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Utah's Transportation Solution: Future Vision

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UTAH'S TRANSPORTATION SOLUTION: FUTURE VISION

by

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I. Introduction

In the vision statement for the future of the State of Utah drafted by the Utah Tomorrow Committee one of the primary objectives outlined is to "Build a statewide economy and infrastructure that supports a broad spectrum of opportunity for all citizens while advancing the standard of living and maintaining a high quality of life." This statement has been reiterated by many over the last several years as the state continues to grow, experiencing along with that growth many pains along the way.

The rapid growth of the state presents a great opportunity along with many challenges for the future. (See Appendix A for South Corridor and Central Business District population and employment trend estimates for the period between 1990 and 2010 based on current trends.) Utah's continued growth will add more than 100,000 people to the area of the I-15/State Street Corridor alone, in the next twenty years (along with nearly the same number of jobs, according to population and employment estimates done by the Wasatch Front Regional Council in 1992). Vision for the future is what is needed at this time. It is up to us to decide at the outset where it is that we want to end up before we move to face the challenges of the future.

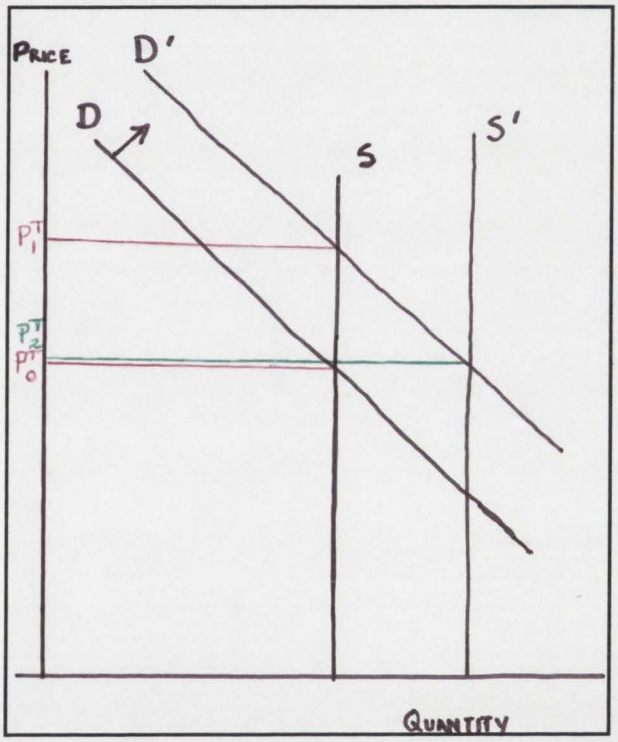
One such dilemma that faces the future of the state is that of transportation infrastructure. Currently, the demand for transportation is outstripping the carrying capacity of that infrastructure. (See figure 1) The principal requirement for current and future transportation is the need for additional people moving capacity, especially during peak-time hours. Once the problem is identified, the question that remains is the method for choosing the alternative that will best serve the needs of the state for the future. This analysis will focus on two of the 33 proposals that were considered by the Wasatch Front Regional Council (WFRC) as potential transit and highway alternatives to improve the state's infrastructure in order to support the increased burden placed on such. Attention will be paid to the benefits of any solution in the aggregate and the costs to Utah as a society.

Capital and maintenance costs for the system are readily estimatable based on experience from neighboring states, while the benefits to the society are relatively more difficult to assess and will be based on estimates compiled by UTA. The benefits to the system would be included,

implicitly, in the estimate of the demand curve for transit with respect to private vehicle operation. It will be important later to the discussion to know what the shape of the actual demand curve for public transit is in the region that will be impacted by the implementation of this new project.

The most notable of all the problems that face the Salt Lake Corridor is congestion, especially during peak-time. Although this is a serious problem that significantly raises the costs of commuting, there are other problems for the future, such as air quality and energy conservation. .

Figure 1



The short-run supply curve for transportation is fixed at a certain carrying capacity. A downward-sloping demand curve is the aggregate representation of the demand for transportation systems, most notably roads, along the Wasatch Front. As move cars are added to the system the demand for each unit of transportation is shifted outward. With the outward shifting of the demand curve the cost of transportation increases dramatically. The costs associated with the increase in price are indirect costs that result from additional time and fuel costs due to congestion, costs associated with externalites that society will have to pay such as air pollution and safety improvements (ie. reduced number of accidents).

The only way to reduce the costs associated with transportation is to shift out the supply curve, in the long-run, and to change the consumption pattern of individual users. Long-range planning has gone into the process of changing the consumption patterns of Utah commuters, but any such efforts will take years. The only way, then, to reduce (or stem the increase) in the costs associated with such demand increases is to increase the carrying capacity of the infrastructure system.

The increase in supply will follow only after the price per unit of transportation reaches a preset price "limit." Once prices rise to this level there is an incentive to shift the supply curve outward, thus reducing the price per unit. The reduction and increase in price depends on the magnitude of the shift. The aforementioned costs associated with commuting that increase with the amount of traffic are due to the level of traffic demand and the capacity of existing and planned facilities. The carrying capacity for any transportation system is fixed, at least in the short-run. Each unit of transportation can be viewed as an individual part of the road that is used by an individual. Each unit is privately consumed but it is virtually impossible to exclude any individual from consuming, price is not sufficient to exclude potential users until the costs become extraordinary. Individuals on a bus or other means of public transit move the unit of transportation to a more joint consumption level, making it closer to a public good (ones consumption doesn't affect the consumption of anyone else).

Hence, the focus for this study. Data will be presented on the costs and benefits of these two differing alternatives. One of which is the path that has been pursued for the past several decades as transportation has become more and more important; this we will refer to as the "No Build" solution. The "No Build" solution is an overall expansion of the highway system to

accommodate a certain level of demand increase, but will not incorporate any expansion in public transport services.

"No Build" is really the status quo that has been observed over many years. The purpose of including this option in the analysis will be for comparison purposes only, in order to see the benefits of a change in the status quo. With this being the case, it will be possible to calculate an equivalent variation, or the amount that would be required to be paid if the change were not implemented.

The variable that we will be concentrating our analysis upon in this study is that of a light rail component (LRT) addition to the current infrastructure network. A careful analysis of the data provided through the WFRC, Utah Transit Authority, Utah Department of Transportation and other sources will provide a comparison of the benefits and the relative costs of each project. Through this study it will be possible to judge whether or not the benefits that will accrue because of such a project will justify the costs to the state for the implementation of such.

