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CINCINNATI STREETCAR FEASIBILTY STUDY: RISK ANALYSIS- INVESTMENT AND FINANCE ECONOMICS AND POLICY

Final Report

November 15, 2007

HDR | HLB Decision Economics Inc.

Risk Analysis • Investment and Finance Economics and Policy

ECONOMIC WORTHINESS STUDY OF CINCINNATI STREETCAR

FINAL REPORT

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EXECUTIVE SUMMARY

Cincinnati has been experiencing a decline in its population and business community over the past fifteen years. A four-mile streetcar investment is proposed to stimulate the economic development within the downtown and Over the Rhine areas.

HDR has been retained to conduct a benefit cost analysis of a four-mile streetcar investment in the city of Cincinnati. The benefits to be assessed in this study include the following major categories:

- **Travel Cost Saving Benefits-**benefits related to a reduction of traffic in downtown Cincinnati due to the proposed streetcar system. Travel cost savings include vehicle operating cost savings, accident cost savings and emission cost savings.
- **Mobility-related Benefits-**benefits related to the increase in mobility of low-income people by using streetcar services. These benefits includes affordable mobility benefits and cross sector benefits.
- **Economic Development Benefits:** Economic development benefits are measured as the incremental premiums for both residential and commercial sector due to the proposed streetcar system.

The study determined that the proposed streetcar system is expected to bring substantial economic development benefits for both the residential and commercial sectors in Cincinnati. Figure ES-1 depicts the projected incremental growth in property values in the Base Case (without a Streetcar System) and Alternative (with a Streetcar System) over the period 2008-2042. The Alternative case accounts for value growth resulting from the Streetcar investment only and not from other additional or complementary policy initiatives. Figure ES-2 indicates the baseline and projected growth in usable units (both commercial and residential) attributable to the Streetcar investment over the same period.

Figure ES-1: Projected Total Property Values (2008-2042)

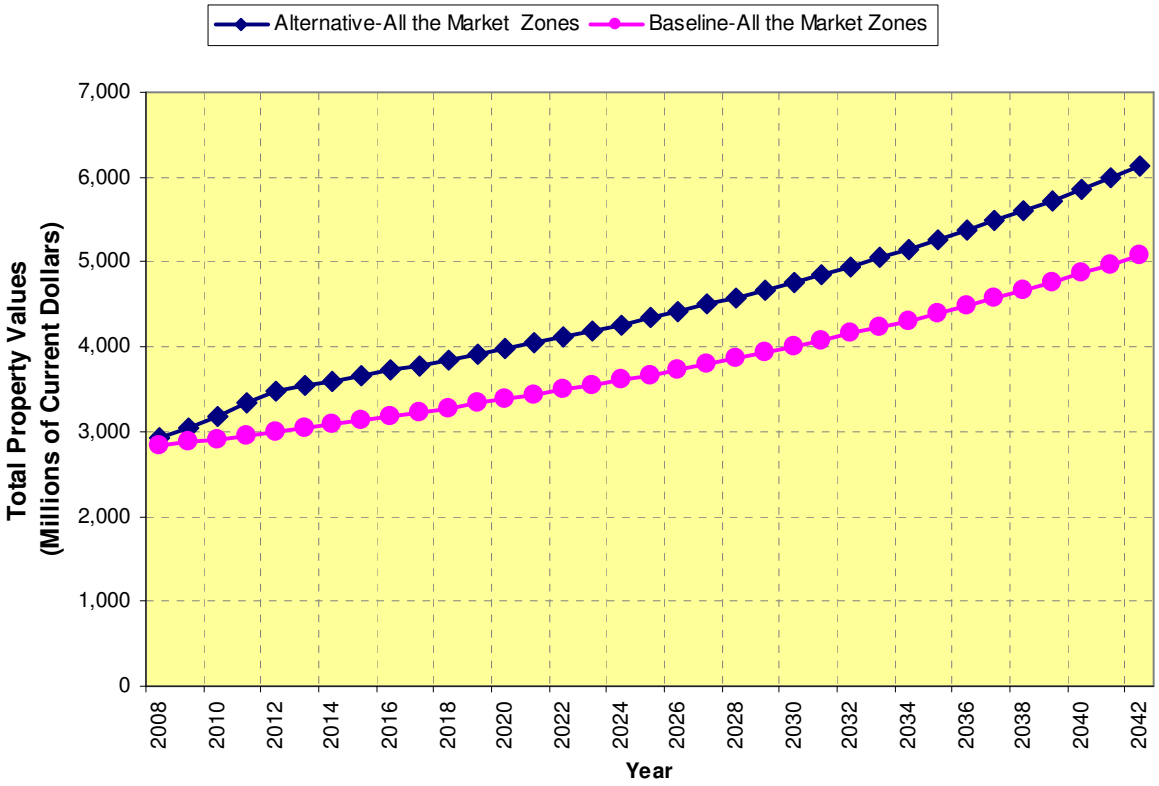


Figure ES-2: Projected Useable Unit Growth (2008-2042)

