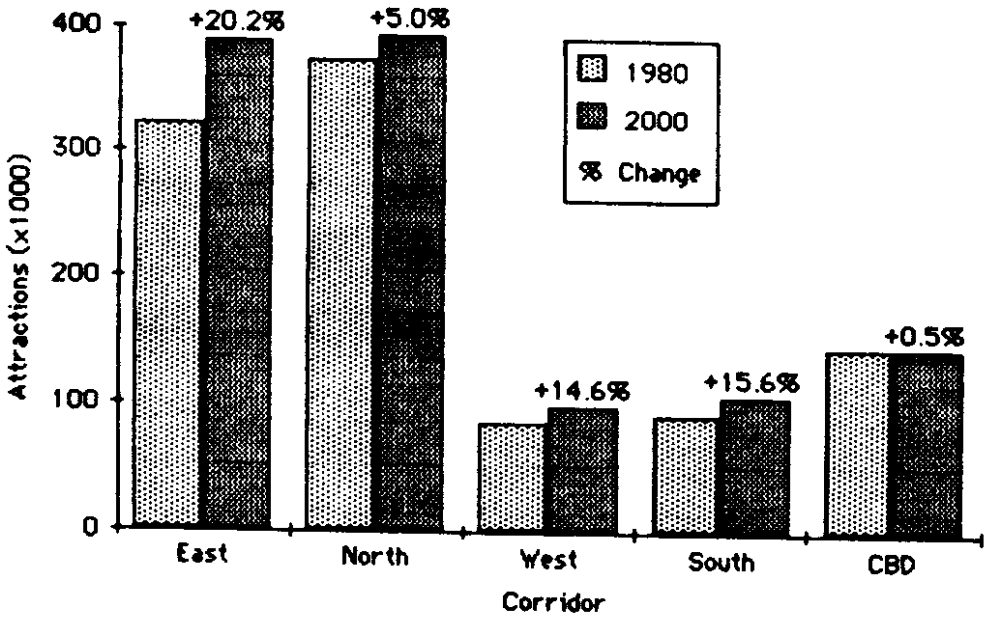


Figure 7. Daily Trip Attractions.

planners to define the amount of trip making for travel in a region. In a simplistic sense, people produce trips and jobs attract trips. Hence, an area with dense residential development will have many trip productions, and an area with high employment will have many trip attractions. The trip totals reported here are the result of travel modeling processes undertaken especially for the LRT Feasibility Study.

Throughout the entire region, daily person trips will increase by about 115,000 (to a regional total of about 1,133,000). Forty percent of the new trips will be produced in the east, with about 20 percent produced in the north and also in the west. Less than 2 percent of all new trips will be produced in the CBD.

Trips attracted to the east will increase by 20.2 percent, with this growth representing almost 60 percent of the region's total. In the north, 18,835 new attractions are estimated; this is an increase of 5 percent in the corridor and represents 17 percent of the total regional increase. Trips attracted to the CBD are expected to increase by only about 750 per day, less than a 1 percent increase over 1980 levels.

The Process

This section is intended to provide a brief description of the activities involved in the feasibility study. It will provide an overview of the study as a whole; later report sections will include elaboration of some items listed below. The Technical Appendix to this report also includes meeting notes, working papers, etc., that supplement this section.

1983

Jan-Feb
- TRAC submits proposal to WSDOT for study of Feasibility of Light Rail Transit in Spokane.
- Steering Committee formed.

Mar
- WSDOT awards a contract to TRAC. Funds are not tax dollars. Subcontracts with Eastern Washington University and Washington State University are negotiated.

Apr
- TRAC team tours east and north Spokane corridors.
- Steering Committee (Planning Sub-committee) approves criteria to be used in identifying highest priority corridors for study.
- TRAC staff suggest criteria to be used in feasibility assessment, and Committee asks for more detail.

May
- Staff continues to collect background information on all corridors to allow selection of single corridor for detailed study.
- First issue of newsletter.

Jun
- Steering Committee selects East Valley as highest priority corridor.
- Second newsletter issued.

Aug
- Planning Sub-committee considers various CBD LRT alignments.
- Systems Sub-committee meets.
- TRAC receives computer model (from FHWA) to be used for ridership forecasts.

Sept
- Steering Committee selects a one-way couplet on Main Street and Spokane Falls Boulevard for CBD alignment. Committee also adopts a set of feasibility criteria.
- Third issue of newsletter published.

Oct
- Steering Committee approves a final alignment for East Valley LRT.
- Study team meets with BN and UP to discuss interface with existing railroad operation.

1984

Apr
- Results of ridership forecast announced to Steering Committee. Criterion is not met; hence a fatal flaw for East Corridor. Committee asks that additional "what if" work be done on East Corridor and that remaining fund be spent on preliminary assessment of North Corridor.
- TRAC contracts with The TRANSPO Group, Inc. to do additional forecast work in East Corridor and to make ridership estimates for a North Corridor LRT (of unspecified alignment).

Establishing Feasibility

A major task of the study's Steering Comittee was the selection of criteria used to determine LRT feasibility. A goal at the outset of the study was to establish these criteria very early on, so that there could be no chance of choosing criteria to fit the results and bias the outcome. Consequently, in April 1983, staff members presented to the Committee a preliminary set of criteria, suggested after extensive research into planning and operations reports from other LRT studies and systems. At the direction of the Steering Committee, study staff members undertook further research with the goal of expanding the criteria from general statements to more specific,

objective ones. In September 1983, the Steering Committee approved and adopted a set of 20 criteria to be used in the final evaluation of feasibility.

Table 3 presents these feasibility criteria in four major categories. (Details about the individual criteria are included in the Technical Appendix to this report. Table 3 includes descriptive information only for quantitative and semi-quantitative criteria.) Perhaps the most important criterion during the remainder of the study was the one set for ridership forecasts. The object was to establish the very minimum ridership that could justify consideration of LRT, based upon experience with other LRT systems. For a very low capital investment system (i.e., generally single track on existing rights-of-way with minimal stations and maintenance facilities), the adopted criterion called for 900-1,100 peak hour-peak direction riders. A more costly system (i.e., dual tracks on new right-of-way) could only be justified with about 1,700 peak hour-peak direction riders.

Table 3. Criteria for Feasibility of Spokane LRT

I. SERVICE FACTORS

Activity Centers Served. The proposed LRT line should serve several major activity centers.

Ridership Forecast. The minimum forecast volume for the year 2000 should be 900 - 1,100 riders per peak hour per peak direction (for very low-capital system).

Corridor Travel Times. The LRT should be able to maintain an overall average schedule speed of 15-20 MPH. Alternatively, the LRT should produce a corridor travel time less than the existing bus time.

Capacity for Future Expansion/Upgrading

Interface with Other Modes

II. COST FACTORS

Capital Cost. The estimated cost per mile of the proposed LRT should not exceed costs determined to be feasible in other recent studies.

Operating/Maintenance Cost. The proposed operating plan should result in estimated farebox recovery of at least 50%.

Funding Sources. Potential sources for capital financing and for future operating deficits should be indentified.

III. URBAN FACTORS

Right of Way Availability. It should be demonstrated that sufficient ROW is available for purchase or lease over the whole length of the proposed LRT line.

Consistency with Regional Goals

Transit-Induced Development

Residential/Business Disruption. The proposed LRT should minimize removal of existing businesses or homes. Mitigation of construction-related business disruption should be outlined.

Joint Development Opportunities

Citizen/Business Support and Institutional/Political Support. Endorsements should be obtained from businesses, citizens' groups, public agencies, Spokane Transit Authority, etc.

IV. ENVIRONMENTAL FACTORS

Air Pollution, Noise Pollution, and Water Pollution. It should be shown that the LRT will not cause environmental impacts more severe than the existing transportation system. Mitigation of temporary construction-related impacts should be outlined.

Visual Impacts

Energy Consumption. An estimate of annual electricity requirements should be made, and availability of the power should be demonstrated.

CHAPTER III
LRT - A NATIONAL PERSPECTIVE

Before examining LRT feasibility in a detailed manner, it is useful to take a brief look at LRT nationwide and see how Spokane ranks with other areas which have or plan to have rail transit. Since a major transit facility would likely be well beyond the capacity of local funding sources, it is useful to examine current federal policy on funding for new light rail construction in the United States.

LRT in Other Cities

At present there are more than 300 light rail systems in operation worldwide and even more under construction. Some of the newest lines are in North America, including LRTs in Edmonton (which opened in 1978), Calgary (1981) and San Diego (1981). Systems are presently under construction in Buffalo, Portland, San Jose, and Vancouver, B.C. Cities with systems in the planning stages include Detroit and Sacramento. Seattle studied the feasibility of LRT as part of an alternatives analysis for its North Corridor, but instead selected an all-bus system with capability to upgrade to LRT in future.

Using 1980 census data, Figures 8 and 9 compare Spokane to U.S. cities having or planning light rail lines. The same cities are listed in Tables 4 and 5, with some statistics comparing their light rail lines. The aforementioned LRT systems in the United States serve or will serve metropolitan areas with populations ranging from 1 to 2 million people and daily transit ridership of 14,000 to 145,000 riders. As can be seen from the figures, Spokane is a relatively small city compared with the others, especially in population, population density, and number of workers. Line lengths for LRT in these cities vary from 6.4 miles to 18.3 miles and expected daily ridership from 24,000 for Sacramento to 145,000 for Detroit. San Diego is the only city shown that has a system actually in service; its line length is 15.9 miles and carries a daily ridership of 14,000.

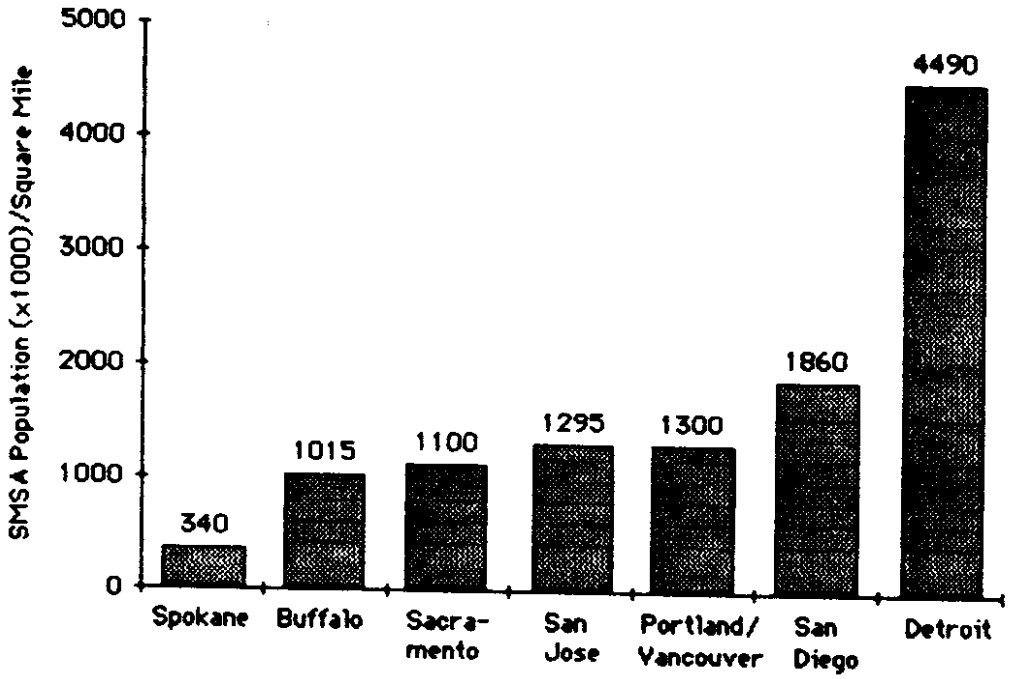


Figure 8. Population in SMSA's Planning or Having LRT.

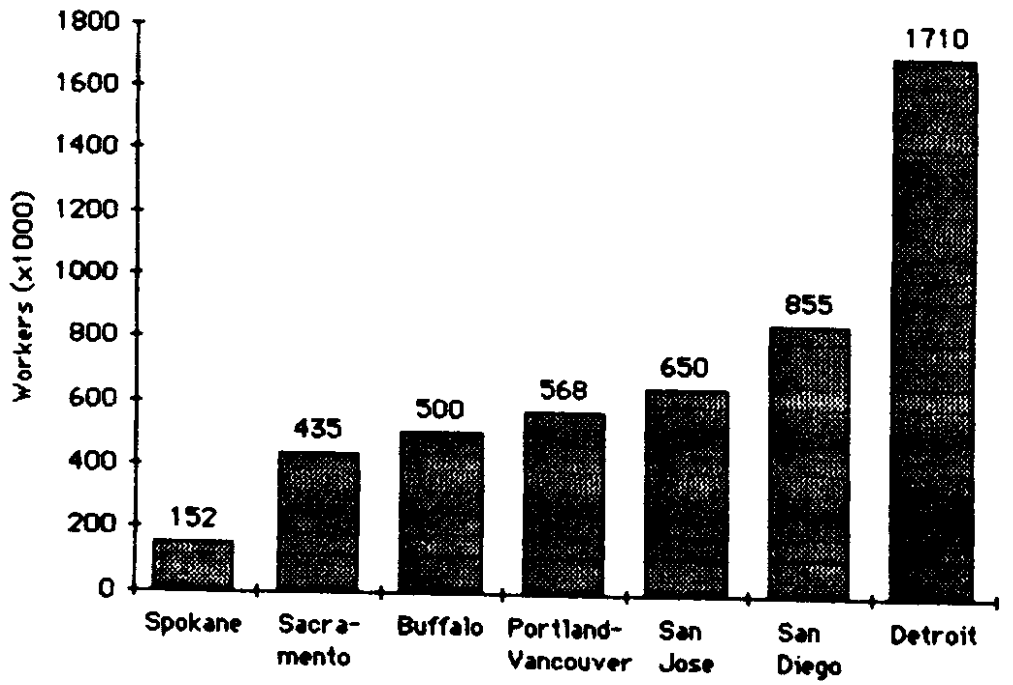


Figure 9. Workers in SMSA's Planning or Having LRT.