Independent transportation experts have analyzed Utah's growing problem for over a decade. Their collective goal has been to reduce congestion by identifying transit solutions that provide better accessibility to more people, improve travel times, and assist in energy conservation and clean air goals.

II. Method of Analysis

Many different methods may be employed in the determination of the net benefit to society of a project of this nature. The model that will be used will result in a ratio of costs to benefits, thus giving some evidence of the relative cost-effectiveness of the different projects. However, just because one project will result in the greatest amount of net benefits, does not mean that it will be the process that is followed. The ultimate decision on the future of transportation policy along the Wasatch Front will lie in the political arena.

This study will take the approach of potential compensation to those that will be adversely affected by the implementation of any project, and not on actual compensation. Planners and

citizens alike must realize one thing from the very outset of the discussion---there is nothing that could be proposed that will fully satisfy all of the citizens of Utah. In the overall analysis, this will be an important point to consider.

Because the compensation to be considered is a potential compensation, we are assuming that this is not a Pareto improvement. This is significant in that there may be many who will be adversely affected while the benefits of such a project may be entirely concentrated in a small proportion of the population, but as long as the benefits outweigh the costs the project is viable. In effect, the distribution of the benefits will not come into play at all in the analysis, although it may play a significant role in the final decision of the project. Our concern here is the positive analysis of any project that could be proposed as an alternative solution to increasing transportation demand, not the subjective side of the decision-making process.

The manner in which we will proceed to rank the two investments under study is based on the ratio of excess benefits (or net benefits) to cost. The greater the ratio in the final analysis will necessarily be ranked ahead of the one with a lower ratio. Because some of the important data is still relatively inestimable at this point, a method of impact analysis could be used to assess the potential positive or negative impacts of any alternative to such project.

One assumption that we will make in order to simplify the analysis, that would be an important consideration for the policy-makers, is that of no budget constraint. The projects will be analyzed on their individual cost-effectiveness, not on whether or not the projects would be fundable. We will assume from this point, that since the projects are under consideration at all that they are within a certain budget constraint that will not be evaluated in this particular study.

Naturally, we will assume a basic set of expectations inherent in every economic analysis, in order to retain consistency. Included in this set of assumptions are the following: consumers of transportation are rational decision makers, as long as they have the information necessary to make such rational decisions. In this case, it will be imperative to assume that each consumer is provided with perfect information. The service provider, UTA, is also a profit-maximizer. They will set their prices and output at a level whereas they will maximize the gains to themselves and to society.

III. Description of Alternatives

A. No Build Alternative

In order to have a comprehensive analysis of the two parallel alternatives it is imperative that a careful definition of the particulars of each project be lineated. No Build Alternative (Alternative 1) provides a baseline for establishing the transportation and environmental impacts of all other alternatives being considered. "This alternative consisted of buses operating in mixed traffic on local streets and freeways, with few highway improvements proposed to increase the buses' running speeds." (UTA EIS, 2-5)

The transit alternative of this alternative was determined to be "attainable" by the year 2010, assuming that current revenue sources would be available for the study year 2010. This option also calls for the expansion of peak hour buses from a total of 208 in 1986 to 280 in the year 2010 (142 of which would be used in the study corridor), according to the current short range transit plan. "No new or expanded park-and-ride facilities or bus transit centers were planned for this alternative. No additional costs or environment impacts were anticipated. New maintenance facilities would be necessary to manage the expanded bus fleet, and the appropriate costs were included in the No Build alternative's capital costs." (UTA EIS, 2-7)

The No Build policy satisfied FTA and National Environmental Policy Act (NEPA) requirements for a "do nothing" scenario for the evaluation.

B. Locally Preferred Alternative--Light Rail Component

The approximately 15-mile long alignment of the light rail project is contained within the existing Union Pacific Railroad Right-of-Way (UPRR ROW) from approximately 10000 South Street in Sandy City to a north terminus on South Temple Street at approximately 400 West in the Salt Lake City CBD. (Note: A map of the proposed route is enclosed in the back of the study under the heading Appendix B.)

The alignment, which essentially conforms to the existing at-grade profile of the UPRR, will be located entirely within railroad property or on city streets, requiring no additional right-of-way acquisition. The UPRR ROW is currently owned by UTA and thus the only additional property that will require acquisition is that for station and yard shop facility sites. (UTA EIS 2-15)

The light rail line included in the LPA is expected to carry approximately 23,000 passengers per day in the year 2010. The daily ridership for a proposed 1999 opening day is estimated to be slightly over 14,000 passengers per day (a figure that is expected to grow moderately until the full system is built). The hope is to reduce the road use by those who have legitimate options, while opening the roadways for those who may not.

IV. Relevant Issues

In the classic model of user fees, only the one that directly benefits from the program would be required to pay for the service. What we must recognize, though, is that there are many externalities involved in a common-pool good, such as transportation. The real problem must then be identified and applied to the destination that we are trying to reach.

Among the facts that we must weigh carefully, are the costs, including the two main areas of capital and construction costs along with the operation and maintenance costs. (Costs are estimates provided to UTA by the independent firm of Parsons, Brinkerhoff, Quade & Douglas, Inc. in February of 1994.) Costs of either of the projects are fairly straightforward, due to the fact that there are relatively few external considerations that concern the study.

Time will also be a relevant factor to consider when considering the total costs to the expected benefits. The initial outlay for the project is extremely high but the stream of benefits is expected to last over a considerable amount of time. According to the figures put out by UTA the expected return is stretched out over a period of fifty years. Due to the lengthy time frame, the discount rate, which is set at 7 percent, will play a significant role in the determination of the total benefits over that period of time.

Costs that are not readily accounted for are the loss of personal freedom and convenience while subjecting oneself to the schedule of the public transit system. The way that this is accounted for is within the social demand curve, which is a horizontal summation of all individual's demand for the new system. Discussion will therefore, be limited on the incentive issues of marketing the LRT to the general public, assuming that price will be the only real factor involved in the decision of whether or not to use the new system. This is a far-reaching assumption, considering human behavior as that of a rational individual acting under perfect information as to the prices involved in the decision.