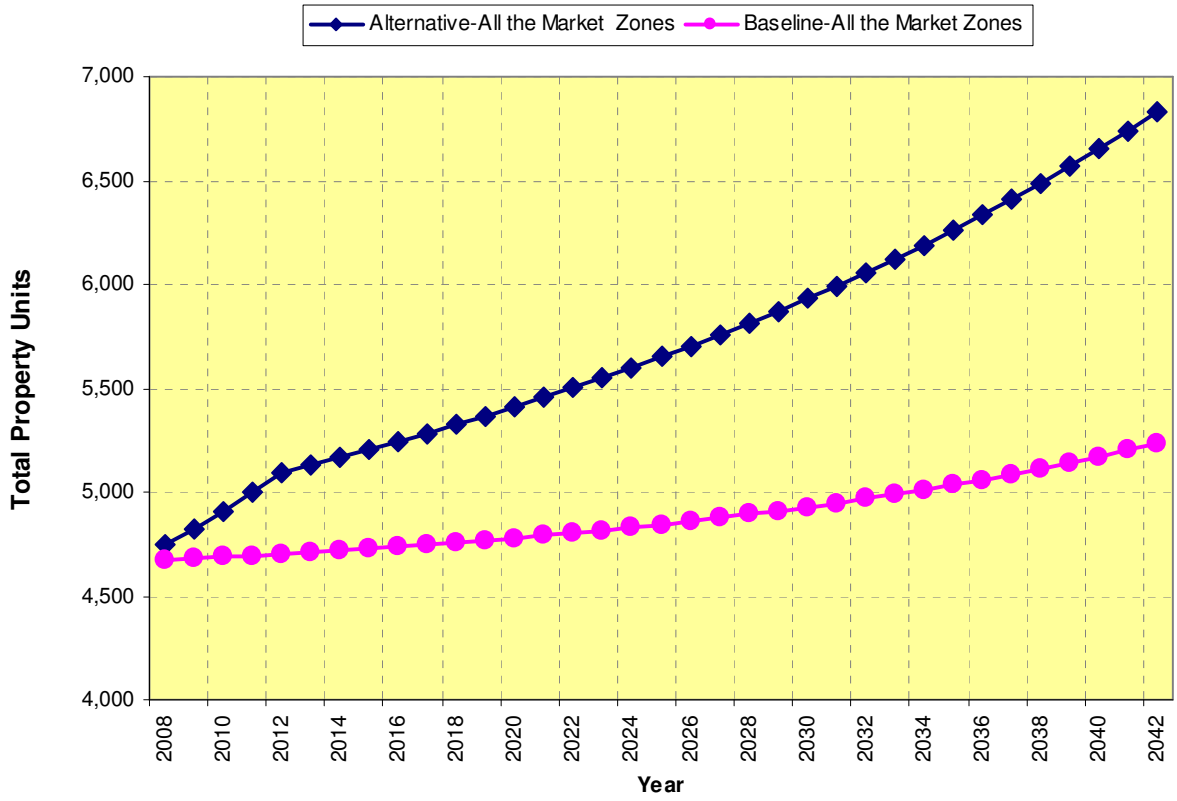


Table ES-1 summarizes the present value of benefits for each category, net present value and benefit cost ratio over the period 2008-2042. As is shown, about 90 percent of total benefits stems from economic development. Total benefits are expected to be $430.9 million. After deducting total costs, the median net present value is expected to be $315.1 million. The mean expected benefit cost ratio is 2.7, a return on investment over 35 years of 2.7 times.

Table ES-1: Benefit Cost Analysis of the Streetcar System (2008-2042)

In Millions of 2007 Dollars, Discounted	Mean Expected	90% Probability of Exceeding	10% Probability of Exceeding
Congestion Management Benefits			
VOC Savings	$13.0	$10.4	$16.5
Emission Savings	$0.4	$0.1	$0.6
Accident Cost Savings	$3.0	$0.8	$5.8
Total Congestion Management Benefits	**$16.4**	**$12.3**	**$21.0**
Affordable Mobility Benefits			
Trip Cost Savings	**$35.2**	**$23.9**	**$47.4**
Cross Sector Benefits			
Welfare Cost Savings	$0.7	$0.5	$1.0
Home Care Cost Savings	$0.3	$0.2	$0.4
Total Cross Sector Benefits	**$1.1**	**$0.7**	**$1.4**
Economic Development Benefits			
Residential	$106.9	$70.8	$143.0
Commercial	$272.0	$148.5	$398.3
Total Economic Development Benefits	**$378.9**	**$249.5**	**$509.1**
Grand Total Benefits	**$431.6**	**$303.0**	**$565.7**
Project Costs			
Capital Expenditures	$75.7	$73.7	$77.7
Incremental O&M + Disruption Costs	$40.1	$39.7	$40.5
Total Costs	**$115.8**	**$113.8**	**$117.9**
Net Present Value	**$315.8**	**$186.8**	**$450.4**
Benefit-Cost Ratio	**2.7**	**1.6**	**3.9**

The last two columns of Table ES-1 present the 10 percent lower and upper limits of risk analysis results. The probability distributions of the net present value and benefit cost ratio are presented in Figure ES-2 and Figure ES-3, respectively on the next page. As is shown in Figure ES-2, with an 80 percent probability the net present value will range between $186.8 million and $450.4 million. Figure ES-3 indicates that with a 90 percent probability the benefit cost ratio will be above 1.6. This suggests that the investment of streetcar is economically worthwhile.