Table 4. Spokane Compared to Other SMSA's with LRT.

SMSA	Population (x1000)	Land Area (Sq. Mi.)	Population/ Square Mile	Workers (x1000)	% Transit to Work
Buffalo	1,015	1,086	971	500	6.6
Detroit	4,490	4,495	999	1,710	3.7
Portland-Vancouver	1,300	4,368	298	568	8.4
Sacramento	1,100	5,116	215	435	3.5
San Diego	1,860	4,212	442	855	3.3
San Jose	1,295	1,293	1,002	650	3.1
Spokane	340	1,762	194	152	4.2

Table 5. LRT Statistics for SMSA's

SMSA	Line Length (miles)	Expected Daily Ridership (year)	Status	Service Begins	Expected Construction Costs ($ millions)
Buffalo	6.4	45,000 (1985)	Nearing Completion	1984	535
Detroit	15.0	145,000 (2000)	Preliminary Engineering	1990	750
Portland-Vancouver	15.1	42,000 (1990)	Under Construction	1986	750
Sacramento	18.3	24,000 (1985)	Under Construction	1986	131
San Diego	15.9	14,000 (actual)	In Service	1981	---
San Jose	35.2	40,000 (1990)	Construction to begin in 1985	1987	382

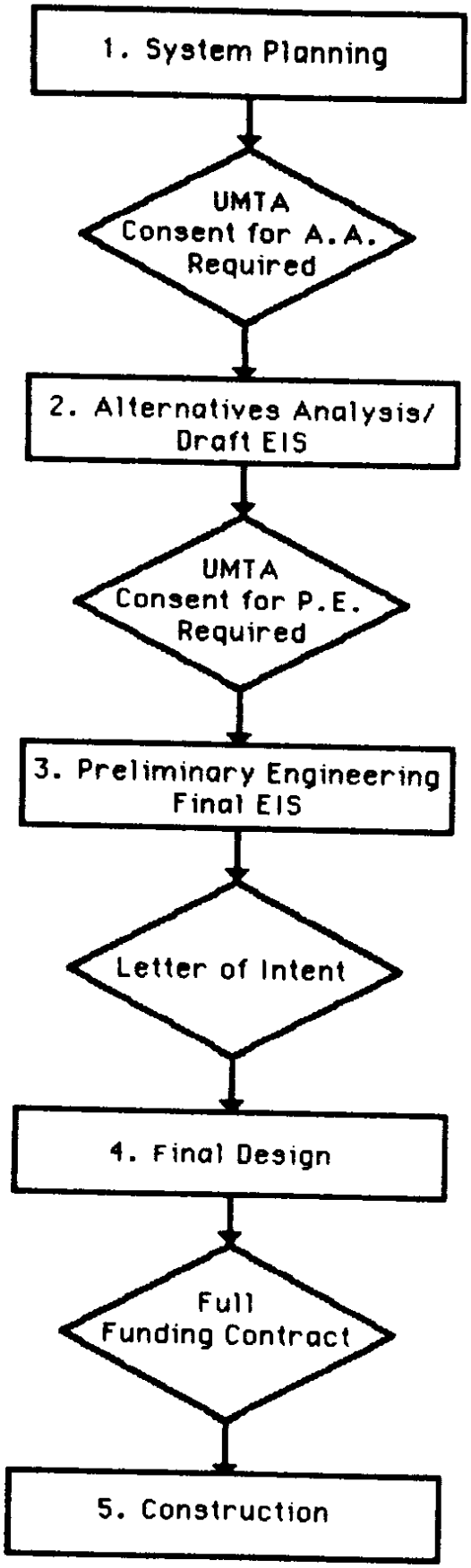
Federal Views on LRT

Federal policies on light rail system construction in the U.S. have been rapidly evolving over the past few years. Shortly after President Ronald Reagan took office in 1981, the Secretary of Transportation issued a policy against federal participation in new rail construction for any cities which had not received at least preliminary funding commitments from the Urban Mass Transportation Administration (UMTA). This move effectively precluded any new rail starts in the U.S. in the foreseeable future. However, in 1983 the U.S. Congress passed a five-cent-a-gallon increase in the federal gasoline tax; one cent of the increase was earmarked for mass transit. Congressional guidelines directed that for FY 1986 and beyond, the monies generated by the one cent gas tax would be divided as follows: 40 percent for rail modernization, 40 percent for new rail construction, 10 percent for extraordinary bus capital projects and 10 percent for miscellaneous needs.

In May 1984, UMTA proposed a revised policy for evaluating mass transit proposals for new fixed guideway systems and extensions to present systems. In December of 1984, conversations with UMTA officials indicated that a major restructuring of present policy is likely. One possible proposal would entirely eliminate UMTA discretionary funding for new rail. Should a discretionary program remain, the criteria used to evaluate rail starts would likely be at least as stringent as those proposed in May 1984.

The May 1984 policy proposal would require UMTA funding applicants to follow a four-phase process in the development of fixed guideway projects. The four-step process as illustrated in Figure 10 includes system planning, alternatives analysis, preliminary engineering and final design. At the conclusion of each step, UMTA would evaluate the merits of the proposal and decide whether or not to fund the next step in the process. Each step in the project development process has certain procedures that must be followed in order to be approved for advancement. The steps are described briefly below.

Systems Planning. The systems planning phase is a part of a metropolitan area's comprehensive transportation planning process. This process develops through analysis of long-range trends and forecasted needs. Local transportation corridors are assessed, and local officials select a broad range of potential solutions for each corridor. The corridors are then ranked for priority and alternative solutions for the highest study.



Source: Federal Register/ Vol. 49, NO. 98

Figure 10. UMTA Project Development Process.

Alternatives Analysis. In order to proceed to UMTA funded alternatives analysis, certain threshold criteria must be proven in the system's planning process. These criteria include (1) evidence of a reasonable possibility that fixed-guideway alternatives will be cost-effective and (2) there must be 15,000 existing daily transit trips in the priority corridor.

If approved, the alternatives analysis phase subjects the priority corridor to a detailed study of alternative transportation solutions including medium- and low-cost options and TSM actions as well as fixed guideway. At the conclusion of the analysis phase, UMTA carries out an evaluation of the study. The evaluation includes an assessment of the relative merits of the project against the relative merits of other projects in the "pipeline."

Preliminary Engineering. The UMTA administrator must issue written approval of a fixed guideway project before it may be advanced into preliminary engineering. This approval can be expected where UMTA finds that the locally preferred alternative is cost effective. One threshold test for this finding is that the proposed project must produce greater benefits in terms of new riders and time-savings benefits for existing riders than the TSM alternative.

The preliminary engineering phase allows the project sponsors to refine the design of the proposal. This phase results in estimates of project costs and impacts.

Final Design. This is the last phase of project development before construction. In order to win funding for final design, the project must be rated higher than other projects awaiting approval. The rating system is based on such criteria as marginal cost per marginal rider, the monetized value of travel time savings for existing riders, and the size of the local capital match.

Upon receipt of approval, the local agency proceeds with final construction plans. During this phase, UMTA and the local agency will negotiate a contract for the Federal share construction funding. Once the final design is approved, the project proceeds to the construction phase period.

Conclusions

Based upon the information above, one would conclude at the outset that the chances of LRT being feasible in Spokane were slim. Population of the Spokane SMSA is one-third that of Buffalo, the next smallest SMSA included in Table 4, and Buffalo's population density is five times that of Spokane, a situation typical of the older urban areas of the East Coast. Spokane's population density compares favorably to that of Sacramento, but Sacramento

has nearly three times as many workers as Spokane, indicating a richer market for LRT work trips.

As regard to the proposed UMTA guidelines for Federal funding, it is important to note that there is a requirement for 15,000 existing daily transit trips in the priority corridor. According to UMTA officials, it is unlikely that this criterion would be less stringent in future than at present, presuming that UMTA continues its discretionary funding at all. By way of comparison, total system wide ridership in 1982 on Spokane's all-bus system was 24,000 per day; ridership in the heaviest corridor was 12,100 (includes all rotues north of the Spokane River and the Coliseum park-and-ride shuttle service). (Transit Monitoring Program: Summary Report for June-December 1982, Spokane Regional Planning Conference, January 1983.)

CHAPTER IV

FEASIBILITY ANALYSIS AND EVALUATION

This portion of the report describes the evaluation of the opportunities that exist in the Spokane region for establishing light rail transit. The major travel corridors will be briefly described, a process which makes obvious the conclusion that only the East and North Corridors are worthy of real consideration. These two corridors will be described in more detail, and the feasibility analysis undertaken in each of the two corridors will be explained. This section closes with a conclusion about the feasibility of light rail transit in Spokane.

Major Travel Corridors

One of the earliest tasks (April 1983) of the feasibility study team was identification of travel corridors in the Spokane region, with a view towards selecting a single corridor as the most likely candidate for LRT. Figure 11 shows the eight narrow corridors that were considered, most of which closely followed major highway network lines. These eight were compressed for further study into five broader corridors, or service areas, as shown in Figure 12. Brief descriptions of these five corridors follow, along with an explanation of the process that led to selection of the East Valley Corridor for detailed study. The Technical Appendix includes the full interim report prepared by team members in May of 1983.

East Valley Corridor. This corridor extends between the Spokane CBD and Liberty Lake near the Idaho border, a distance of nearly 15 miles. I-90 is the major transportation facility in the corridor; important east-west arterials include Trent, Sprague and Broadway. Activity centers in this corridor include a major shopping center (University City) and several small ones, Spokane Community College, fairgrounds and Playfair Race Track. Employment centers include commercial strip development along Sprague, Kaiser Aluminum and Hewlett-Packard. In 1980, the population in the East Valley corridor was 106,000.

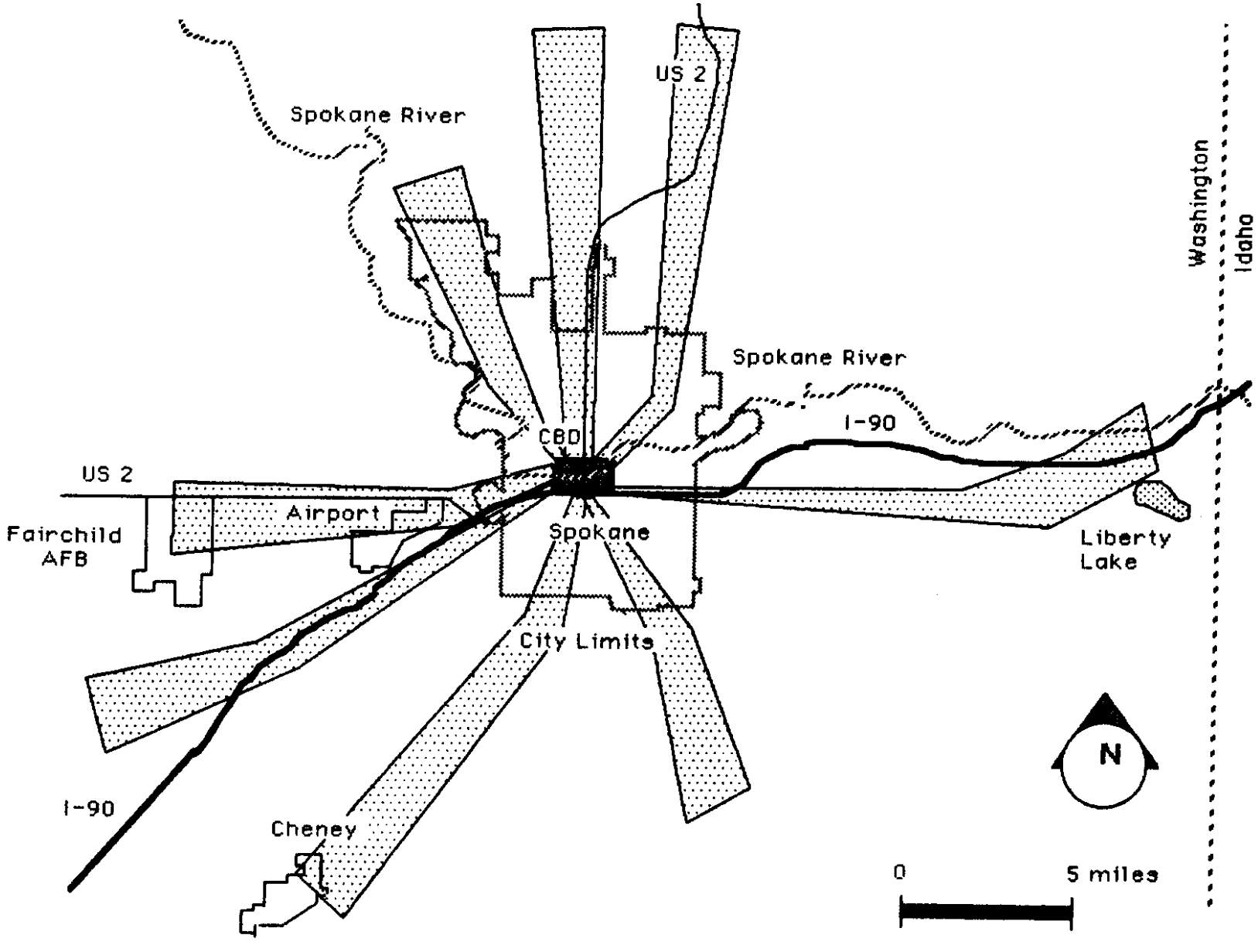


Figure 11. Original Corridors Proposed for Analysis.