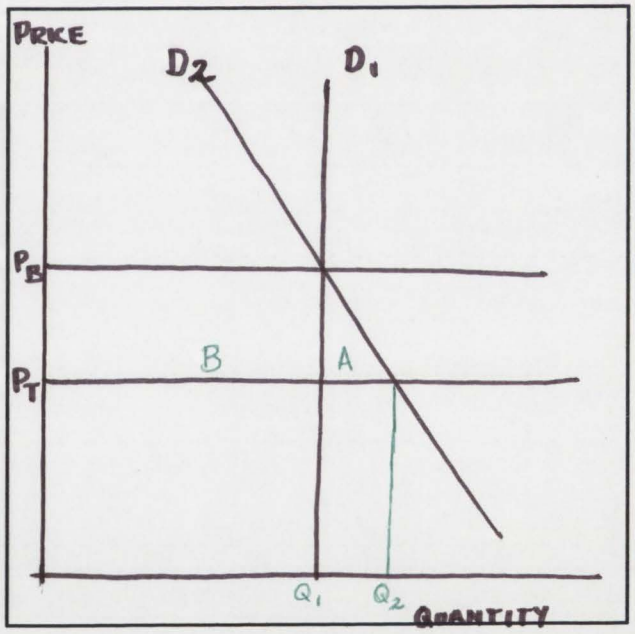
Although this curve is very difficult to assess, we will assume that it is downward-sloping. Thus, the lower prices for public transit will induce others to give up the convenience and security of their private vehicle in favor of the LRT. (See Figure 2)

Figure 2

There are a number of different ways that we may estimate the demand curve for transportation. One of which, D1, is the graphical depiction of a demand curve that is perfectly inelastic; quantity demanded is not affected by price. The second demand curve, D2, is a more realistic representation of the demand curve as downward-sloping.

With a downward slope on the demand curve it is possible to gain an additional amount of consumer surplus, area A, through the expanded demand. Area B is included as an increase in surplus (an additional benefit) due to the lower price of transit in relation to the price of the existing bus service. Depending upon the priced elasticity of demand (the slope of the demand curve), the amount of benefit that is derived can easily be calculated. The area A will be larger the more elastic the demand and smaller, even to nothing as in the case of D1, with a more inelastic demand curve.

Price in this case is a per trip price that is equivalent to the marginal cost of the trip, based on the preceding assumptions.



The specific costs and benefits will be discussed further in their respective sections of the study, but it is relevant, at this point, to look at the other economic benefits of the LRT project (as opposed to the "No Build" option, which will not garner any other economic benefits). According to the Utah State Office of Planning and Budget (OPB) the following economic

benefits were found to exist through the implementation of the LRT component of the Locally Preferred Alternative (LPA) for transportation policy, assuming that the greater part of the project will be financed through federal monies: 1) Each dollar of federal assistance circulates through the economy 2.44 times, generating $2.44 of economic activity; 2) Each dollar of federal assistance raises income by $1.29; and 3) The greatest employment impacts will be during the years of peak construction (1997-1999 for transit). OPB estimates the job creation from the rail project alone to be 959 new jobs during the peak construction years, with 396 of them being in construction.

Some mention of the possible effects, whether positive or negative, to the environment and the natural resource base of the state will be made. Most of the focus, however, will be based upon the expected reduction traffic congestion leading to the reduction of airborne pollutants emitted by vehicles and the shift in fuel uses by final consumers. Other potential benefits and costs to the environment will be viewed as negligible in this study, for the sole purpose of simplification.

The benefits from the implementation of the LRT are readily assigned to different categories. The most formidable of which is the time savings that would result from a reduction in traffic congestion. Other benefits fall into the next few categories respectively, as to the dollar amount of the benefit: value of reduced vehicle operation cost for fuel, oil, tires, depreciation, and repairs/maintenance; value of resulting safety improvements; value of energy conservation; and value of improved air quality. Each of these benefits (along with others that don't fit as neatly into categories such as these) is important and will be treated individually for both the LRT and the "No Build" options.

In a word, transportation is a great example of a common pool good. Because there is no way to exclude or select the users it becomes first come, first serve. Consumption of common goods is individual and therefore ones benevolence or concern for the future will only result in another taking that persons forfeited share. Therefore, there is no incentive to conserve because no one else will and the common property is thus overexploited by the many users, all scrambling to get their share.

UTA also considered the socioeconomic environment of the region, as the LRT would impact it. One natural consequence of the system would be that of concentrating transit activity

and increasing pedestrian activity in the vicinity of the rail stations. Most of the environmental impacts, including those of the visual and community, have already been mitigated years ago because of the fact that the LRT will run along the existing Union Pacific Right of Way that UTA has already purchased in the South Corridor. Many areas will even be improved upon because of the planning that will be done around the stations.

V. Costs

Although most opponents of the system see the merits of public transit, most would simply claim that LRT is not the solution that we should be looking for. The claim is that the costs of construction and maintenance are too exorbitant while the benefits that will accrue are not as great as some would claim and are not large enough to compensate for the costs.

Because the capital investment is so sizeable, there must be some guarantee in the minds of the principal players that the LRT will be used before any construction will begin. The thing that drives down the efficiency of the system is the transfer time between LRT and the expanded bus system.

Over the twenty year period between 1991-2010, a total of $614.18 million (YOE $) will be required for the bus and light rail system capital needs of the Locally Preferred Alternative. Of this total, 53 percent is attributable to bus capital and 47 percent is attributable to light rail capital.

A. Capital Costs

Capital costs were developed using base cost estimates compiled in current dollars following FTA standards of unit cost estimation. "The LRT capital costs were developed for major cost categories using similar light rail projects, industry standard costs, or, where detailed information was available, by using the contractor crew/spread method. IN this method, each work item is broken down into the categories of labor and insurance, permanent materials and equipment, construction equipment, consumable supplies and subcontract costs and the elements

of the item are estimated and a detailed unit price calculated."(UTA FEIS 2-41)

The total capital cost estimate in 1992 dollars for the LRT component of the LPA is presented in Table 2 on the next page. The total capital cost estimates for the entire No Build and revised LPA systems is presented in Table 3. These estimates include the following main cost categories: 1) additional new buses over the existing fleet (1991) including 20 percent spares. The new buses are estimated to cost $220,000 each. The No Build alternative will require 72 new buses, and the revised LPA a total of 236 new buses; 2) transit bus facility allowances are included. The current capacity of UTA's Slat Lake facilities is approximately 366 buses. UTA is planning a new maintenance facility at a 1992 cost of $7.8 million. It will have the capacity of 100 buses. UTA estimates that a new satellite facility will be needed for the additional 70 buses for the LPA (total fleet of 536 buses) and that facility will cost approximately $9 million; 3) six special transit centers, park-and-ride lots, and bus passenger enhancements estimated at $1 million per location for the LPA are included in the capital cost estimates; and 4) light rail costs are based on the updated preliminary engineering and cost analyses as described above. (UTA FEIS 2-41)

The estimated capital costs for the alternative subsequently selected as the LPA (two new lanes on I-15 and a UP Railroad LRT alignment) were $1,155 million ($597 million for highway and $558 million for transit components). The No Build alternative had a total capital cost of $243 million, primarily for highway improvements, with $11 million for transit upgrades.