Figure ES-2: Risk Analysis of Net Present Value
(Millions of 2007 Dollars: 2008-2042)

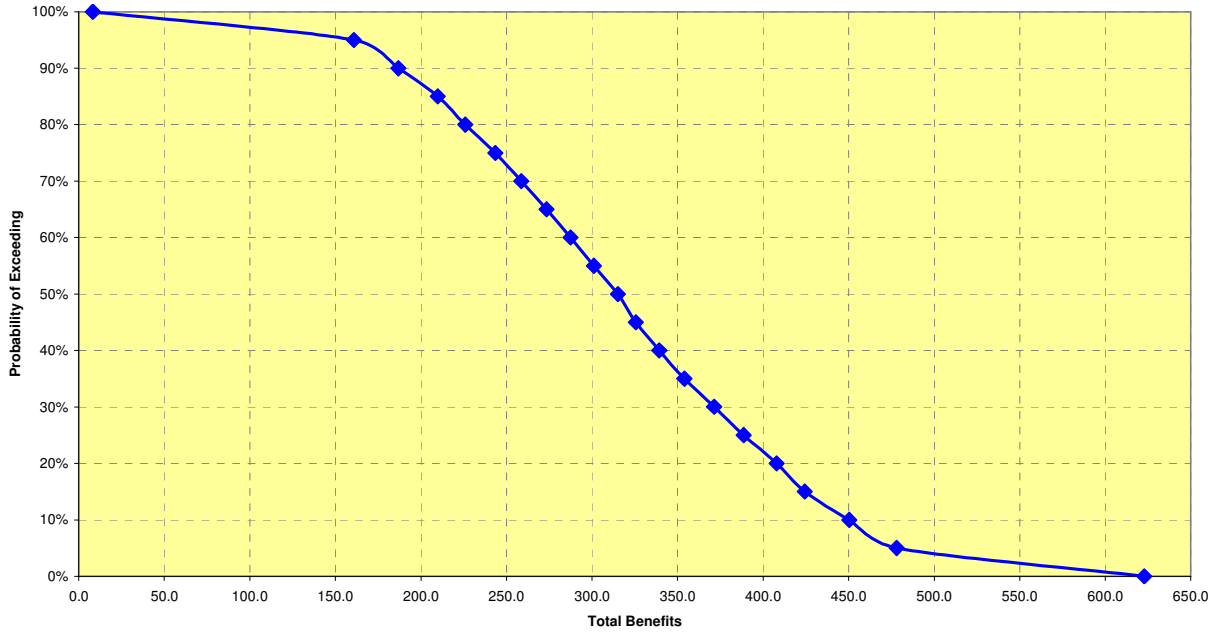
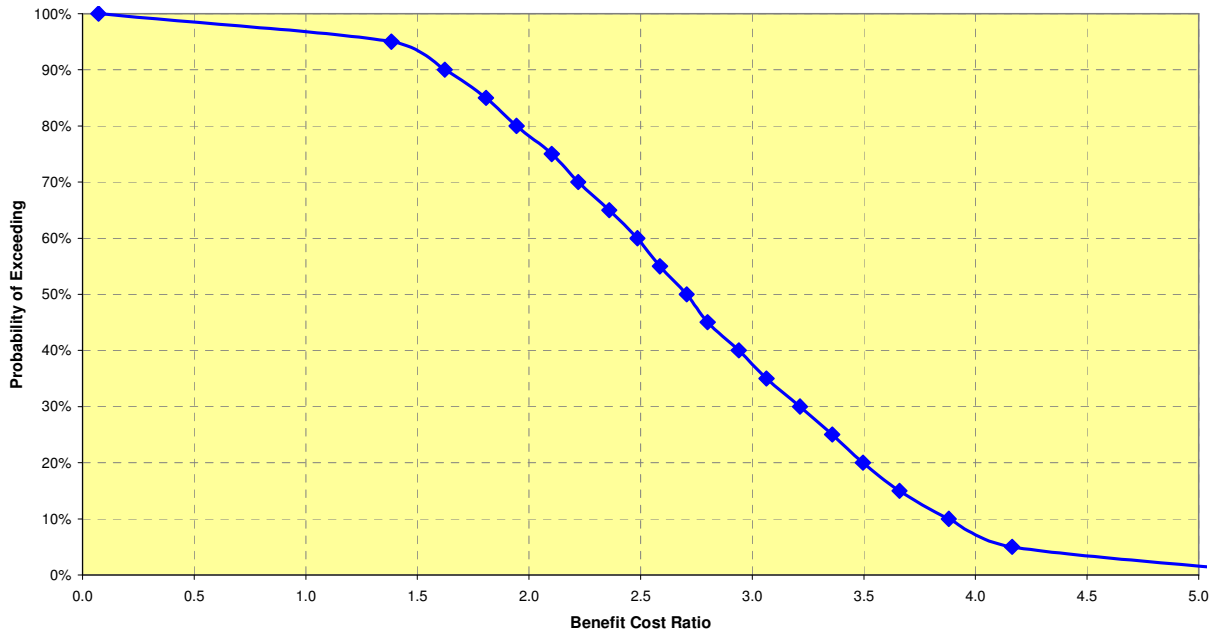