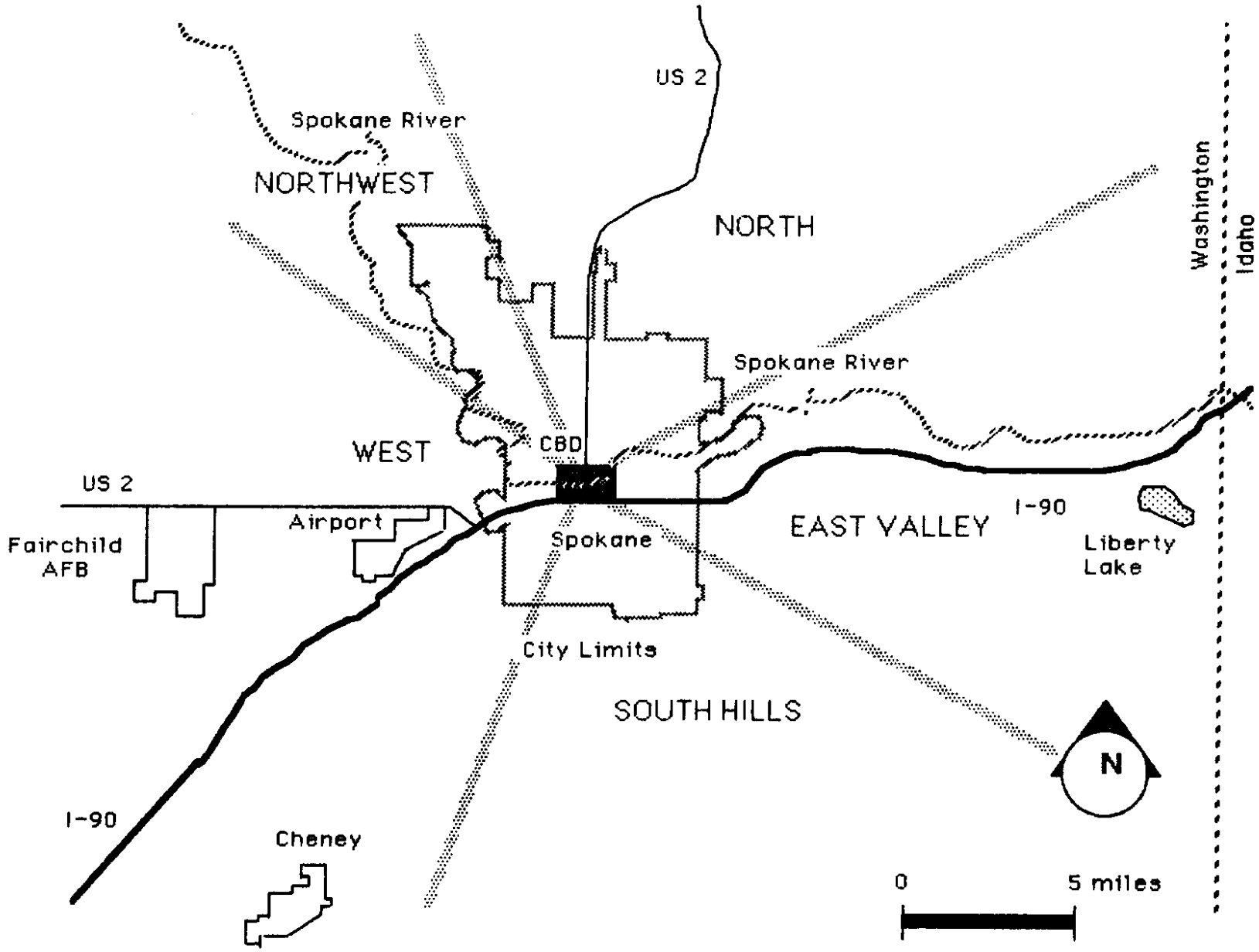


Figure 12. Corridors Selected for Priority Analysis.

Existing transit service in the East Valley Corridor consists primarily of east-west radial routes feeding the CBD; routes extend eastwards as far as Barker Road, about 12 miles from the CBD, and operate on I-90, Trent, Broadway, and Sprague Avenues.

The primary opportunity for LRT in this corridor is a strip of abandoned railroad right of way (ROW) that parallels Sprague Avenue east of Argonne Road to the Liberty Lake area; this ROW is owned by Spokane County. It has been hoped that the above ROW could be utilized somehow to increase people-moving capacity in this corridor; the Milwaukee ROW was considered for future use in the 1980 Major Review of the Spokane Metropolitan Transportation Plan. Additional opportunity for LRT is provided by Union Pacific and Burlington Northern Railroads, which have mainline trackage in the East Valley.

North Corridor. This corridor emanates from the CBD and includes most of northern incorporated Spokane. The primary transportation facility in the corridor is Division Street, or SR 2. Market Street, at the east city limits, Monroe west of the CBD, and Hamilton east of the CBD also carry significant daily vehicle volumes. The Spokane River separates most of the North Corridor from the CBD; four arterial bridges cross into the CBD.

Main activity centers in this corridor include Gonzaga University, Whitworth College, a major hospital and a major shopping center. Strip development lines Division Street; major employers elsewhere in the corridor include Kaiser-Mead and the Northtown Office Building. In 1980, population in this broad corridor totaled 103,000.

The Spokane Transit Authority provides its most dense route coverage within the North Corridor. The system is basically radial, feeding the CBD, but with more extensive neighborhood coverage than is provided in the East Valley. Major routes operate north/south on Division, Wall, Monroe, Maple/Ash, Nevada, Crestline and Market Streets.

Increasing travel capacity within the North Corridor has long been a recognized need in Spokane, and has been the focus of earlier planning efforts. This proven and relatively high travel demand directed toward the CBD provides the primary reason to further consider the North Corridor. Additionally, there are existing railroad ROWs in the corridor that provide possible opportunities for joint use of existing trackage. These include Burlington Northern industrial track extending northeasterly between Pearl Street and Market Street, and additional trackage through Burlington

Northern's Hillyard Yard, paralleling Market Street between Wellesley Avenue and Lincoln Road.

Northwest Corridor. This corridor starts in the CBD and extends to the northwest along the east bank of the Spokane River. Once away from the CBD, the corridor is largely low density residential without major employment centers. Activity centers include the Coliseum, Albi Stadium, and parks and scenic areas along the River. In 1980, population in this corridor was 43,000, less than half that in the North or East. There is little existing rail ROW in the Northwest Corridor; LRT here could not take advange of joint use tracks.

West Plains Corridor. The broad corridor west of the CBD encompasses many major activity centers, all of which are widely dispersed. These include Spokane International Airport, Eastern Washington University at Cheney, Fairchild Air Force Base, and the communities of Medical Lake and Airway Heights. I-90 and SR 2 carry major traffic volumes within the corridor; other important highways are the Cheney-Spokane Road, SR 902, SR 904, and SR 195. In 1980, this area had a population of 47,000. Bus service is provided to Medical Lake, Fairchild AFB and Cheney. LRT opportunities within this West Plains Corridor include active and abandoned railroad ROWs which connect many of the activity centers to the City.

South Hills Corridor. The southerly wedge emanating from the CBD has been labeled the South Hills Corridor. 1980 population was about 41,000 in this corridor and some of the area's most dense housing development is found here. Grand Boulevard, Ray Street and Monroe Street provide primary north-south access; 29th Avenue is a major east-west arterial. Major activity centers are two hospitals and local shopping areas. I-90 separates the CBD from the rest of this corridor. Transit service within the City limits is fair; major centers are linked to each other and to the CBD.

Corridor Selection Criteria. The Steering Committee realized at the outset of the feasibility study that available resources could best be spent if research was focused upon a single corridor. To this end, staff members worked with the Steering Committee to identify a list of corridor selection

criteria to be used in the selection of the corridor most deserving of detailed study. In April 1983, the Steering Committee approved the following list of criteria:

- show potential for providing substantial increases in transportation service to the corridor and region;
- involve no impractical engineering applications;
- exhibit low-cost potential;
- contain significant amount of suitable ROW;
- minimize adverse environmental impacts; and
- minimize adverse social impacts.

Staff members were directed to collect sufficient information about all five major corridors to allow an objective evaluation and selection process. The Technical Appendix includes an evaluation matrix prepared by staff members to aid the Steering Committee with this decision. In June 1983, the Steering Committee selected the East Valley as the single corridor most likely to exhibit feasibility for LRT. The East Valley Corridor was seen as the high ranking corridor for all but possibly the first criterion, mainly due to the availability of the county-owned Milwaukee ROW. It was recognized by the Committee that existing travel demand and transit ridership were highest in the North Corridor, particularly in the Division Street area. However, the apparent difficulties in obtaining suitable ROW were felt to outweigh the advantage of proven travel demand.

The study team was thus directed to devote remaining resources to detailed analysis of East Valley LRT feasibility, with the proviso that discovery of a fatal flaw in the East would lead to redirection of remaining resources to North Corridor study.

East Valley Corridor

As shown in Figure 13, the East Valley Corridor stretches from the Spokane CBD to Liberty Lake, which is about two miles west of the Idaho border. Just across the state line to the east is the City of Coeur d' Alene, Idaho; the East Valley Corridor can be considered to extend to that city. The East Valley includes the communities of East Spokane, Dishman, Opportunity, Veradale, Greenacres, Trentwood, Millwood and Liberty Lake.

Attractions

1. Spokane Community College
2. Spokane Interstate Fairgrounds
3. Playfair Racetrack
4. Zoo
5. Valley General Hospital
6. Hewlett Packard and ISC
7. University City
8. Spokane Industrial Park and Kaiser Aluminum

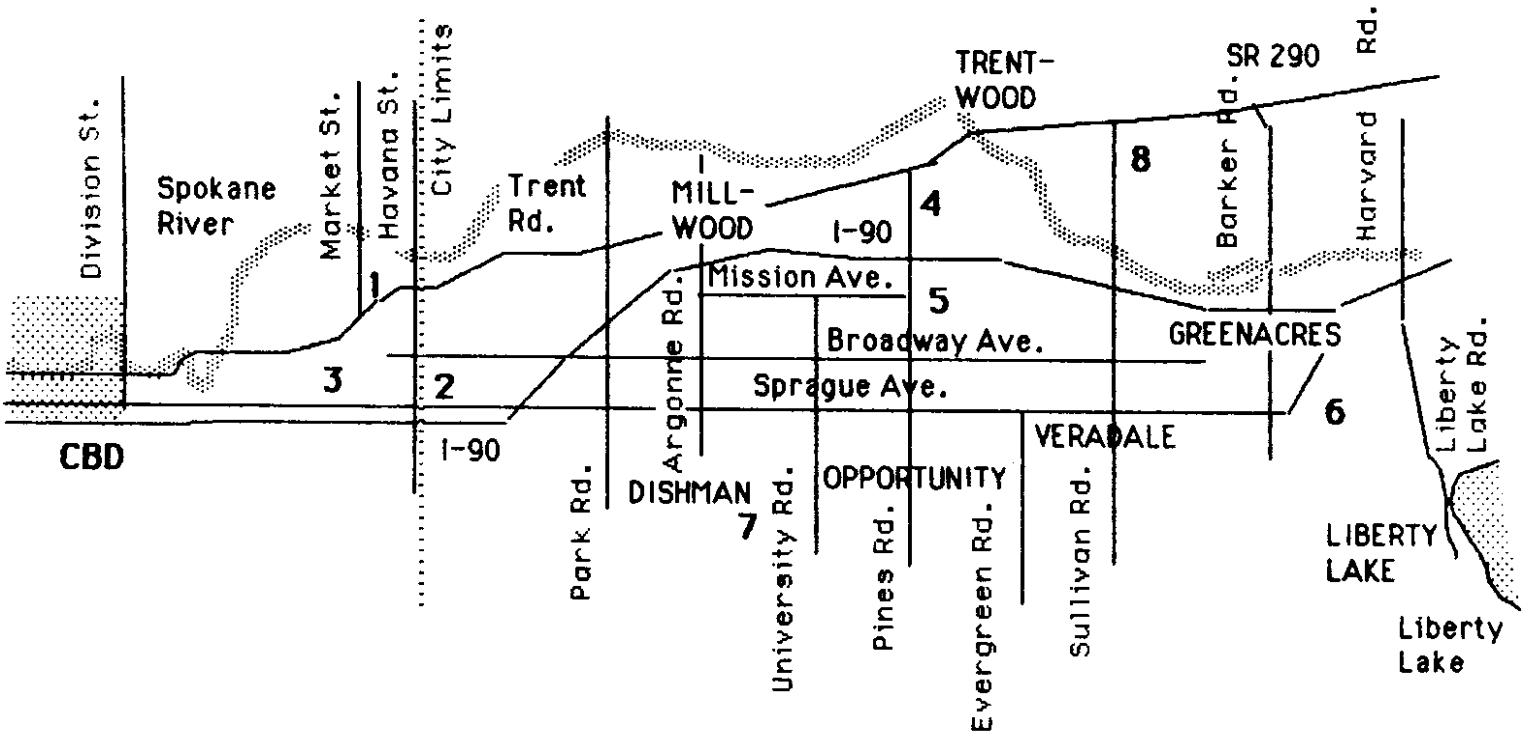


Figure 13. East Valley Corridor.