Bus replacement requirements and costs were also estimated over a 20-year time frame to account for the 12-year life of a standard transit coach under normal operating conditions. The cost of replacement buses varied little among the alternatives, $195.85 million for the No Build to $236.98 million for the LPA.

LRT expenditures include the costs for planning, design, construction, management, agency oversight, and capitalized start-up costs. The elements include right-of-way purchase, the rail improvements, stations, vehicles, impact mitigation, the LRT yard and shop facility, and total $237.44 million in year-of-expenditure dollars.

The light rail transit capital program reaches maximum expenditures during 1995 through 1999.

Table 2: Capital Costs

Summary of Capital Costs (in millions of 1992 Dollars)

Component	ALTERNATIVE	
	No Build	Revised LPA
New Buses	$15.84	$51.92
Planned Maintenance Facility	7.80	7.80
Additional Maintenance Facility	--	9.00
Park and Ride Lots, Transit Centers, Passenger Enhancements	--	6.00
LRT Costs	--	210.50
Total	$23.64	$285.22

Source: Parsons Brinckerhoff Quade & Douglas, Inc., February 1994.

Table 3: Light Rail Component

Revised LPA (Light Rail Component) Capital Cost (in millions of 1992 Dollars)

Item	Cost
Trackwork	$ 32.8
Bridgework	1.5
Stations	4.1
Park-and-Ride Lots	5.9
Yard and Shop Facility	18.7
Utilities	6.9
Street Restoration	2.1
Catenary System	29.3
Signals, Train Control and Communications	18.4
Traffic Signalization	0.9
Fare Collection	3.7
Vehicles	50.9
Station Right-of-Way Acquisition and Environmental Mitigation	16.7
SUB-TOTAL	$191.9
UPRR Right-of-Way	$ 18.5
TOTAL	$210.4

Source: Parsons Brinckerhoff Quade & Douglas, Inc., February 1994.

B. Operating and Maintenance Costs

The operating and maintenance cost (O&M) estimation procedure for the LPA and the No Build alternatives was based on the methodology recommended in FTA's technical guidelines, using input data from the projects detailed operating plans and the travel demand forecasting results for the alternatives. The costs for the No Build alternative in 2010 would be about $37.7 million (1992 base dollars). This compares with the current operating costs for the existing bus system of about $28.65 million. The increase is attributable to an increase in the constant dollar per unit cost of providing the bus services, and to an increase in service assumed for the No Build alternative. The No Build alternative is constrained, by definition, to the existing fleet size plus 72 additional buses. By the year 2010, transit demand will have grown for both peak and off-peak hours so that the No Build alternative would accommodate the peak period demand only at heavily loaded conditions due to the fleet constraint. However, off-peak service would be enhanced to satisfy the future demand at reasonable load standards.

Annual operating and maintenance costs were estimated for the transit elements of each alternative only; O&M costs for the highway elements were assumed part of the overall maintenance program for state highways and not included in the financial analysis. Total cumulative transit O&M costs for the period 1989-2010 ranged from $1,079 million for the No Build alternative to $1,015.02 million for the LPA (period from 1991-2010) .

On a year-by-year basis, the operating budget for the LPA will be more than fully recovered through existing revenues and other sources. Over the analysis period, there is an annual net surplus of operating funds that would be available for capital of $370.44 million (period 1991-2010). (UTA FEIS 6-11)

NOTE: For financial analysis data for the Bus and LRT components of the LPA see table 5. This is a summary of what is referred to as Option 1 in the UTA Final Environmental Impact Statement. This option assumes that UTA would receive the ISTEA authorization of $131.0 million in Section 3 New Start funds, so that an increase in local sales taxes would not be necessary.

VI. Benefits

The real dilemma in this case is not whether or not a project such as the light rail will indeed help solve many transportation problems along the Wasatch Front which could potentially be crippling for the state's future. Rather, it is a question of whether or not the benefits that will accrue to the state and it's citizens justifies the enormous costs associated with the construction and maintenance of such.

The marginal cost of providing the service is much lower for transit than on a bus. Because the per trip cost in this case is equal to the marginal cost of producing the additional service and the marginal cost for transit is lower than that for the bus, with the implementation of the transit system there is an increase in the consumer surplus.

A. Time Savings

For the entire LPA project, transit and highway criteria, there is an expected time savings, due to congestion reduction, of 40,000 hours per day in 2005, 50,000 hours per day in 2015, and 55,000 hours per day in 2020. Dollars values for the time saved were calculated on the 2010 estimate of 42,009 hours daily saved multiplied by 335 days per year for highway, 3,410 hours daily for transit multiplied by 274 days per year. A travel time cost of $5.32 per hour (1995 dollars) with a growth rate assumed at 3.5 percent annually. Year by year estimates prorated on the basis of total VMT (Vehicle Miles Traveled) per year. (Source: I-15 EIS/WFRC)

Based on the above assumptions the time savings due to the implementation of the LPA translates into$102 million in 2005, $178 million in 2015, and $232 million in 2020. The transit only portion of time reduction for the year 2010 equates to nearly $5 million annually, prorated in the same manner as the total time savings.

Buses must operate in mixed traffic while a light rail system would run on an exclusive right-of-way. It would also require an enormous increase in buses to simply accommodate the existing level of transit demand as it adjusts to the increase in population. Pricing on either of the

systems is a simple addition of the price of operation plus the time cost. The time costs of transit seem to be much less and thus there are time savings that go into the benefits category of the project. We could then take these time savings and times them by the average wages in the Salt Lake County area to get a dollar value for the transit district. Although there are other ways to estimate the benefits of time-saving, the average wage model seems to be the best measure of that estimate.

The light rail system also has many efficiency advantages over the traditional transit currently employed in the region. The most striking of which is the speed with which it delivers passengers to specific points. Because the LRT runs on its own tracks and would be synchronized with signalized arterials, the LRT will make the round trip in 90 minutes. According to data presented to UTA by the Wasatch Front Regional Council, who sponsored the transportation solution research for the region, a typical trip (from approximately 10600 South and 700 East in Sandy to Main and South Temple in downtown Salt Lake) would be 22% faster on the LPA over the no-build. Most of the time that would be saved is as a result of the LRT with most of the time loss due to the LRT from the bus. In general, transit operating in an exclusive right-of-way is less affected by traffic congestion, accidents, weather, and other factors, thus, rail transit runs on more reliable schedule. Ride quality is also better on the rail system, since trains experience fewer starts and stops.