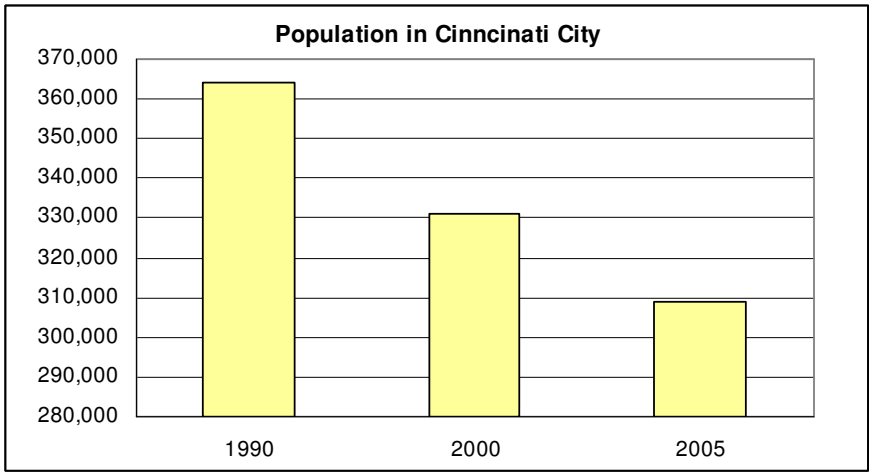
Figure ES-3: Risk Analysis of Benefit Cost Ratio



1. INTRODUCTION

Cincinnati has been faced with declining population and a reduction in businesses over the past fifteen years. Figure 1 depicts the historical trend of population in Cincinnati.

Figure 1: Historical Trend of Population in Cincinnati City



Source: U.S Census

A four-mile streetcar investment is proposed to stimulate the economic development and to help reverse the trend of losing population in the downtown and Over the Rhine areas. This study assesses whether the economic benefits of the streetcar investment would be sufficient to justify its costs and whether it can be considered economically worthwhile.

In this chapter, the analytical approach is presented. The organization of this report is discussed below.

1.1 Analysis Approach

Using a Benefit Cost Analysis approach, HDR has assessed the benefits of the Streetcar investment in Cincinnati within a risk analysis framework. The benefits assessed in this study include the following categories:

- **Travel Cost Saving Benefits:** This section estimates the Streetcar's ability to reduce traffic in the downtown areas based on its likelihood of attracting passengers away from using personal vehicles to access jobs and shopping centers. It is envisaged that streetcar trips may displace mid-day car trips in the downtown area and may be used for limited commuting purposes for residents living or moving north of downtown within the streetcar area. Travel cost savings include vehicle operating cost savings, accident cost savings and emission cost savings. Delay time savings is not measured in this analysis as it is not predicted that traffic speed will be improved significantly in downtown areas due to streetcar system.

- **Mobility-related Benefits:** This category will focus on the assessing of the potential for a streetcar to improve mobility. It has two parts: affordable mobility benefits and cross sector benefits. Affordable mobility is assessed as the difference in trip costs between the with and without streetcar scenarios. Cross sector benefits are measured as the savings on social services expenditures due to a streetcar system.

- **Economic Development Benefits:** Economic development benefits are measured as the property value premiums for both residential and commercial sector due to streetcar system. Property value premiums are one of the more popular and widely used methods of measuring regional economic development, either in the form of property value or rent. Real estate prices are easily quantifiable and represent an individual's willingness to pay for specific amenities of an area. The same holds true for businesses. An examination of real estate prices reveals individuals' true preferences, where a survey of opinions might fail to capture actual consumer preferences. Real increases in prices for real estate can be seen as an increase in the market's willingness to pay for a specific location due to the availability of more desirable amenities.

The present value of benefits for each major category and total benefits is calculated within a risk analysis framework. Upon completion of the risk analysis, net present value and the benefit cost ratio are assessed to determine the economic worthiness of the proposed streetcar investment.

1.2 Organization of the Report

The report consists of seven chapters. Following this chapter, Chapter 2 discusses the analysis framework for this study. Chapter 3 through Chapter 5 provide the evaluation of different benefits. Chapter 3 focuses on travel cost saving benefits; Chapter 4 examines mobility-related benefits; and Chapter 5 presents economic development benefits.

Chapter 6 examines the estimated costs of the streetcar investment in Cincinnati including capital expenditures for construction and spending for on-going operations and system maintenance.

Chapter 7 builds on the previous chapters and reports the results of the Benefit-Cost Analysis within a risk analysis framework.

2. ANALYSIS FRAMEWORK

The framework used for this analysis has two elements: Benefit-Cost Analysis and Risk Analysis. This chapter discusses these two elements. First an introduction about Benefit-Cost Analysis is presented. Following this, the principles and application of Risk Analysis are provided.

2.1 Benefit-Cost Analysis

Benefit-Cost analysis evaluates the fundamental merit of undertaking possible investments. The basic idea is straightforward. An investment option 'A' is worthwhile if its economic benefits exceed its economic costs. Importantly, the benefits of the next best alternative to option 'A' are viewed as a cost of option 'A.' This is because the alternative benefits are lost if 'A' is implemented.

2.1.1 Principles

Benefit-Cost Analysis counts all the negative and positive economic effects of an investment, regardless of how they are paid for. Benefit cost analysis treats all negative effects as costs. In addition to a project option's capital outlays, the analysis accounts for the cost of capital (interest)[1]; yearly operating expenses; and the costs of maintenance to keep capital assets in good shape. Also included are the disruptive effects of construction, such as noise and detours.

On the other side of the coin, Benefit-Cost Analysis treats all the positive effects as benefits. The principal categories of benefit considered in this study are those associated with:

1. Travel cost savings (including vehicle operating costs, safety and environmental factors);
2. Mobility-related benefits;
3. Community economic development;

In reviewing the list above, it is important to recognize that the Benefit-Cost Analysis framework does not count any benefit more than once. This is important because the economic value of some effects can arise in more than one category on the list. It is also important to recognize that the framework counts only "new" as distinct from "transferred" benefits and costs. Stated differently, benefit cost analysis measures value creation, not value redistribution.