In general, residential development throughout the East Valley is of the single family, low density type. There are scattered pockets of multifamily housing; these generally are clustered along the major arterials and highways that run through the corridor. East of Havana, most of the area between Sprague Avenue and the Spokane River is developed as far east as Sullivan Road. South of Sprague, the same single family subdivision development is found between Argonne Road and Evergreen Road.

Outside the CBD and west of Market Street, employment opportunities are concentrated in strip development along Trent and Sprague Avenues. East of Market, commercial and light industrial strip development, including neighborhood shopping centers, continue along Broadway, Trent and Sprague. In addition, there are several major employers in the East Valley. These include Hewlett-Packard and ISC at Liberty Lake, with about 1,800 employees between them; University City Shopping Center, a major regional center south of Sprague Avenue at University Road; Spokane Industrial Park, with about 3,000 employees; and Kaiser Aluminum with 1,500 employees.

Important activity centers in the East Valley Corridor include Spokane Community College, Spokane Interstate Fairgrounds, Playfair Race Track, Walk-in-the-Wild Zoo, and Valley General Hospital. In keeping with the residential development throughout the Valley, there are numerous schools and parks.

I-90 is the major highway facility in the East Valley, with 1983 average daily traffic of about 45,000 vehicles per day at the Argonne Road interchange. In addition to providing for interstate travel, I-90 also serves as the only freeway facility for commuter trips in the East Valley. Outside the CBD, I-90 has full or partial interchanges with Sprague, Broadway, Argonne, Pines, Sullivan, Barker and Liberty Lake Road. East-west travel through the Valley is also served by Trent Road, Broadway Avenue and Sprague Avenue, all of which have uncontrolled access in the Valley.

North-south travel in the East Valley is constrained to some extent by the Spokane River and I-90. Major arterials serving north-south demand are on an approximate one mile grid; they include Havana Street and Park, Argonne, University, Pines, Evergreen, Sullivan and Barker Roads. The only crossings over the Spokane River east of the CBD are on Argonne, Trent, Sullivan, Barker and Harvard Roads.

Transit routes in the East Valley generally follow the major east-west highways, i.e., I-90, Sprague, Trent and Broadway. Figure 14 shows route coverage provided by Spokane Transit Authority in the Valley in 1983. Service extends east as far as Barker Road. Headways average 30 minutes, and some peak hour express service is provided on I-90 between Pines Road and the CBD. In 1982, daily ridership on STA routes serving the East Valley corridor totaled about 3,500.

Alignment Alternatives. Only one East Valley route was seriously considered as a potential LRT alignment. This route was chosen to make use of the former Milwaukee Railroad right of way (ROW), a county-owned corridor south of Sprague Avenue extending from Argonne Road to Liberty Lake. Between the CBD and Argonne Road, much of the suggested alignment follows existing in-service rail lines (Burlington Northern and Union Pacific).

Figure 15 illustrates schematically the East Valley alignment identified as most feasible by the members of the study team. Because the East Valley was the highest priority corridor in the study, the alignment was analyzed quite specifically, with detailed consideration given to each segment of the route. The technical appendix to this report includes a detailed description of the route shown in Figure 15; highlights are discussed below.

The CBD alignment was identified as a one-way, single track couplet eastbound on Main Avenue and westbound on Spokane Falls Boulevard. A possible northward loop, also a couplet, would be placed on Monroe and Lincoln Streets, extending to Boone Avenue near the Coliseum. The Main Avenue segment would cross Division Street at grade and head east on Burlington Northern (BN) and a private switching track; the Spokane Falls segment would swing north to an existing underpass near Olive Avenue and head southeast under Trent Avenue via an abandoned RR tunnel (presently city owned). The two one-way segments merge on the old Inland Electric ROW at Erie Street.

Construction required for this porton of the line includes earth embankment and tunnel repair/excavation for the Trent Avenue crossing, a signal system at the Division/Main intersection, an earth ramp for the Main Avenue segment to descend from BN ROW to the old Inland Electric ROW near Erie, trackbed/rail placement, and a signal at Erie Street.

The route stays on Inland Electric ROW to Napa Street, using existing timber bridges over Helena, Medalia and Napa. Major new bridge work would be required to carry the LRT to the southeast over the BN yards. The route would

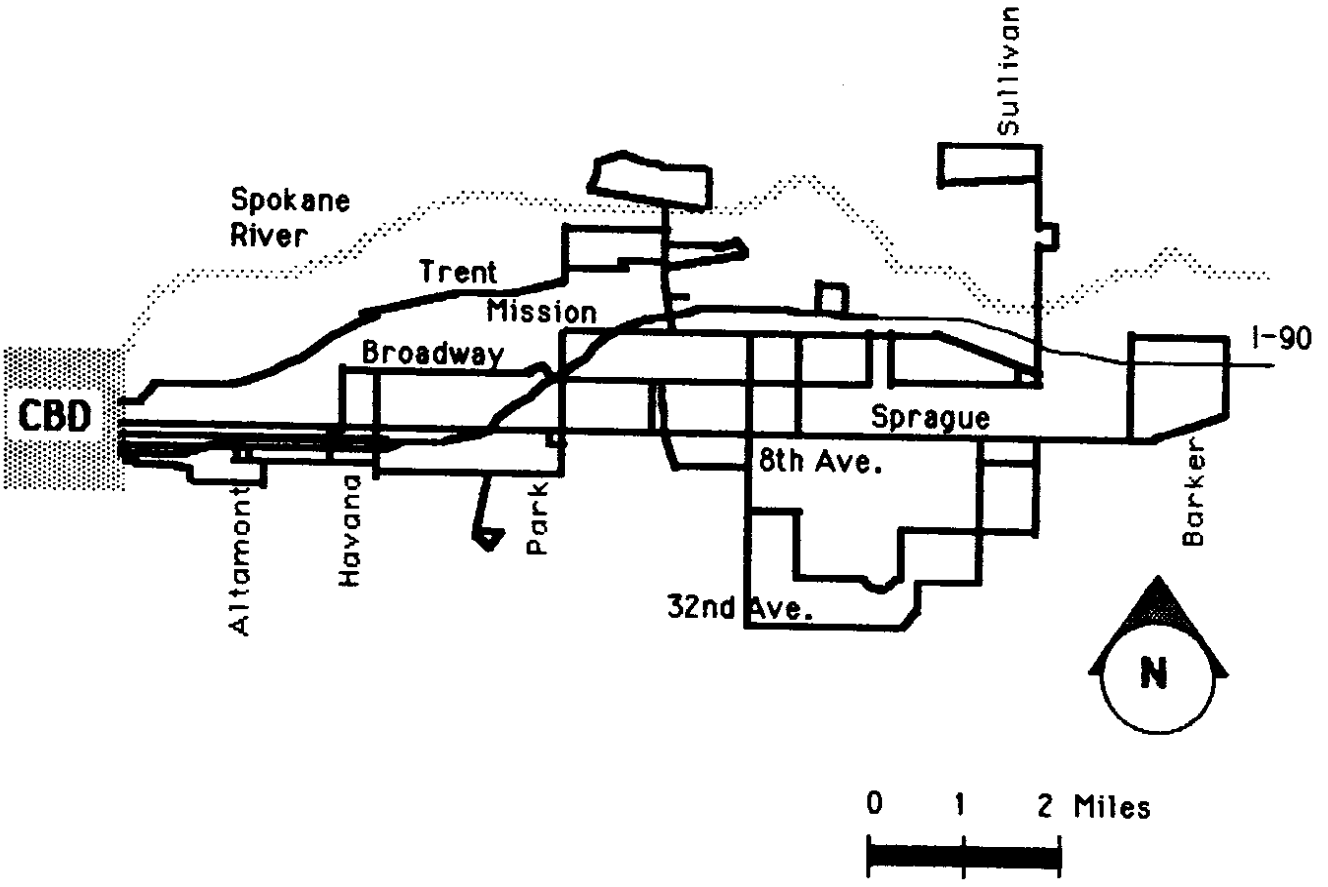


Figure 14. East Valley Corridor Existing Transit Routes.

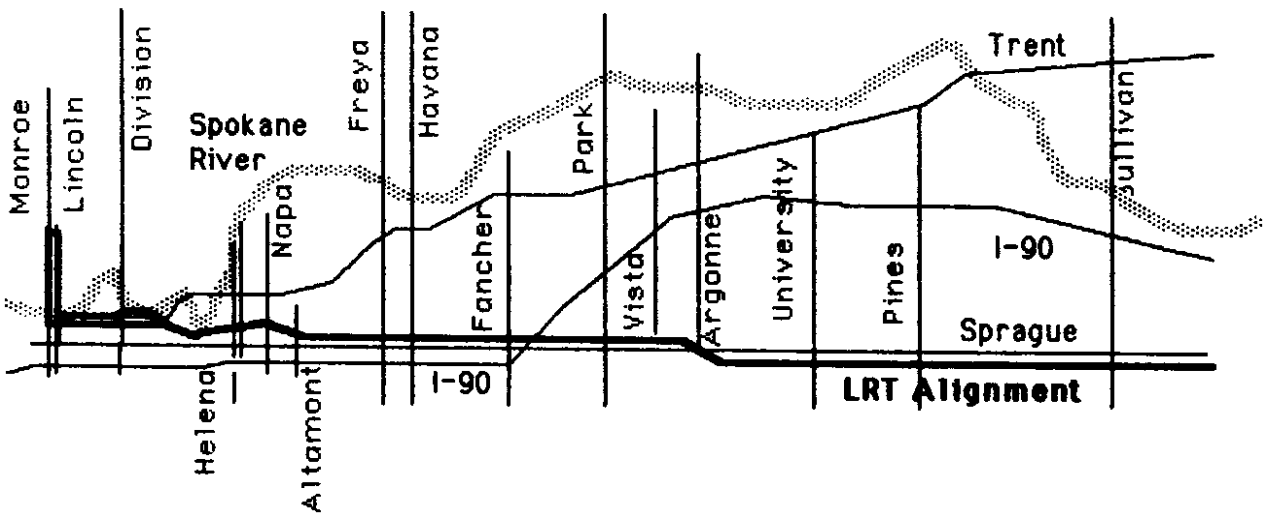


Figure 15. East Valley Corridor LRT Alignment.

then follow along the south side of the Union Pacific (UP) ROW all the way to Argonne Road. LRT tracks could be constructed on UP's existing berm, although in several places it would be necessary for UP to revise their use of existing tracks.

Major construction for this portion of the route would include a new bridge over Altamont, at-grade crossings of Freya and Havana Streets (new signal systems), relocation of siding/switch track at UP's administrative offices near Havana, extension of an overpass at Fancher Road, extension of the berm on the south abutment of the I-90 overpass, and extension of UP's Park Road overpass.

At Argonne Road (Dishman Station), the LRT would leave the UP embankment and cross under the UP line that heads south. Construction of a trestle to carry the UP tracks over the LRT would be required. At this point, the LRT would join the county-owned ROW, formerly the Milwaukee RR line to Coeur d' Alene. Spokane County is in the process of placing a sewer trunk line on this ROW; the existing berm will be removed during construction, so new track-bed for the LRT would have to be built.

Alternatives to the above alignment consisted of variations on the manner of crossing Division Street, which is the major obstacle in getting the LRT out of the CBD and headed east. Alternatives which were considered included at-grade crossing of Division for both the Spokane Falls and Main Avenue segments, and excavation of the Division Street ramp over Trent to provide an LRT undercrossing.

Travel Demand Forecast. As was the case with alignment identification, the travel demand forecast for the East Valley Corridor was undertaken with considerable detail. "Travel demand forecast" refers to the methodology employed to make an estimate of future year travel; in this case, an estimate of LRT ridership in 2000. Traditional methodology makes use of computerized mathematical descriptions of existing travel so that relationships between demographic data and travel demand can be identified. These relationships are assumed to remain constant over time, allowing future year travel demand to be estimated according to independent forecasts of population, employment, and travel network descriptions. A complete discussion of the methodology and data used in this forecast appears in the Technical Appendix; highlights appear below.

The planning area used by Spokane Regional Council (SRC) was used for the LRT forecast; this allowed use of SRC data for model calibration and future year forecasts of population and employment. The planning area boundary was illustrated earlier in Figure 2; it includes most of Spokane County. The LRT team selected "QRS", a microcomputer forecasting model, for the East Valley travel demand forecast. The QRS models were calibrated on 1980 Spokane data, which means essentially that the model could fairly accurately "predict" 1980 transit demand when population, employment, travel times, etc. were input. The 1980 transit system was, of course, a bus-only system; the model therefore was calibrated by comparing QRS-predicted transit ridership to actual ridership reported by STA.