Traditional bus systems must operate in mixed traffic and are no faster than private vehicles, while contributing to the traffic problems instead of reducing them significantly. A single driver of a LRT vehicle, which will has a peak hour peak direction maximum load of approximately 2,100 according to an estimate for the year 2010, can move many more people an hour aboard LRT than on a bus. This same driver can then turn around and make the return trip back on the same vehicle, in about the same time it would take for a bus in mixed traffic to make the trip just one way. Less traffic would result in fewer accidents, less congestion, which would then result in less fuel consumption and pollution caused by traffic congestion.

B. Vehicle Operating Costs

Based on research done by the Wasatch Front Regional Council and the American Automobile Association the value of reduced vehicle operating costs for fuel, oil, tires, depreciation, and repairs/maintenance is projected to be $38 million in 2005, $67 million in 2015, and $87 million in 2020. These figures were calculated using the annual VMT reduction multiplied by $0.29 per mile beginning in 1995. Annual estimates based on 105 million miles saved in 2010 with the values prorated year by year on the basis of total VMT. Cost savings are beginning in 1995 and phased in with construction to 2002.

C. Safety Improvements

Reduction in the number of accidents from expected safety reductions will carry a value of $13 million in 2005, $23 million in 2015, and $30 million in the year 2020. The Utah Department of Transportation and the Wasatch Front Regional Council based these figures on the reduction in VMT multiplied by $0.10 per mile.

D. Energy Conservation

Exact figures (in dollar values) are not given for the reduction on fuel consumption due to the implementation of the LRT since it is extremely difficult to assign a future price to a commodity such as oil. The projected energy savings have been estimated for the base years 2005, 2015, and 2020, however, at 4.6 million, 5.8 million, and 6.5 million gallons of fuel, respectively.

E. Air Quality

The reduction in VMT is once again the basis for the value placed on improved air quality. This figure is multiplied by $0.33 per mile to give the total value of improved air quality in 2005

of $280,000; 2015, $350,000; and 2020, $380,000.

Indirect costs that may be overridden due to the new system would also be associated with the federal regulations that govern such measures. Current fines and extra costs associated with the environmental regulations could be added to the benefits, if the system were sufficiently able to reduce such external costs.

The project's greatest benefit on the environmental side is a reduction of the total quantities of motor-vehicle-related pollutants emitted in the study area. "The results of a mesoscale analysis for the project show that compared with No Build conditions, the LPA would result in an 1.8 percent reduction in CO, a 1.6 percent reduction of HC and a 1.1 percent reduction in NOx." (Utah Transit Authority, Final Environmental Impact Statement) The project work towards critical federally-required emission reductions toward attainment and will result in a reduction in mobile source emissions in the region.

Another advantage of the system being designed for an area that has been previously zoned for that use is that construction delays during the building of the system will be minimal, with most of the work being done along the existing ROW. With the construction and operation of the LRT being confined to a relatively small area, interruptions along the route will be minimal. Traffic signals at intersections of arterial roadways and the rail system will be no longer than the average traffic signal at present.

F. Other Benefits

Since the Highway component is rehabilitation and expansion within the existing freeway right-of-way, and the freeway has been in place for over 30 years, most of the business and industrial activities surrounding interchanges are already well established. The improved travel time and air quality, however, will positively impact business throughout the region.

For the light rail component of the project UTA's Economic Enterprise Opportunity Study completed a site-by-site analysis of potential station locations and outlined possible strategies for corridor communities to take advantage of those opportunities. Without completion of final design, it would be inappropriate to estimate the gain to the economy of the region.

However, improved land use could mean tremendous savings in many sectors of the regional economy. Taxpayers would benefit from reduced need to provide parking and roadway improvements. Location of housing and employment along the corridor would reduce travel time, cut energy consumption, reduce air pollution, and permit more efficient use of existing infrastructure. The recycling of land uses in the developed corridor would potentially save a large amount of community and economic resources. (UTA Cost Benefit Analysis Fax)

VII. Results

Salt Lake County is in vital need of capacity increases in it's transportation system. Not only are highway improvements necessary, but transit improvements are a vital component of the network. In this context, Slat Lake County is working to increase the capacity in transit through light rail and increasing bus service. The analysis indicates that operating efficiencies from a light rail system will ultimately allow more transit service to be provided in the area.

After all numbers are in and the analysis is all completed the one thing left to do is wait and see whether or not anyone will ride the light rail system. The goal of the system is to provide an alternative form of transportation to the ever increasing population of the state. Thus, there may not be a drastic reduction from the present level of traffic congestion but with an alternative there not be the ever increase that would be expected by the rise in population.

By reducing the cost of transportation along the Wasatch Front there would be an increase in the use of a more efficient system. This would start the change in consumer behavior patterns that are as much a part of the system as any other aspect. This will likely lead to the fulfillment of the motto used by many of today's political leaders, "Use the resources that the state currently has in a more efficient manner."

A system such as this is expected to last for a period of approximately 50 years, therefore the initial capital investment amortized and discounted over this period of time will not have to be fully recovered (or will it possibly be) within the first few years of the project. The greatest benefits, in fact, will accrue mostly in the period just beyond the completion of the final project construction.

Transportation is an industry that seems to have economies of scale internalized within. Due to this fact, the taxpayers of today may be subsidizing the future of the state as the state learns how to manage such a project to optimal efficiency.

FTA guidance on evaluation of major new transit investments has in the past incorporated a means for comparing the total of each alternative to its benefits.

The general methodology for the cost-effectiveness index translates the capital cost of the alternatives into equivalent uniform annual capital costs. These uniform annual capital costs reflect assumptions about the economic life of the transit capital components of each alternative and the cost of capital funds (ie. the discount rate). The assumed discount rate is seven percent as recommended by FTA and the federal Office of Management and Budget. The uniform annual capital costs are combined with annual O&M expenses and then compared to the benefits of each alternative to arrive at the cost-effectiveness index. The benefits of the transit alternatives are measured by the additional transit patronage of the LPA compared to the TSM (This alternative not only intensified the transit supply in the Corridor, but provided a major expansion of service in the east and west portions of the urban area. The development of this transit alternative was initiated as an extension of the No Build alternative, dramatically increasing bus service and the number of peak period buses to 558 vehicles, which represented a doubling over the No Build condition.). Additionally, the value of the travel time savings for the "existing" transit patrons is included in the benefits. The "existing" transit patrons are the forecasted transit users for the TSM alternative who would then have the choice to ride the more capital intensive LPA alternative and thus save time and therefore money.