Lastly it is important to note that the Benefit-Cost approach isolated "incremental" effects. That is those effects arising specifically due to the investment. As such, development in progress or planned and outcomes arising from other initiatives can not be considered as benefits of the investment under review.

2.1.2 Valuation

To permit the ready comparison of options, Benefit-Cost analysis measures benefits and costs on one scale, namely *value*. For convenience, value is expressed in units of monetary exchange,

[1] More precisely, Benefit-Cost Analysis accounts for the "opportunity cost" of capital. This reflects a combination of interest and the "time-preference" of the community for benefits now versus greater benefits later.

namely *dollars*. Not everything of course can be assigned value in the form of a monetary equivalent. Neither this nor any benefit cost analysis promises to attach a monetary-equivalent value to every possible negative or positive effect of a project. Some effects must be anticipated in qualitative terms and set out along side "the numbers." Some researchers believe for example, that the additional walking entailed in the use of transit options leads to improved cardiovascular health and a reduction in healthcare costs. While clearly an economic effect, science has yet to measure its monetary equivalent value. Benefit-Cost Analysis must thus be satisfied with its qualitative presentation.

From a decision-making perspective, however, it is unrealistic to avoid valuation entirely. Whenever option 'A' is superior to option 'B' on one count and inferior on another, a refusal to weigh up the relative value of each count implies only one possible decision, "Do both." Doing both is obviously not possible in most circumstances. Benefit-Cost Analysis is a framework within which practical trade-offs can be considered.

How are the monetary equivalent values measured? The valuation of some effects, both negative and positive, is made easy by the existence of markets and market prices. The cost of building a light rail station or a lane-mile of highway, for example, hinges on the market price of land, labor and materials – prices that are easily observed. The valuation of "non-market" effects, such as safety, environmental pollution or predictable journey times, is based on measurements of how much individuals are willing to pay to acquire the benefits or avoid the costs.

In short, values for non-market effects are inferred from peoples' actual behavior.[2] The study presented here did not conduct such studies, however. Rather, it relies on consensus valuations[3] from the economic literature coupled, as described in paragraph sub-section 2.2 below, with allowances for local variation and measurement uncertainty based on the techniques of Risk Analysis.

2.1.3 The Opportunity Cost of Capital

An important rule for private sector investment is that new capital projects should not be undertaken if shareholders would earn more if the capital were to be invested instead in low-risk, interest bearing securities (such as bonds). Benefit cost analysis presumes the same to be true for the taxpayer in relation to public sector investments. The real-dollar (i.e., after inflation) return on low-risk securities today is about four percent. This study thus examines the investment alternatives under consideration in relation to a four percent benchmark, or "hurdle" rate of return. Stated differently, all costs and benefits are discounted to their present day values at a rate (the "discount rate") of four percent per annum.

The above means that if the street car option, when compared to the Base Case, fails to offer a four percent return with minimal risk, it is not economically worthwhile from a taxpayer perspective.

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[2] The scientific methods of inferring value from peoples' behavior include a wide range of data collection and statistical analysis techniques. For a useful summary, see Richard Layard and Stephen Glaister, **Cost-Benefit Analysis**, Cambridge University Press, 1994

[3] Consensus valuations, also called "meta-analysis," are based on expert panel reviews of refereed and published scientific valuation measurements of the non-market effects of transportation projects.

Two evaluation benchmarks, or criteria of merit, are used in this report. The first one is net present value or NPV. Net present value is measured as a project's benefits minus its costs. More precisely, NPV is measured as the discounted present-day value of benefits minus the discounted present-day value of costs. Net present value is measured over the life-cycle of the projects being considered (30 years in case of light rail and highway capacity). A project with net present value greater than zero means that the project is economically worthwhile. As well, if project 'A' is seen to offer a higher net present value than project 'B', it is correct to conclude that 'A' is economically superior to 'B'.

An alternative way of expressing the same information given by net present value is the benefit cost ratio, measured as the ratio between benefits and costs. If a project's benefit cost ratio is greater than one, it can be considered economically worthwhile.

2.2 Risk Analysis

Like business case analysis in the private sector, benefit cost analysis involves the formulation of analysis models and estimates of future conditions. Although some models and estimates will be more reliable than others, all entail an element of uncertainty and thus pose the risk of error in the final assessment of net benefit. Risk analysis is employed to reflect the uncertainty in the analysis models.

2.2.1 Principles

Risk-Analysis is a departure from traditional cost estimating and forecasting methods. Traditional methods develop "most likely" outcomes. The term "most likely" equates to the statistical concept of a "mean expected outcome." In this context, the question of risk is immaterial if the bandwidth of uncertainty around the most likely outcome is trivial: If the outcome with 10 percent probability of occurring is about the same as the mean expected (50-50) outcome, the latter estimate is as good as any other.

When the range of uncertainty is non-trivial, on the other hand, the question of risk is anything but immaterial. In large corporations, decision makers rarely make investment decisions on the basis of 50 percent probable outcomes. Rather than 50 percent, they need to know what rate of return they can be 80 percent, or even 90 or 95 percent sure of achieving. And they need to know the probability of the investment failing to achieve the company's minimum-required rate of return on investment. This is how large companies seek to protect shareholders from risky ventures.

2.2.2 Application

In application, each and every assumption in the benefit cost analysis is assigned a probability range. These probabilities are then combined using the technique of "simulation." Simulation reflects the reality that the actual result for each estimate will differ from the assumed result according to its own probability range of uncertainty. The simulation thus yields not just the mean expected net benefits of the investment, but also the range of all other possible outcomes *and their associated probabilities*.