To forecast LRT ridership for 2000, the information input to QRS was changed to represent 2000 conditions. SRC's forecasts of population and employment constituted basic input. In addition, transit system parameters were altered to reflect the presumed bus-plus-LRT system for 2000. For purposes of the forecast, the LRT was presumed to replace any existing east-west bus routes; the only direct service from the East Valley to the CBD was supplied by the LRT. All bus routes in the East Corridor were presumed to be feeders operating at right angles to the LRT. This resulted in a maximized LRT forecast because the real transit system would probably continue to operate with some east-west bus service, at least express routes on I-90.

The resulting LRT ridership forecast for 2000 was as follows:

- 6,580 total daily riders; and
- 610 peak hour-peak direction riders.

Capital Cost Estimate. Estimates of capital cost for construction of an East Valley LRT were prepared; the results are shown in Table 6. Most of the component estimates in Table 6 were based upon average system costs reported in a 1976 report to the Urban Mass Transportation Administration. Right of way costs were based upon local Spokane average land prices. Per-mile estimates presume a mostly single-tracked line; it is assumed that enough double track would be in place so that two-way operation would not be constrained by lack of turn-out opportunities. The line was assumed to extend east to Liberty Lake Road, and to have the downtown alignment selected by the Steering Committee. Further assumptions used in making the estimates are detailed in Table 6.

Table 6. East Corridor Capital Cost Estimate

Expense Item	Cost	Notes
Right of Way	$ 2,600,000	Based on average Spokane land prices, 26' width. Presumes zero cost for CBD alignment on Main, Spokane Falls, and north loop, for Milwaukee ROW (owned by County), and for the city-owned tunnel.
Route Construction	$ 5,820,000	Grading, drainage, utilities and structures.
Guideway Construction	$15,330,000	$880,000 per mile
Signals and Communication	$ 6,550,000	$308,000 per mile plus $66,000 per controlled crossing.
Electrification	$20,550,000	$1,180,000 per mile. Includes catenary and substations.
Storage Yard	$ 1,310,000	$131,300 per car.
Vehicles and Parts	$ 9,900,000	$900,000 each; parts at 10% total. Source: This is LRT! March 1982, TRB. Number of vehicles = 1.25 times number needed at peak hour.
Car Barn/Shop	$ 2,630,000	$262,600 per car
Stations	$1,370,000	$39,200 each. Assume 2 per mile. Simple shelter.
Engineering and Administration	$ 9,910,000	15%
Contingencies	$16,520,000	25%
Total Estimate:	$92,490,000	Per mile: $5,300,000

Notes: Unless otherwise noted, estimates are based on average U.S. system costs reported in Rail Transit System Cost Study, by Thomas E. Dyer, Inc. for UMTA, January 1976. Dollars reported by Dyer were converted from 1974 to 1983 using Engineering News Record construction cost index.

Alignment length: 17.42 miles (counts loop mileage in CBD twice)

The resulting total estimates for initial capital cost of an East Valley LRT were $92,490,000 total cost; this translates to an average of $5,300,000 per mile (1983 dollars).

Conclusions. Given an estimated start-up capital cost of $5.3 million per mile, the East Valley LRT would fall within the range of systems considered to be relatively low-capital-intensive. The required minimum ridership for feasibility, as defined by the Steering Committee, was 900-1,100 peak hour-peak direction riders. The estimated 2000 LRT ridership in the East Valley (610 peak hour-peak direction) is short by 30 percent or more. As explained above, the LRT assignment was maximized by the assumed lack of parallel bus service to downtown Spokane and beyond.

Failure of the LRT to meet the minimum acceptable ridership forecast must be considered a fatal flaw. Light rail transit for Spokane's East Valley Corridor is not a viable transportation alternative in the foreseeable future.

North Corridor

Discovery of a fatal flaw in East Valley LRT feasibility (i.e., the low ridership forecast) meant that remaining study resources were to be spent making a less detailed investigation into North Corridor feasibility. Beginning in April, 1983, the study team began to examine the potential for LRT in the North Corridor.

Figure 16 illustrates important elements of Spokane's North Corridor. Extending northward from the CBD, this corridor is roughly bisected by Division Street, from about Assembly Street on the west to Havana Street on the east. The corridor can be considered to extend as far north as the community of Mead, but for all practical purposes, real development does not go beyond Hawthorne Road.

The North Corridor includes Spokane's oldest settled areas; residential development in the corridor is almost entirely single family neighborhoods. North of the city limits boundary (generally Francis Avenue), newer subdivisions are most common. Pockets of multifamily housing are found along Division Street south of Francis Avenue and near Gonzaga University.

Employment in Spokane's North Corridor is not concentrated in pockets as it is in the East Valley. Commercial strip development (light industry, neighborhod and community shopping centers) line Division Street and portions

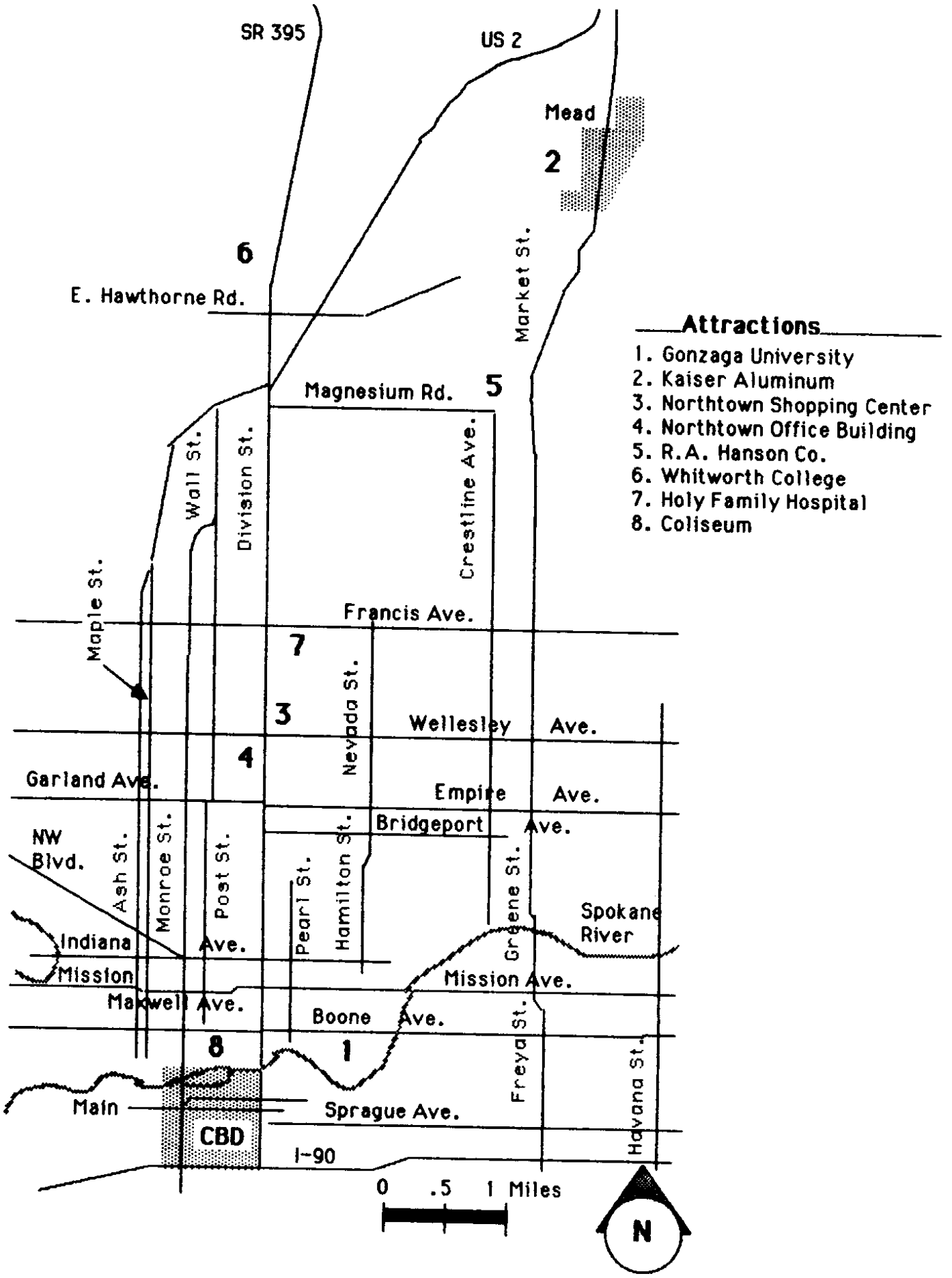


Figure 16. North Corridor.

of other major arterials. In addition, there are the following major employment centers: Kaiser Aluminum's plant at Mead; the Northtown Shopping Center and the Northtown Office Building, north of Wellesley Avenue and west of Division; and the R.A. Hanson Co. at Magnesium Road and Crestline.

Other activity centers of note in the North Corridor include Whitworth College, Gonzaga University, Holy Family Hospital and the Coliseum. The single family residential settlement gives rise to the typical scattered schools and parks throughout the corridor.

Travel throughout the North Corridor is generally local and regional in nature, as there is no freeway facility providing for longer distance trips. SR 2, called Division Street within the City, is the major facility. The maximum volume estimated in 1983 for Division Street was 42,100 vehicles per day (vpd) at Main Avenue; farther north, at the SR 395/SR 2 wye connection, daily volumes are around 12,000 vpd. Other important north-south arterials include the Market/Greene/Freya corridor, the Ash/Maple couplet, Monroe Street, Nevada/Hamilton, and Crestline Street. Provision of additional north-south travel capacity in the North Corridor is a recognized need, according to previous planning documents from Spokane.

East-west travel takes place on a fairly regular system of arterials. Primary facilities include Francis Avenue, Wellesley Avenue, Garland/Empire, Indiana Avenue and Mission Avenue. Northwest Boulevard carries considerable daily traffic; it may be considered as a boundary of the North Corridor.

Transit routes in the North Corridor are shown in Figure 17. Transit covereage in this area is more dense than in other parts of Spokane; north-south routes are generally separated by only 6 or 7 city blocks. The service is oriented to principal arterials: Oak, Maple, Monroe, Wall/Post, Division, Hamilton/Nevada, Crestline and Market Streets.

Alignment Alternatives. Figure 18 shows alignment opportunities for LRT in the North Corridor. It has been assumed that a North Corridor LRT would have the same CBD alignment as the East Valley LRT, i.e., a couplet on Main Avenue and Spokane Falls Boulevard. Beyond that, details of North Corridor alignment were not investigated except in preliminary fashion. Possible alignments which take advantage of existing rail are shown in Figure 18; also shown is an alignment near Division Street, where existing travel demand is highest in the corridor.

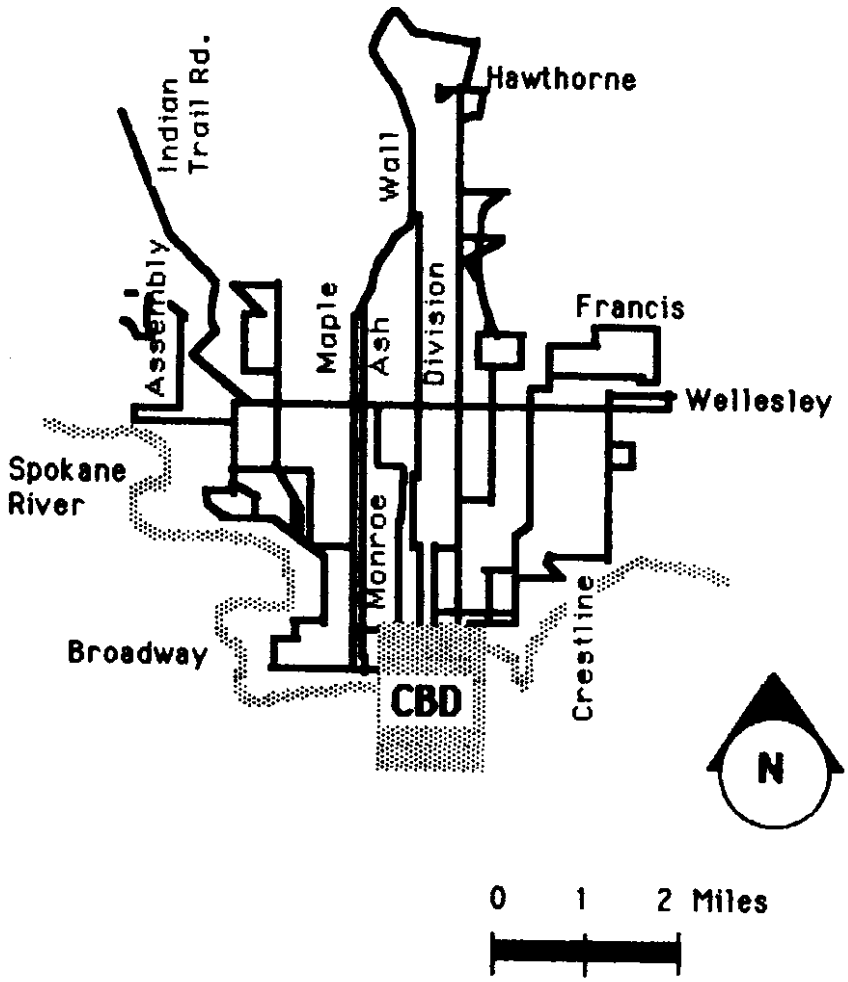


Figure 17. North Corridor Existing Transit Routes.