The cost-effectiveness index as used by the FTA and described in table 4 is :

$$\text{Cost-Effectiveness Index} = \frac{\$ \text{ Capital Costs} + \$ \text{ Operating \& Maintenance} - \$ \text{ Travel Time Savings}}{\text{Transit Riders}}$$

Table 4

FTA Cost-Effectiveness Index (CEI) for the LPA

Alternative	1992 Annualized Capital Cost ($, Millions)	1992 Annual O&M Costs ($, Millions)	2010 Annual Time Savings Compared to TSM ($, Millions)	2010 Annual Transit Riders (Millions)
TSM 2010	$12.91	$63.33	$ 0.00	23.22
LPA 2010	$25.51	$58.39	$ 1.10	24.79
[LPA-TSM]	$12.60	$-4.94	$ 1.10	1.57

Source: Parsons Brinckerhoff Quade & Douglas, Inc., 1994.

$$\text{Cost-Effectiveness Index} = \frac{\$\text{Capital Costs} + \$\text{O\&M Costs} - \$\text{Travel Time Savings}}{\text{Transit Riders}}$$

$$\text{CEI} = \frac{\$12.60 - \$4.94 - \$1.10}{1.57} = \frac{\$6.56}{1.57}$$

$$\text{CEI} = \$4.18$$

where the figures represent changes in costs and benefits between the LPA and the TSM alternatives. The specific figures for this analysis are displayed in table 4, on the next page. The results indicate that the cost-effectiveness is $4.18 for each new rider that is added to the system once it is fully implemented. In relation to the costs of the TSM, the LPA seems to be very cost-effective.

There are still many question marks that remain, for the moment, as mere estimates based on the history of such projects in neighboring cities. Revenues and costs need to be viewed with a certain margin of error in mind, due to the uncertainty of the future. These questions need not be resolved before the project may be implemented. The figures that we have at this point are reliable enough to show that this project would have a positive ratio of costs to benefits.

After all the analysis of all the different alternatives it was concluded that the LPA, with the light rail, is the best alternative. This conclusion would be based, for the most part, on the cost-effectiveness of the other alternatives and on the political forces at work in the state. It is through the politics of the matter that a project with the highest ratio of costs to benefits would be passed over for another with a lesser ratio; this is not for us to determine.

In response to the results that were generated through the analysis of the diverse alternatives, I would have to propose that the Locally Preferred Alternative, incorporating the Light Rail Transit component, be accepted as the alternative that should be followed for the future transportation needs of the state of Utah. The analysis seems clear that the benefits accruing from the implementation of the LPA, will certainly outweigh the costs, most especially the capital costs, associated with undertaking such a project.

VIII. Financial Analysis for the LPA

The I-15/ State Street Corridor financial analysis had the following as its main objectives: 1) establishment of the degree to which financial resources could meet future capital investment, operations and maintenance, and replacement costs for the entire transportation system; 2) development of investment options for the alternatives; and 3) provision of a clear understanding

of the financial ramifications of each alternative for decision-makers.

To determine the adequacy of revenue to finance the capital and operating requirements of the LPA, the major sources of existing and new revenue were examined. Costs were then compared to the revenues projected to be available from these existing sources and from new revenue sources.

Because the amounts for the capital and operating costs were denominated in year-of-expenditure dollars (because it better reflects the actual funds that would be expended), an inflation rate of 3.59 percent per year has been assumed. Sales tax, which provides the major source of revenue available to UTA, is assumed to have a 1.97 percent rate of real growth in addition to inflation. These rates are based on analysis done for UTA by the Governor's Office of Planning and Budget (OPB) and are consistent with current trends and similar project analyses. Operating and maintenance costs are assumed to have an annual increase of 2.26, which is twice the actual rate of growth that UTA has experienced over the last ten years. (UTA FEIS, 6-2)

The funding resources for continued transit system operations and capital needs and for the LPA include passenger revenues, local sales taxes (both existing and new), FTA Section 9 operating and capital funds, advertising and special bus revenues, FTA Section 3 capital for "New Starts" and for the bus, FHWA Highway Demonstration Program funds, UTA capital reserves, and bond proceeds.

"The results of the cash flow analysis and sensitivity testing indicate that UTA has the financial capacity to implement the Bus/LRT Program without a new local sales tax I Salt Lake County, assuming it secures federal funding from the Federal Transit Administration and Federal Highway Administration at the levels proposed. This capacity is constrained, however, and requires vigilance on the part of the UTA Board and management with respect to the rate of cost growth, the rate of services expansion, and the rate of increase in fares."

"Particularly during the years of bus service expansion with LRT construction, it will be essential that UTA continue to keep growth in operation cost per revenue vehicle mile in line with changes in cost and patronage. This will require that administrative costs remain low and that the productivity of the service be kept high." (UTA FEIS 6-16)

Table 5

Financial Analysis Bus/LRT
Total YOE$ 1991-2010
Summary

OPERATING AND MAINTENANCE SYSTEM	
	Bus/LRT without Tax
O&M Costs	$ 918,618
O&M Revenues	
Farebox	$ 211,709
Sales Tax	758,080
Fed. & Other	67,498
TOTAL	$1,037,287
O&M Surplus	$ 118,669
CAPITAL SYSTEM	
Capital Costs	
Bus	$ 279,861
LRT	264,740
Debt Service	69,583
TOTAL	614,184
Capital Revenues	
Capital Reserve	$ 20,000
O&M Surplus	118,669
Section 9 Capital	127,260
Section 3 Bus	102,029
Section 3 LRT	79,516
FHWA Demo	117,664
Bonds	65,900
Interest on Reserves	11,209
SUBTOTAL FEDERAL	$ 426,469
TOTAL	$ 642,247
2010 ENDING BALANCE	$ 28,063

Source: Sharon Greene & Associates, February 1994.

IX. Politics and Opposing Viewpoints

There are, of course, certain limitations to my analysis. Admittedly, the information and sources that were cited in this work were, for the most part, the work of organizations that were in favor of the light rail alternative. In using the estimates provided by such organizations one must realize that the figures are taken as the optimistic point of view.