The probability ranges for each estimate are drawn from two sources. The first is historic data on the actual range of variation. Capital costs, for example, often vary from initial projections.

Statistical analysis of past projects in a region provides data on the probability of cost overruns going forward. .

The second source of information about uncertainty is drawn from the opinions of experts in relation to available scientific information. Called "subjective probability," this technique is common in biomedical research. For example, when the Food and Drug Administration needs to decide whether it is safe to release a new drug for public use, it presents the various scientific studies to expert panels that modify the probabilities according to their experience and expert opinion.

3. TRAVEL COST SAVINGS

The availability of streetcar access would lead some vehicle users to switch to transit for some trips. As a result of operating the streetcar downtown, door-to-door travel times along streetcar alignment roadways during congested periods would not be expected to improve significantly. However, the switch from automobiles to transit will reduce the traffic volumes; and generate savings in travel costs. Travel cost savings are those congestion management benefits other than delay savings.

This chapter starts with a discussion of different categories of travel costs specifically assessed for this study and methodology developed to compute travel cost savings. The chapter then presents the travel cost savings by each category. Finally, a summary of overall savings in travel costs is presented.

3.1 Savings in Travel Costs

The methodology developed to compute congestion management benefits evaluates the incremental savings (other than delay savings) associated with individuals switching from automobiles to transit. These incremental savings consist of decreased pollution costs, decreased safety/accident costs, and decreased automobile operating costs, as compared to transit.

Estimating travel cost savings requires three steps. The first step determines the number of trips diverted from other modes (cars, taxi, and bus) to streetcar person trips. The estimate is based on the availability of cars to commuters, price of alternative modes, and the income level of commuters. The second step consists of translating the number of trips into Vehicle Miles Traveled (VMT) based on average trip length for each mode. The third step computes the costs incurred as a result of the newly generated VMT. The costs identified in this step[4] are:

1. Vehicle operating costs, based on speed-flow ratio, demand, and vehicle characteristics, as well as other fees such as parking;

2. Safety costs, based on statistics provided by the Bureau of Transportation Statistics (BTS) and Federal Highway administration (FHWA). The costs savings are determined based on fatalities, injuries, and property damage for peak and off-peak periods; and

3. Environmental costs, based on the amount of vehicular emissions that are leading factors in air pollution. Carbon monoxide (CO) is the leading pollutant from vehicles (in terms of amount), followed by nitrogen oxides (NOx), and hydrocarbons (HC). The emission factors depend on the vehicle characteristics, speed, volume, and motion stroke. In addition, the methodology estimates the greenhouse gas emission saving mainly due to the decrease in fuel consumption.

[4] A description of the derivation methodology of the benefits can be found in the Technical Report accompanying this document.

3.2 Savings in Vehicle Operation Costs

Vehicle operating costs (VOC) are an integral element of computing travel user costs. They generally are the most recognized of user costs because they typically involve the out-of-pocket expenses associated with owning, operating, and maintaining a vehicle. The cost components associated with operating a vehicle are: fuel consumption, oil consumption, maintenance and repairs, tire wear, insurance, license, registration, taxes, and roadway related vehicle depreciation. Each component is a unique function of vehicle class, vehicle speed, grade level, and surface condition. Thus overall vehicle operating costs can vary significantly between different facility types, geographic areas, and traffic patterns.

Figure 2 presents the annual vehicle operating cost savings throughout the life cycle of the investment. Table 1 demonstrates a 50% probability that the present value of vehicle operating costs savings is $13 million over the period of evaluation.

Figure 2: Vehicle Operating Cost Savings (2008-2042)

(Thousands of 2007 Dollars)