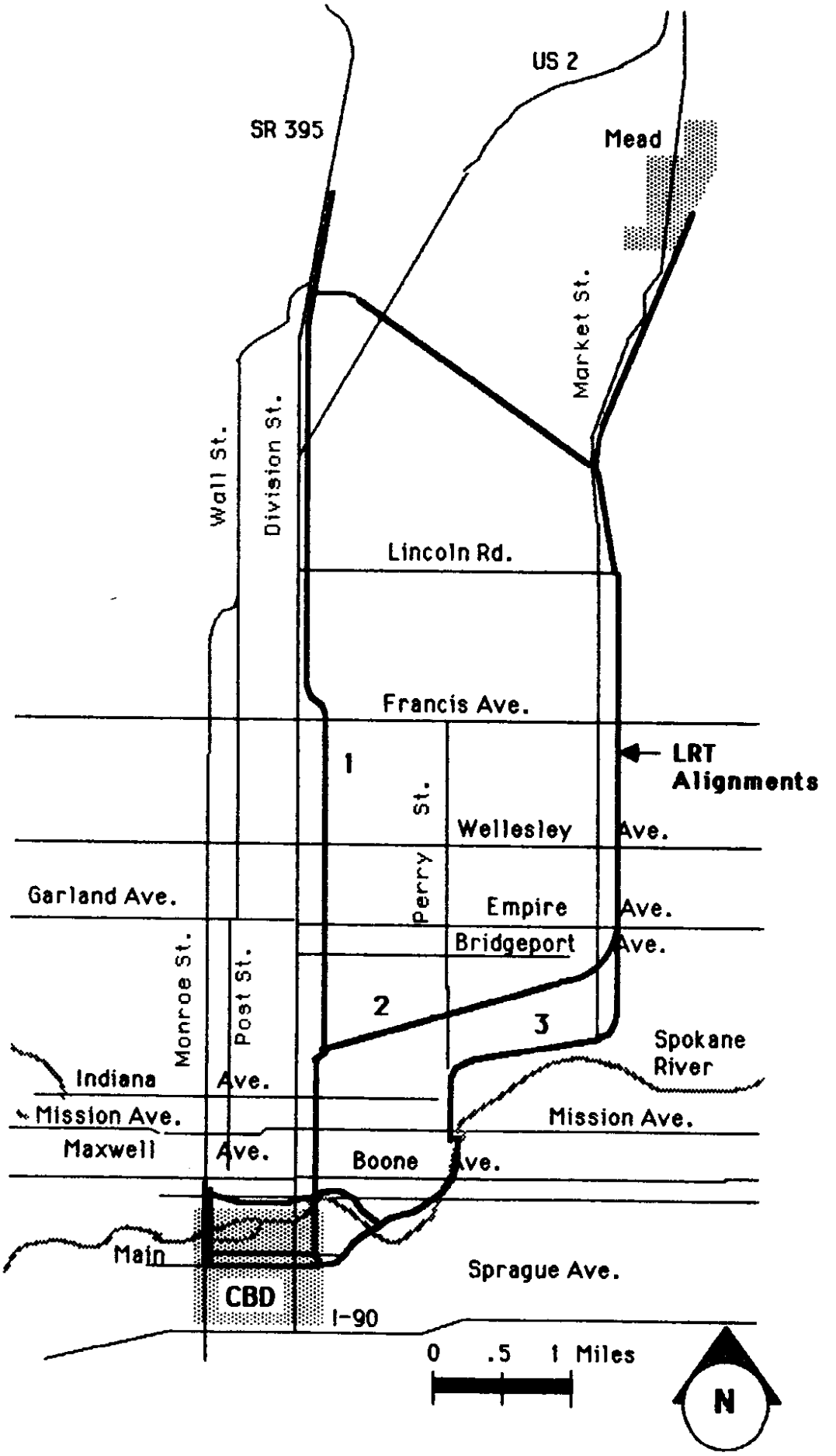


Figure 18. North Corridor Possible LRT Alignments.

The alignment near Division could make use of industrial tracks on Pearl Street as far north as Montgomery Avenue. Between Montgomery and Wellesley, tracks could be laid on Lidgerwood. It is notable that steep grades on this route could prove to be an impediment, perhaps even requiring tunneling. North of Francis, LRT could possibly be placed east of the strip development that lines Division. Figure 18 shows this alignment crossing over SR 2 at the SR 2/SR 395 wye and continuing farther north. Numerous at-grade crossings of busy arterials would be involved on a Pearl/Lidgerwood/Division alignment.

The other alignments in Figure 18 make use of existing BN trackage to get from the CBD to Market Street. Just east of Market Street is BN's Hillyard Yard, and the LRT alignment continues north through the yards to Magnesium Road. At this point, Figure 18 shows the route swinging back in a northwesterly direction to Division Street, traveling along a powerline easement. Also shown is BN track continuing northwards to Mead.

Travel Demand Forecast. North Corridor analysis was intended to be less rigorous than that in the East Corridor; it was therefore decided that a sketch planning approach to the travel demand forecast would be appropriate. In this way, the extremely time-consuming process of model calibration that was required in the East Valley forecast was avoided.

"Impedance" is a term used by transportation planners to represent the total sum of time and money that must be spent for a particular trip. The impedance value for an auto trip would be different than the impedance for the same trip made by transit, because transit involves more waiting time, may have higher out-of-pocket costs, and is generally slower. For a given trip (e.g., from an outlying suburb to the CBD), relationships may be found between auto and transit impedances and the observed likelihood of people to travel by transit. Such relationships were established for travel behavior in the East Valley Corridor, based upon results of the original QRS forecasts for 2000.

Impedance values were next calculated for trips made to and from the North Corridor, based upon a presumed LRT with feeder buses. This meant that transit parameters such as walk time, wait time, headways, etc. had to be estimated. This in turn meant that an alignment for the LRT had to be presumed. For purposes of the travel demand forecast, it was assumed that the LRT followed the first alignment described above, i.e., straight north from the CBD just east of Division Street. Additionally, it was assumed that buses would operate as feeders to the LRT, and that there would be no parallel bus

service competing with the LRT in the North Corridor. The relationships between travel impedances and mode choice that had been defined earlier were applied to the year 2000 person-trip matrix generated during the original East Corridor forecast.

The result of this process was an estimate of ridership for a North Corridor LRT, based upon Spokane Regional Council's population and employment forecasts for 2000:

- 12,970 total daily riders; and
- 1,210 peak hour-peak direction riders.

Capital Cost Estimate. Table 7 shows the estimates of capital cost for start-up of a North Corridor LRT. As with East Valley Corridor estimates presented previously, these were based upon average LRT costs reported to UMTA in 1976, and upon local information where available. Also, as before, the estimate is based upon a presumed zero cost for public-owned ROW. This is perhaps inappropriate for the portion of the line placed on downtown streets, where peak hour train operation would interfere with normal vehicular flow.

Table 7 includes estimates prepared for the three alignments discussed above. The estimates ranged from $70.4 to $79.2 million with resulting per mile costs of $7.5 to $8.9 million per mile (1983 dollars). North Corridor estimates are not as firm as the ones for the East Valley Corridor, because alignment details have not been as carefully defined. However, the information in Table 7 appears reasonable, and will serve to establish whether the North Corridor LRT should be considered a low, medium or high cost line.

Conclusions. The range of capital costs discussed above places the North Corridor LRT alignment in the medium cost category, even without ROW costs in the CBD. A medium cost system would require about 1,700 peak hour, peak direction riders as a minimum level of demand to be justified.

The North Corridor LRT forecast of 1,210 peak hour, peak direction riders falls short of the minimum criteria by 30 percent. Thus, as in the East Corridor, LRT is not feasible for the North Corridor of Spokane.

Table 7. North Corridor Capital Cost Estimate

Expense Item	Cost	Notes
Right of Way	1. $ 8,800,000 2. $ 5,400,000 3. $ 5,600,000	Based on average estimated Spokane land prices, 26' width. Presumes zero cost for Main Street and Spokane Falls Boulevard downtown ROW. Varies with alignment.
Route Construction	1. $ 6,750,000 2. $ 5,480,000 3. $ 4,780,000	Includes grading, drainage, utilities and structures.
Guideway Construction	1. $ 6,950,000 2. $ 9,060,000 3. $ 9,240,000	Ballast, rail and ties ($880,000/ mile).
Signals and Communication	1. $ 3,620,000 2. $ 4,290,000 3. $ 4,090,000	$308,000 per mile plus $66,000 per controlled crossing.
Electrification	1. $ 9,320,000 2. $12,150,000 3. $12,390,000	$1,180,000 per mile. Includes catenary and substations.
Storage Yard	1. $ 1,440,000 2. $ 1,970,000 3. $ 1,970,000	$131,300 per car.
Vehicles and Parts	1. $ 9,900,000 2. $13,500,000 3. $13,500,000	$900,000 each. Source: This is LRT! published March 1982 by TRB. Parts estimated at 10% of car total. Number of vehicles = 1.25 times number needed during peak hour.
Car Barn/Shop	1. $ 2,890,000 2. $ 3,940,000 3. $ 3,940,000	$262,600 per car.
Stations	1. $ 620,000 2. $ 810,000 3. $ 820,000	$39,200 each. Simple shelter. Assume 2 stops per mile.
Engineering and Administration	1. $ 7,540,000 2. $ 8,490,000 3. $ 8,450,000	15% of preceding
Contingencies	1. $12,570,000 2. $14,150,000 3. $14,080,000	25% of preceding, except E & A.
Total Estimate	1. $70,400,000 2. $79,240,000 3. $78,860,000	Per Mile 1. $ 8,900,000 2. $ 7,700,000 3. $ 7,500,000

Notes: Unless otherwise noted, estimates are based on average U.S. system costs reported in Rail Transit System Cost Study, by Thomas E. Dyer, Inc. for UMTA, January 1976. Dollars reported by Dyer were converted from 1974 to 1983 using Engineering News Record construction cost index.

Alignment lengths used for estimates:
1. 7.9 miles
2. 10.3 miles
3. 10.5 miles

CHAPTER V

WHAT IF?

This chapter explores the effects of different land development scenarios on LRT ridership in the Spokane area. Part of the reason for the low LRT patronage forecast for 2000 is that very little growth is forecast by SRC to occur in Spokane's CBD. A line-haul system, such as the suggested LRT, needs a heavy concentration of trip productions (i.e., homes) at one end of the line and a heavy concentration of attractions (i.e., jobs) at the other end in order to be effective. Spokane's expected situation in 2000 is the opposite --continued suburban sprawl of low density residential developments and scattered pockets of employment throughout the region.

In Spokane, employment in the CBD is expected to increase by less than 200 jobs between 1980 and 2000, while employment in the East Valley is expected to increase by 10,600 jobs over the same period. This means that workers residing in the East Valley in 2000 are much more likely to work in the Valley (where there will be 50,700 jobs) or outside the Spokane planning area (since population will grow much faster than jobs in Spokane), than in the CBD (where there will be only 23,000 jobs). Thus, it difficult to expect much patronage on a line-haul system running through the Valley to the CBD.

Considerable growth in population is expected in the North Corridor, and one might expect that many workers would take advantage of a Valley LRT to reach jobs east of the CBD. But: a worker in the north who desires to use transit to reach a job in the Valley must walk or drive to a bus stop, ride the bus to downtown, and then transfer to the LRT to travel east. And unless his workplace is very near the LRT, he will have to again transfer to another bus in the Valley. The time and trouble of three transfers makes the LRT transit trip a very unattractive option.

Another "What if?" situation is the potential for future shortages of gasoline; e.g., nationwide shortages which are created by a serious disruption of the flow of crude oil from the Persian Gulf to the U.S. During the 1973 Arab oil embargo, transit systems throughout the country experienced significant jumps in ridership as commuters experienced great difficulty in getting enough gas for their solitary drive to work. If a similar situation occurs in the future, would LRT be an energy efficient way to handle the travel demand in one or more corridors of Spokane?

The following sections of the report provide some answers to these questions.

WHAT IF CHANGES OCCUR IN LAND DEVELOPMENT PATTERNS?

Much discussion about LRT patronage has focused on the implications of SRC's regional forecasts of dispersed population and employment growth (as well as the imbalance between people and jobs). For both the East and North Corridors, the study team tested three hypothetical development alternatives for their effect on potential LRT patronage: (a) all population growth concentranted in the subject corridor, (b) all employment growth concentrated in the Spokane CBD, and (c) a combination of (a) and (b). While such extreme land development patterns are unrealistic, they do provide scenarios which are the most favorable for LRT feasibility under the regional growth totals forecast by SRC.

East Corridor

Three alternate development patterns were tested in the East Valley, so that the resulting changes in potential LRT ridership could be estimated. The results of the original modeling process were used as a basis for this work, with regional travel patterns being shifted in accordance with the presumed shifts in development.