One of the underlying assumptions for the entire project is that of expected federal funding sufficient to finance the capital costs of construction with only a 80-20 matching ratio. This ratio would guarantee the provision of the project without a local sales tax increase, as UTA declared to do. Some funds have been made available already, but are not entirely certain. The UTA Board is only waiting for the funds to come through (or some guarantee of the funds coming in the future) before anything will be begun on the new system. Many of the questions that are still lingering in the distance will not be resolved until the project is in operation, others will need to be addressed before that can happen.

The UTA Board of Directors virtually guarantees the support of the public for the project from data collected in neighboring states who have already undergone the implementation of similar systems. There are, however, many influential citizens who remain quite vocal in their support or opposition to the plan. Although the matter is not technically a political debate (as far as additional state taxes are not assessed for the operation and construction of the system), it is important that any change would be supported by state leadership.

UTA officials have released the statement that Salt Lake City endorses as a public policy objective the development of a light rail transit system extending through the downtown area. This is a very important declaration for the project politically, yet is entirely unnecessary in the real decision making process.

The Light Rail Transit option of the LPA underwent political scrutiny during 1992 when it was on the ballot in connection with an increase in sales tax. Public outrage for any increase in taxes was dominant and the proposed project failed. That project would have funded the new light rail system through an increase in the local sales taxes of Salt Lake County.

As the state and the entire country, indeed the world, seek to combat the problems that are associated with an increase in population, especially in urban areas, there has been an increased focus on the area of public transit. Although a light rail component of an expanded public transit system seems to be the wave of the future, there are still many here in the state that oppose the measure.

One of such is Richard M. Eyre, former student body President at Utah State University and candidate for Republican Governor position in 1992. The cornerstone of Eyre's campaign was the book Utah In the Year 2000: Choice or Chance which pinpointed the critical issues facing the future of the state according to the author. One of which was, of course, the future of transportation and infrastructure.

In Eyre's words the light rail "is a classic example of trying to apply yesterday's technology to today's problems." Instead of building for the future, Eyre would have a change in the consumption patterns of Utah citizens change. This is an admirable goal and a necessary element of a comprehensive plan for the future of the state, but it is no t sufficient for our needs at this time. Eyre sites a U.S. Department of Transportation study done for Salt Lake City that came to the conclusion that a light rail system for the Wasatch Front was "premature."

Granted, the existence of a light rail system may have been premature at that point in time, but when considering the direction of the state and the time lag due to the construction of such an system, "premature" no longer describes this project.

"There isn't a public transit system in any major city in America that comes close to paying for itself. Most of the difference between passenger revenues and operating costs has to be paid out of taxpayers' dollars. . .and most people who ride newly built rail systems are former bus passengers. . .and attracting people from busses does little to ease traffic congestion." (Eyre, 311-12)

In response to this argument, UTA has done extensive research on the growth of new systems in operation in recent years. They have found that in every case there has been consistent growth towards the new transit system. Once the system was built and fully-operational, there has been not only a rejuvenation in public use of the system but also an increase in public support for other public systems.

After all of the analysis and a tremendous amount of input from those parties that would be affected in the implementation of a transportation alternative, the UTA board finally stated on June 22, 1994:

> "NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of Utah Transit Authority that the Board does hereby affirm its position that the current and future needs of the Corridor can best be served by an expansion of both Interstate Highway I-15 and the public transit system, including the implementation of a light rail or fixed guide way transit system in the Corridor.
>
> BE IT FURTHER RESOLVED by the Board of Directors of Utah Transit Authority that UTA proceed with the implementation of the first phase of an expanded public transit system,. . . subject to the following terms and conditions: (1) that the light rail be designed and engineered to be constructed and operated with no additional local option sales and use tax increase permitted pursuant to Utah Code; (2) that the light rail system be constructed and operated without a decrease in the current level of bus service in Salt Lake County; (3) that the level of bus service in the portions of the public transit district located outside of Salt Lake County will not be reduced as a result of the light rail system in Salt Lake County; and (4) that matching federal highway and/or transit funding in an amount not less than 50 percent of the capital cost be obtained to construct the light rail system, and that UTA's share not exceed 25 percent of the capital costs."

Politically speaking the alternatives are extremely important but from a practical standpoint whether or not the politicians of the state and local governments support the plan or not is irrelevant. As long as extra revenue not be required from the state in the form of extra sales taxes, etc. However, the project does have the support of most of Utah's highest ranking officials. One statement that was released recently by UTA made the assertion that "Salt Lake City endorses as a public policy objective the development of a light rail transit system extending through the downtown area."

It is obvious that the consumption patterns of transportation users in the area will have to change, but there are ways to make the change easier. Other alternatives besides those two that have been expounded, made the assumption that incentives can and will change thus asserting that car and vanpools would be sufficient for the future. The question then remains whether or not that is an answer to the problem or simply a postponement of a future, more serious problem. It is important that we treat the cause of the problem and not only the symptoms. Limiting population growth in a state like ours is virtually out of the question, therefore we must plan for the future and be prepared for whatever comes our way.

APPENDIX A

South Corridor
Station Area Population and Employment Trends

1/4 mile Station Area	POPULATION 1990	POPULATION 2010	POPULATION Annual Growth Rate	EMPLOYMENT 1990	EMPLOYMENT 2010	EMPLOYMENT Annual Growth Rate
South Terminus (10000 S)	350	1,595	7.88%	200	324	2.44%
9000 South	1,124	1,500	1.45%	667	1,032	2.21%
Center Street (7800 South)	855	1,253	1.93%	501	788	2.29%
7200 South	591	1,078	3.05%	1,397	2,332	2.60%
6400 South	358	822	4.24%	387	445	0.70%
5300 South	229	819	6.58%	933	730	-1.56%
4500 South	123	476	7.00%	551	752	1.57%
3900 South	129	193	2.19%	1,013	744	-1.53%
3300 South	222	314	1.75%	1,716	1,381	-1.08%
2700 South	193	122	-2.27%	2,004	3,512	2.84%
2100 South	316	255	-1.07%	1,938	1,390	-1.65%
1300 South	317	463	1.91%	1,587	1,800	0.63%

Source: Wasatch Front Regional Council, 1992

Central Business District
Station Area Population and Employment Trends

1/8 mile Station Area	POPULATION 1990	POPULATION 2010	POPULATION Annual Growth Rate	EMPLOYMENT 1990	EMPLOYMENT 2010	EMPLOYMENT Annual Growth Rate
700 South/West Temple (future)	56	105	3.19%	453	447	-0.07%
Main/600 South (future)	28	54	3.34%	526	758	1.84%
Main/500 South	14	34	4.54%	1,710	2,506	1.93%
Main/300 South	287	240	-0.73%	3,939	5,401	1.59%
Main/100 South	0	1	N/A	9,735	10,728	0.49%
South Temple/ West Temple	0	0	N/A	1,008	1,276	1.19%
South Temple/ 300 West	0	9	N/A	726	891	1.03%

N/A Not available

Source: Wasatch Front Regional Council, 1992

Appendix A:

The highest growth areas in the Salt Lake County corridor under study are generally located in the middle to southern end of the proposed project area. Form the southern terminus of the project, 10000 South, to 4500 South the population will more than double during the periods of 1990 and 2010. In fact, within the next two decades, the Salt Lake Valley population alone is expected to escalate to 1,025,000---a 66% increase.