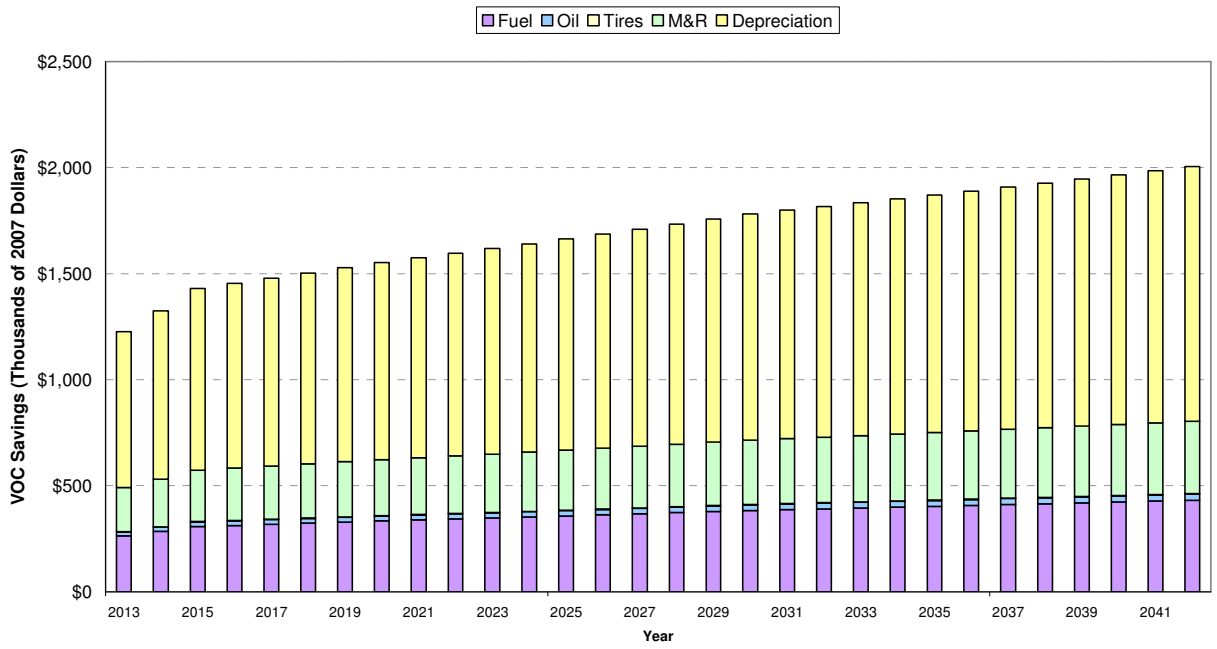


Table 1: Present Value of VOC Savings (2008-2042)

Millions of 2007 Dollars	Mean Expected	90% Probability of Exceeding	10% Probability of Exceeding
Total VOC Savings	$13.0	$10.4	$16.5

3.3 Safety Savings

Safety is a significant component of travel user costs. Safety represents a principal economic factor in the planning of roads, as well as an important indicator of transportation efficiency. Outside the economic context, safety is often the object of public concern and a leading social issue. However,

since improved safety requires the use of real resources, it competes with alternative goals and aspects of transportation efficiency. The accident cost model component is based on incident rate tables developed for the Federal Highway Administration. Incident rates, in the form of fatalities, injuries, and property damage accidents, when combined with their associated costs, are turned into an accident cost.

Figure 3 shows the annual safety cost savings based on the estimated reduction of vehicle miles traveled and safety cost factors. The results are translated in Table 2 as annual safety savings in year 2010 of $1.2 million, reaching $1.63 million in total accident cost avoided by year 2030.

Figure 3: Accident Cost Savings (Thousands of 2007 Dollars)

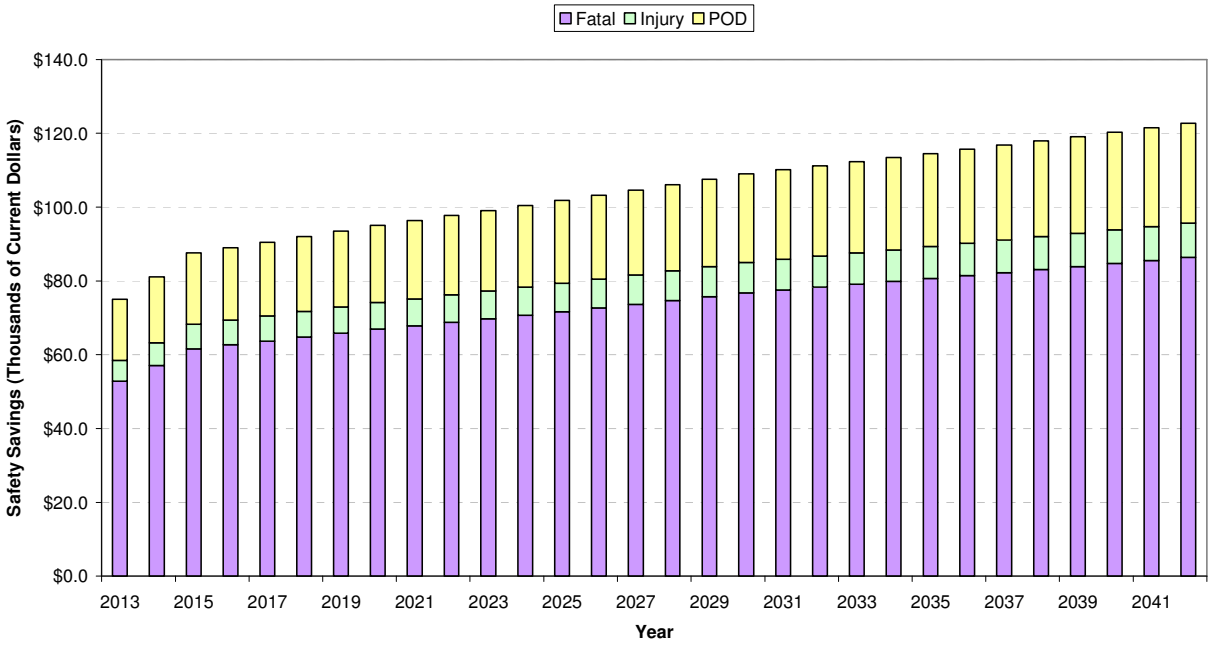


Table 2: Accident Cost Savings

Millions of 2007 Dollars	2010	2015	2020	2030
Fatal Accident Cost Savings	$0.15	$0.16	$0.18	$0.20
Injury Accident Cost Savings	$0.08	$0.09	$0.10	$0.11
Property Damage Cost Savings	$0.03	$0.03	$0.03	$0.04
Total Accident Cost Savings	$1.16	$1.29	$1.41	$1.63