Regionwide, SRC had forecast an increase of 32,450 households between 1980 and 2000. Of these, 11,380 households (35 percent) were projected to occur in the East Valley. The first "what if?" scenario examined was the assignment of all regional population growth to the East Valley corridor. The 21,070 new households originally allocated to the rest of the region were distributed to East Valley zones according to the shares of growth that had initially been forecast. For example, if a Valley zone had received 8 percent of the original 11,380 households it was assigned 8 percent of the additional 21,070 households transferred from other corridors.

Trips produced in each East Valley zone were then increased proportionate to the population increase. Since employment totals throughout the region were not altered, it was assumed that these trips would be attracted to all other zones in the same proportions as originally observed. Finally, trips

produced outside the East Valley were reduced to account for the fact that all population growth was removed from these other non-East Valley zones.

The same bus-plus-LRT system was assumed; that is, a line-haul LRT with north/south-oriented bus feeders. The resulting estimate of LRT ridership was:

- 8,050 daily riders, and
- 750 peak hour, peak direction riders.

This represents an increase of 22 percent over the ridership forecast for SRC's original 2000 demographic scenario.

The second scenario tested was the relocation of all regional employment growth to the CBD. Population growth was assumed to remain as originally forecast by SRC. The methodology was as above, except that trip attractions were shifted into the CBD from the outlying areas, and it was assumed that those trips were produced in all other zones in the same proportion as initially.

SRC had forecast regionwide employment growth of 13,019 new jobs by 2000; only 173 of these were forecast for the CBD. The shifting of all 13,019 jobs to the CBD created a revised 2000 total of 35,879, representing growth of 57 percent over the 1980 job total. By way of comparison, this scenario kept employment outside the CBD at 1980 levels, with a total of 103,640 jobs in all corridors. In other words, if all employment growth in the Spokane region between 1980 and 2000 occurred in the CBD, the CBD would have 26 percent of the region's jobs.

Results of testing the second scenario indicate the following LRT patronage for the East Valley corridor:

- 8,200 daily riders and,
- 760 peak hour, peak direction riders.

This represents a 25 percent increase over the ridership based on SRC's original demographic forecast. It also produces very nearly the same level of LRT ridership that resulted from moving all population growth to the east.

The third and final scenario examined for East Valley corridor was a combination of the first two scenarios. All regional population growth was moved to the East Valley corridor, and at the same time, all new jobs were shifted to the CBD. This meant that the CBD would have 26 percent of the region's jobs and the East Valley would have 43 percent of the region's

population. This scenario created the desired concentrations of population in a linear growth and employment in the CBD.

The travel demand forecast for the third scenario yielded the following LRT ridership projection:

- 10,880 daily riders and,
- 1,000 peak hour, peak direction riders.

This scenario resulted in a forecast exceeding the minimum of 900 peak hour, peak direction riders that was established as a feasibility criterion.

Table 8 summarizes the results of the initial LRT forecast and the three alternate development scenarios.

Screenline Analysis. As a check on the validity of the forecast methodology used for testing the development scenarios, and as a further illustration of the changes in travel patterns expected with development shifts, a screenline was established in the East Valley Corridor. Figure 19 shows the location of the screenline.

Beginning with results of the 1980 model calibration, trip tables for both person trips and transit trips were examined. All daily trips crossing the screenline shown in Figure 19 were identified; i.e., trips between zones on either side of the screenline. The total of all such trips represents total daily travel to and from the zones enclosed by the screenline. Trip tables for the various 2000 scenarios were also examined; in this case, LRT trips across the screenline, as well as person trips and transit trips, were identified and summed. The results of this process are shown in Table 9.

As can be seen in Table 9, person trips and transit trips show increases in a logical manner (with a single exception, discussed below). As the productive power of the East Valley increases (i.e., as population increases) or as the attractive power of the CBD increases (i.e., as employment increases), the level of traffic across the boundary separating the two also increases.

An apparent anamoly appears in the person-trip total across the screenline when employment is shifted to the CBD. Intuitively, one would expect more person trips under this condition than the previous. It also appears illogical that transit trips across the screenline increased while person trips decreased. The reason for this result is the placement of the East Corridor screenline at Havana Street, east of the CBD. Transit trips are

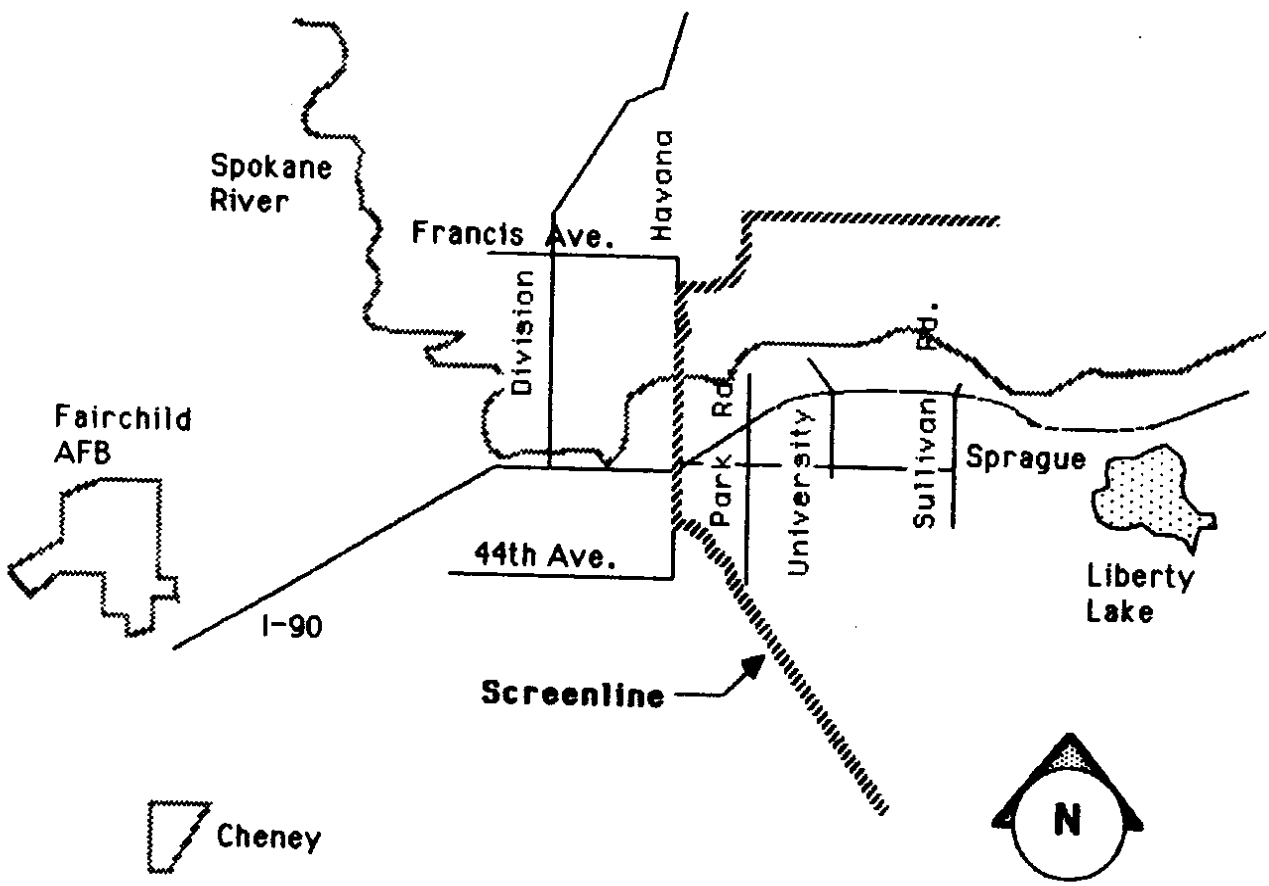


Figure 19. East Valley Corridor Screenline.

Table 8. Development Scenarios for The East Valley Corridor.

Scenario	Number of Jobs in CBD	Number of Households in East Valley Corridor	LRT Ridership Forecast	
			Daily	Peak Hour - Peak Direction
1. SRPC Forecast (March 1984) for 2000	23,030	45,640	6,580	610
2. All population increase (1980 - 2000) to East Valley Corridor	23,030	66,770	8,050	750
3. All employment increase (1980 - 2000) to CBD	35,880	45,640	8,200	760
4. All population increase to East Valley and all employment increase to CBD	35,880	66,770	10,880	1,000

Table 9. Daily Trips Across East Valley Corridor Screenline.

Scenario	Person Trips	Transit Trips	LRT Trips
1980	167,700	3,885	-----
2000			
• Original SRPC Forecast	188,300	4,790	4,790
• Employment increase shifted to CBD	185,400*	5,085	5,085
• Population increase shifted to East Valley	201,300	5,305	5,305
• Employment shifted to CBD and population to East Valley	241,000	8,150	8,150

* See explanation in text

equal to LRT trips across the screenline because the forecasts were based on the presumption that the only east-west oriented transit service would be provided by the LRT.

North Corridor

Just as with the East Valley Corridor, alternate development patterns were tested in the North Corridor, to see how responsive forecast LRT ridership was to shifts in forecast land use. The methodology used to examine alternate scenarios was just as explained earlier for the East Valley.

First, it was assumed that the total regional increase in population between 1980 and 2000 took place in the North Corridor. The additional households were distributed throughout the Corridor proportionate to zonal shares of genuine forecast growth. Projections of employment increase were not altered; e.g., only 173 new jobs in the CBD. Results of this analysis for 2000 were as follows:

- 13,560 daily LRT riders; and
- 1,260 peak hour, peak direction LRT riders.

This represented an increase over the original LRT ridership in the corridor of only 5 percent, and fails to meet the minimum criterion (1,700 peak hour, peak direction riders) by 26 percent.

The second development scenario involved the shifting of all regional employment growth to the CBD, to give the downtown more attractive power for work trips produced in outlying areas. Population distributions were not altered from the original forecast. The results of this analysis indicated the following LRT ridership:

- 13,410 daily riders; and
- 1,250 peak hour, peak direction riders.

This represented an increase of 3 percent over the original forecast. It falls short of the ridership criterion by about 26 percent.

The third and final development scenario was a combination of the two preceding. All employment growth was assigned to the CBD and all population growth was assigned to the North Corridor. The results of testing this scenario were as follows:

- 14,780 daily LRT riders; and
- 1,370 peak hour, peak direction riders.

This final development scenario falls short of the established minimum criterion by 19 percent.

Table 10 presents the above results in summary fashion.

Screenline Analysis. As was done previously in the East Valley Corridor, a screenline was established to separate the North Corridor from the rest of the region. Figure 20 shows schematically the placement of this screenline. As before, person and transit trips across this screenline were identified for the 1980 all bus system, and for the 2000 bus-plus-LRT under four separate development scenarios. Total trips for all cases were examined to test the validity of the sketch planning methodology used in the North Corridor forecasts.

Table 11 shows the results. The North Corridor screenline enclosed the entire corridor; therefore the totals in Table 11 represent total daily travel to and from the North Corridor. Increases in travel shown in the table are logical; all types of trips increase with CBD attractiveness or with corridor productiveness. Daily LRT trips across the screenline are not equal to total transit trips because not all transit trips crossing the line would go via LRT.

Impacts on Highway Needs

In addition to analyzing the impact of the various development scenarios on LRT ridership, it is useful to examine the effect of those scenarios on highway needs in each corridor. This was done by examining the year 2000 daily person travel in a given corridor for each development scenario, subtracting the total transit ridership estimates (LRT plus bus riders) and converting the remaining person trips to vehicle trips using an average vehicle occupancy of 1.55 persons per vehicle. The 1980-2000 growth in vehicle trips across the East and North Corridor screenlines was then computed, and the result compared to typical daily capacities of various highway facilities (i.e., 10,000 daily traffic for a two-lane arterial; 50,000 daily traffic for a four-lane freeway). From this process, the study team estimated the minimum likely highway improvements needed to handle the increased traffic across the screenline.

Table 10. Development Scenarios for North Corridor.