Although the focal point of this study is on a specific area of the Wasatch Front, the I-15/State Street Corridor, in Salt Lake County, the need for action exists along the entire stretch of the Salt Lake Valley. Many of the specific actions that will be proposed cannot, and should not, be limited to this area. They must be expanded outward to meet the future growth needs of areas both north and south of the proposed project. Planning is currently proceeding on future phases of this project that will do just that, along with expansion east and west through the corridor.

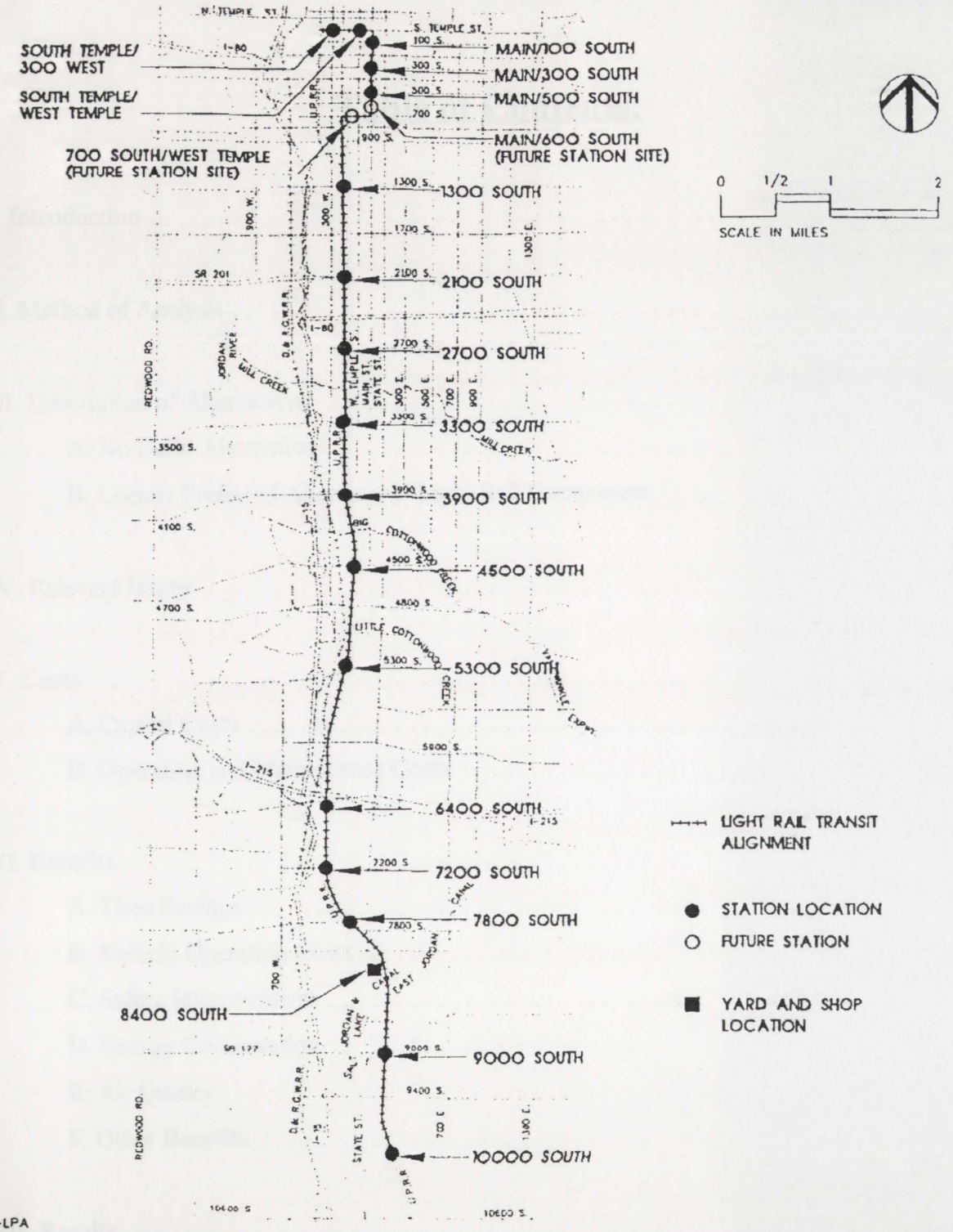
The rate of population growth in Utah currently exceeds the national average two to three times. The rate of automobile traffic is increasing at an even greater rate, according to studies done by the Wasatch Front Regional Council and Utah Transit Authority.

Employment figures project that employment will increase 154 percent in the next 15 years, meanwhile vehicle miles of travel are expected to double by the year 2010.

While these figures only show the growth that will happen in the narrow scope of the project, there are areas of greater annual growth (Davis county and the southwest corner of Salt Lake County, for example). These areas, although not included in this initial phase of development are also under scrutiny as to the feasibility of light rail extensions running to these areas. Further phases of the same project, each producing different results, will then need to be considered during consequent years.

With annual growth rates this high it is not surprising to see problems developing for the traditional transportation infrastructure, in areas along the Wasatch Front and also for areas that don't receive as much attention as being places of high growth potential. As the state continues to grow it will be imperative to have leaders that will look to the future and not concentrate all

their efforts on understanding today.



FEIS-LPA

UTAH TRANSIT AUTHORITY

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
ENGINEERS • ARCHITECTS • PLANNERS

I-15/STATE STREET CORRIDOR PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

REVISED
LOCALLY PREFERRED ALTERNATIVE
LIGHT RAIL TRANSIT SYSTEM

FIGURE
2.4

Table of Contents:

Summary of Resources:

1. Utah Transit Authority, Final Environmental Impact Statement, I- 1 5/State Street Corridor Project; Salt Lake County, Utah. September 1994.

2. Utah Transit Authority, Utah's Transportation Solution: A Balanced Approach, September 1994.

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