Scenario	Number of Jobs in CBD	Number of Households in North Corridor	LRT Ridership Forecast	
			Daily	Peak Hour - Peak Direction
1. SRPC Forecast (March 1984) for 2000	23,030	64,040	12,970	1,210
2. All population increase (1980 - 2000) to North Corridor	23,030	85,220	13,560	1,260
3. All employment increase (1980 - 2000) to CBD	35,880	64,040	13,410	1,250
4. All population increase to North Corridor and all employment increase to CBD	35,880	85,220	14,780	1,370

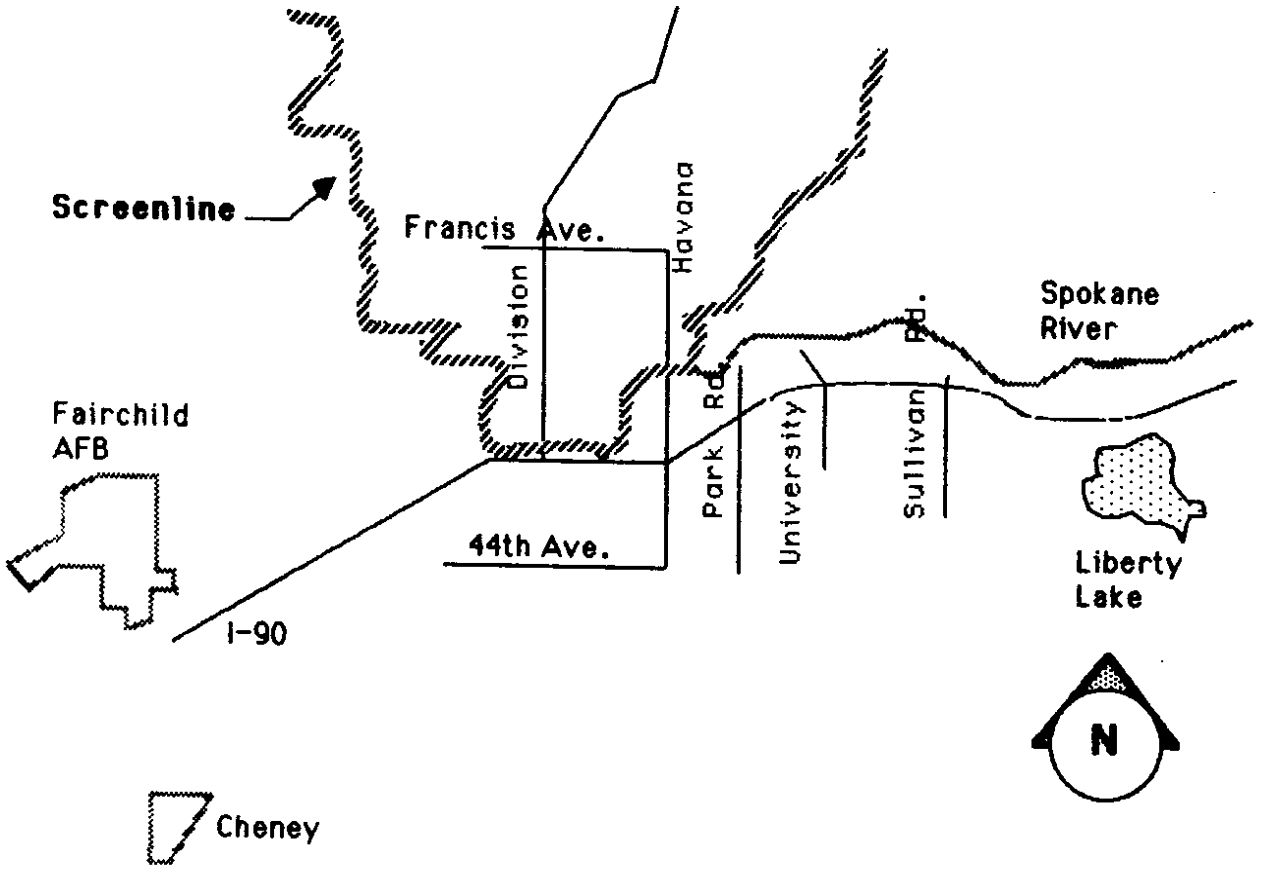


Figure 20. North Corridor Screenline.

Table 11. Daily Trips Across North Corridor Screenline.

Scenario	Person Trips	Transit Trips	LRT Trips
1980	321,100	11,485	-----
2000			
• Original SRPC Forecast	350,200	13,995	8,920
• Employment increase shifted to CBD	360,100	14,585	9,210
• Population increase shifted to North Corridor	356,700	14,340	9,390
• Employment shifted to CBD and population to North Corridor	388,500	15,875	10,530

The results for the East Valley Corridor are shown in Table 12. Several conclusions are evident from this table. First, implementation of LRT would have only minimal inpact on corridor highway travel demand; the difference would be about 200 ADT (average daily traffic) at the screenline, or a less than 1 percent change with or without LRT. As noted before, the vast majority of the LRT ridership would come from diversion of bus transit riders to LRT, rather than conversion of auto users to LRT transit.

Second, a major change in Spokane area development patterns would likely result in greater impacts on highway travel than on LRT ridership. For example, the scenario of allocating all regional population growth to the east corridor and all employment growth to the CBD not only maximizes potential LRT ridership (still 30 percent less than the minimum feasible level), it also results in three times as much additional highway traffic in the corridor than under the original SRC forecasts. Minimum highway improvements in the corridor jump dramatically from three new arterial lanes across the East Valley screenline to the need for the equivalent of a new four-lane freeway (in addition to I-90) in the valley corridor. These estimates of necessary improvements are based upon the 1980 highway system, and do not take into account scheduled capacity modifications (e.g., new lanes on I-90 already planned by WSDOT). Thus, LRT does not appear to be a viable solution to Spokane's future transportation problems in the East Valley under any scenario of development.

Table 13 presents similar results for the Spokane North Corridor. Again, alternative development scenarios have a much greater impact on highway needs than on LRT feasibility. The 1980-2000 growth in daily traffic volumes across the Spokane River screenline would require significantly more capacity under the maximum development scenario than under the original SRC development forecast.

WHAT IF GAS SHORTAGES OCCUR?

This section examines the role that light rail transit might play in serving Spokane area travel needs in the event of a gas shortage. There are five basic ways that people can accommodate energy shortfalls: mode shift, trip reduction, trip distribution (i.e. decreasing the length of trips made), vehicle efficiency improvements, and land use changes. Of these, the most

Table 12. Impact of Development Scenarios on Highway Needs

East Valley Corridor

Scenario	Person Trips	Vehicle Trips	Increase from 1980	Minimum Highway Improvement Needs
1980 Base Year	167,700	105,700	n/a	n/a
2000 Forecast Scenarios				
• Based on Original SRC Development Forecasts				
Without LRT	188,300	118,600	12,900	Add three arterial lanes
With LRT	188,300	118,400	12,700	Add three arterial lanes
• Employment increase shifted to CBD	185,400	116,300	10,600	Add two/three arterial lanes
• Population increase shifted to East Valley	201,300	126,500	20,800	Add one five-lane arterial
• Employment shifted to CBD and population to East Valley	241,000	150,200	44,500	Add two five-lane arterials or one four-lane freeway

Table 13. Impact of Development Scenarios on Highway Needs

Noeth Corridor

Scenario	Person Trips	Vehicle Trips	Increase from 1980	Minimum Highway Improvement Needs
1980 Base Year	321,000	105,700	n/a	n/a
2000 Forecast Scenarios				
• Based on Original SRC Development Forecasts				
Without LRT	350,200	123,500	17,800	Add four lane bridge
With LRT	350,200	122,900	17,200	Add four lane bridge
• Employment increase shifted to CBD	360,100	128,900	23,200	Add four lane bridge
• Population increase shifted to North Corridor	356,700	126,800	21,100	Add four lane bridge
• Employment shifted to CBD and population to North Corridor	388,500	146,400	40,700	Add four lane freeway with new bridge

effective accommodation in the very long range is change in land use patterns, but in the mid- to long-range period, improved vehicle efficiency has the greatest potential by far to reduce our level of energy consumption. Trip conservation (both the number and length of trips) and mode shift are the most effective in the very short term.

An important consideration is whether the crisis is perceived as a long-term structural change or really just a short-term condition. Had the oil embargo been permanent, people may well have reacted differently than they did. Short-term adaptations are more likely to include trip reductions, mode shift to more efficient modes, and changes in driving habits to reduce gasoline consumption.

Table 14 shows how people responded to the 1973-74 oil embargo. The overwhelming response was that people consciously tried to conserve gasoline on their trips, that they traveled less than they had before the oil embargo, and when they made their trips, they drove slower than they had before. Other studies have found that commuter work trip travel patterns changed very little during the oil embargo, but that discretionary or non-work travel trips were substantially reduced in order to conserve gasoline. On the other hand, carpooling and a shift to public transit accounted for only 11 percent of various changes in travel habits of those surveyed.

Probable Response by Spokane Residents

If a future energy crisis results in gasoline shortages in the Spokane area, Spokane residents will most likely respond in a similar manner as those people who answered the 1974 survey quoted above. The immediate responses would deal with reducing discretionary trips and consolidating a number of short trips into one longer journey. In addition, residents would become much more conscious of their driving habits, and thus act to reduce their gasoline consumption through better driving habits. These actions would make a substantial impact on gasoline usage, without seriously disrupting their daily lives, or making a significant change in their mode of travel.

For nondiscretionary travel, such as the home-to-work commute trip, carpooling and bus transit probably have the greatest potential for decreasing gas consumption for these types of trips. The 1980 census Journey to Work statistics reported an average auto occupancy of 1.12 persons per vehicle for

Table 14. Changes in Travel Habits Due to the 1973-1974 Oil Embargo.

Change in Travel Habits	Percentage of Respondents*
Tried to use less gasoline	78%
Traveled less	55%
Drove slower	52%
Bought/used more efficient auto	13%
Carpooled	8%
Used public transportaion more	3%
Other actions (Bicycled, Walked)	17%

*Multiple responses allowed; percentages do not add up to 100%

Source: National Opinion Research Center, "The Impact of the 1973-1974 Oil Embargo on the American Household." Chicago, December, 1974. Cited by North Central Council of Governments.

home-based work trips in Spokane County, over 70 percent of these trips being made in single-occupant vehicles. Thus, there is considerable potential for shifting to carpool mode; even a shift of 10 percent of the single-occupant drivers to carpooling with one or more other persons would result in a savings of over 2 million gallons of gasoline per year.

Likewise, public transit has substantial capacity for accommodating increased ridership. For the County as a whole, the 1980 census indicated that 4.3 percent of the County's commuters used public transit for their daily work trip; within the City of Spokane, this figure was higher, 6.9 percent. Again, even a modest shift from single-occupant vehicles to transit buses would provide substantial fuel savings.

Role of LRT

In the event of a future gas shortage in Spokane, the presence or absence of light rail transit in the east or north corridors would not likely have a significant effect on gasoline consumption patterns. First, identity in both areas, particularly in the east corridor where the Milwaukee right-of-way exists, is low, and most riders would have to use some other mode of transportation to reach the rail line. The assumed transit service scheme would be a series of feeder buses running at right angles to the LRT line, connecting the rail line with outlying residential areas. Fuel consumption by these feeder buses would not likely be significantly less than if they were running on radial patterns connecting these residential areas directly with the CBD and other major employment centers. Because of the low densities in the east and north corridors, only a few of the LRT patrons would be able to walk to the rail line. For those who might avail themselves of Park & Ride lots, an access to rail line by private auto, carpooling to the CBD and other major employment centers would provide substantially better potential for fuel consumption reductions.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Stated simply, the conclusion of this study is that light rail transit is not a feasible transportation alternative in the Spokane region. Reasons for this conclusion, as discussed in preceding chapters, are:

- Regional Growth Forecasts: The Spokane Regional Council's (SRC's) regional forecast of one percent per year population growth and one-half percent per year employment growth do not support the need for any major new capital investment in transit facilities. The imbalance between 33,000 new households and 13,000 new jobs in the planning area by 2000 indicates that new residents will be traveling to new employment/commercial activities outside the Spokane metropolitan area, rather than to new or expanded employment/ commercial centers inside the area. LRT in Spokane cannot serve these trips outside the planning area.

- Development Patterns: The SRC forecasts show less than 200 new jobs in downtown Spokane by 2000, coupled with low density suburban sprawl in the North and East Corridors and scattered pockets of new employment throughout the region. Without continued commercial growth in downtown Spokane and medium-to-high density residential development in the North or East corridors, LRT simply will not generate sufficient ridership to be even marginally cost effective.

- LRT Ridership Projections: Ridership projections fell short of established minimum criteria.

- UMTA Requirements: Existing transit ridership in the most heavily traveled corridor fails to meet the proposed UMTA requirements for Federal funding. While this is not a fatal flaw of itself, it is an indication that obtaining funding for a Spokane LRT would be difficult, and that the funds would have to be entirely local.

- Right of Way Difficulties: Past attempts to take additional Division Street ROW for provision of a high-grade auto facility failed during planning stages; this is an indication that obtaining ROW in the heaviest traveled corridor would be a politically difficult task. In the East Corridor, critical links in the LRT line depend upon securing ROW through heavily traveled freight railroad lines.

- Transit Service: A light rail system with attendant feeder buses would actually lessen the quality of transit service for many patrons, as the bus-plus-LRT would require additional transfers to reach most destinations (unless parallel bus service were maintained, which would reduce forecast LRT ridership).

On the other hand, a Spokane LRT would meet many of the criteria chosen for feasibility evaluation by the study's Steering Committee (see Table 3 in Chapter II). For example, either a North or an East Valley LRT would serve major activity centers, maintain average schedule speed of 15-20 MPH or more, and lend itself to interface with existing bus transit. Additionally, right of way is apparently available in both corridors, there is no evidence of inconsistency with regional transportation goals, there would be opportunity for joint development at stations (although there is little evidence of present interest), and environmental impacts would not appear to be major (unless North Corridor tunneling were undertaken).

In the final analysis, however, cost factors play the deciding role. Low ridership forecasts are an indication that capital investment per capita would be unreasonably high, as well as an indication that required operating subsidies would be excessive. Funding sources would probably have to be entirely local and regional, since UMTA's proposed minimum ridership criterion is not met.

It is the final recommendation of the Spokane LRT Feasibility Study that additional study of light rail transit for Spokane not be pursued. Unless future demographic forecasts include concentrated CBD employment growth or extremely dense residential growth in outlying areas, there is no indication that further studies would provide a more favorable conclusion. It is hoped that the results of this study may be useful in future transportation planning in the Spokane region.