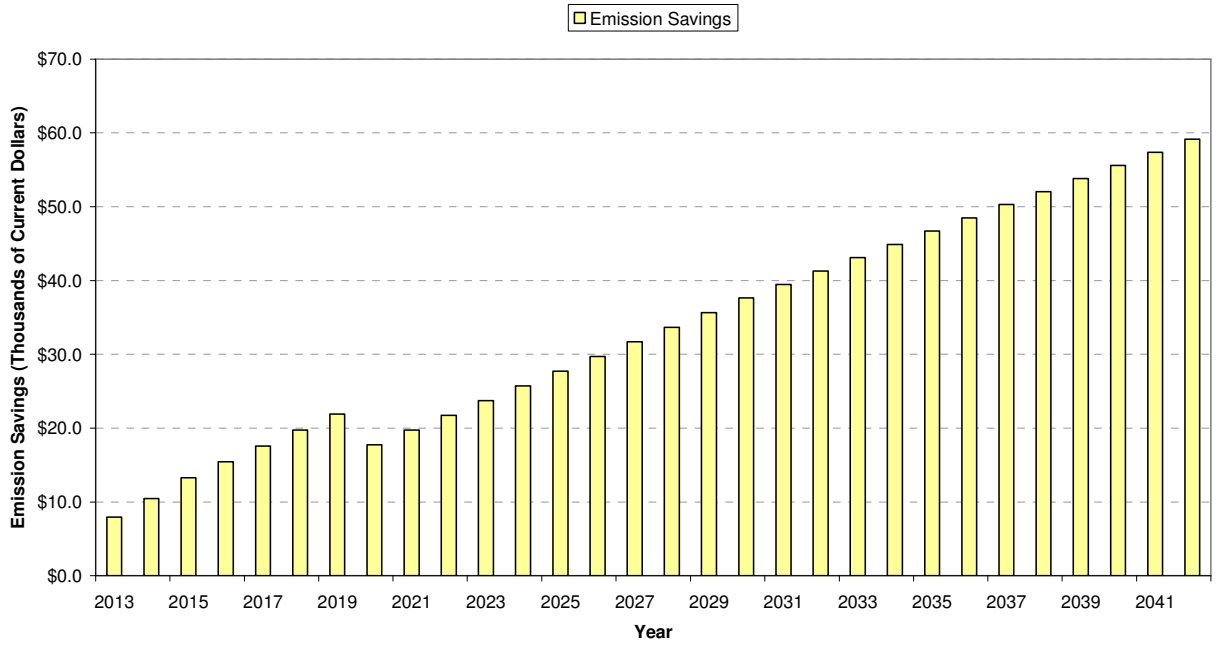
3.4 Emission Savings

Environmental costs are gaining increasing acceptance as an important component in the economic evaluation of transportation and infrastructure projects. The main environmental impacts of vehicle use, exhaust emissions and vehicle-generated noise can impose wide-ranging social costs on people, material, and vegetation. Sections of recent federal legislation, such as the Clean Air Act (CAA) amendments of 1990, as well as the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, are designed to directly account for the environmental impacts of proposed transportation investments. The negative effects of pollution depend not only on the quantity of pollution

produced, but on the types of pollutants emitted and the conditions into which the pollution is released.

As with other travel costs savings, environmental cost savings are calculated based on the vehicle miles traveled Therefore, the emission savings are calculated as the difference between emission at lower annual VMT (without streetcar) and emission at higher annual VMT (with streetcar). Figure 4 shows the annual emission savings.

Figure 4: Emission Cost Savings (Thousands of 2007 Dollars)



3.5 Summary of Travel Cost Savings

The final step of the estimation methodology consists of aggregating all travel cost savings to determine the present value of the travel cost savings resulting from a streetcar system in the downtown Cincinnati.

The risk analysis results of the present value of travel cost savings are shown in Table 3. It indicates an expected $16.4 million in travel cost savings benefits between 2008 and 2042 due to implementation of the proposed streetcar system.

Table 3: Present Value of Travel Cost Savings (2008-2042)

Millions of 2007 Dollars	Mean Expected	90% Probability of Exceeding	10% Probability of Exceeding
VOC Savings	$13.0	$10.4	$16.5
Emission Savings	$0.4	$0.1	$0.6
Accident Cost Savings	$3.0	$0.8	$5.8
Total Travel Cost Savings	**$16.4**	**$12.3**	**$21.0**

4. MOBILITY-RELATED BENEFITS

The mobility-related benefits of transit arise in two distinct ways. The first is the benefit to low income households stemming from the availability of transportation at a more affordable price than taxis and other more expensive alternatives. These are called "affordable mobility" benefits. Some transit users in Cincinnati live in households that do not own an automobile and many more are without access to the family car. Affordable mobility is of disproportionate importance to them.

The second form of benefit is the resource savings arising from reduced social service agency outlays when people are able to travel to centralized points of service delivery rather than receiving home-based care. These are called "cross-sector benefits." A disproportionate share of Cincinnati's transit riders (compared to the population at-large) receives food stamp benefits and Medicaid benefits. Federal Transit Administration research indicates that incremental additions to the availability of transit would help alleviate this budgetary pressure.

This chapter firstly presents the estimates of affordable mobility benefits resulting from the streetcar system in Cincinnati city. Following up, cross section benefits due to the system are discussed. Finally, a summary of total mobility-related benefits is presented.

4.1 Affordable Mobility

People electing to use transit do so because the cost and inconvenience of their next best alternative is greater. For low-income people, the resulting savings, when expressed as a proportion of their disposable income, can be substantial. As shown in Table 4 on the next page, the poorest households rely most heavily on taxis when bus or rail transit is not available. The difference between paying transit fares or taxi fares, when multiplied over all the journeys people make in a month, can be enough for significantly more food, clothing, shelter, childcare and other necessities.

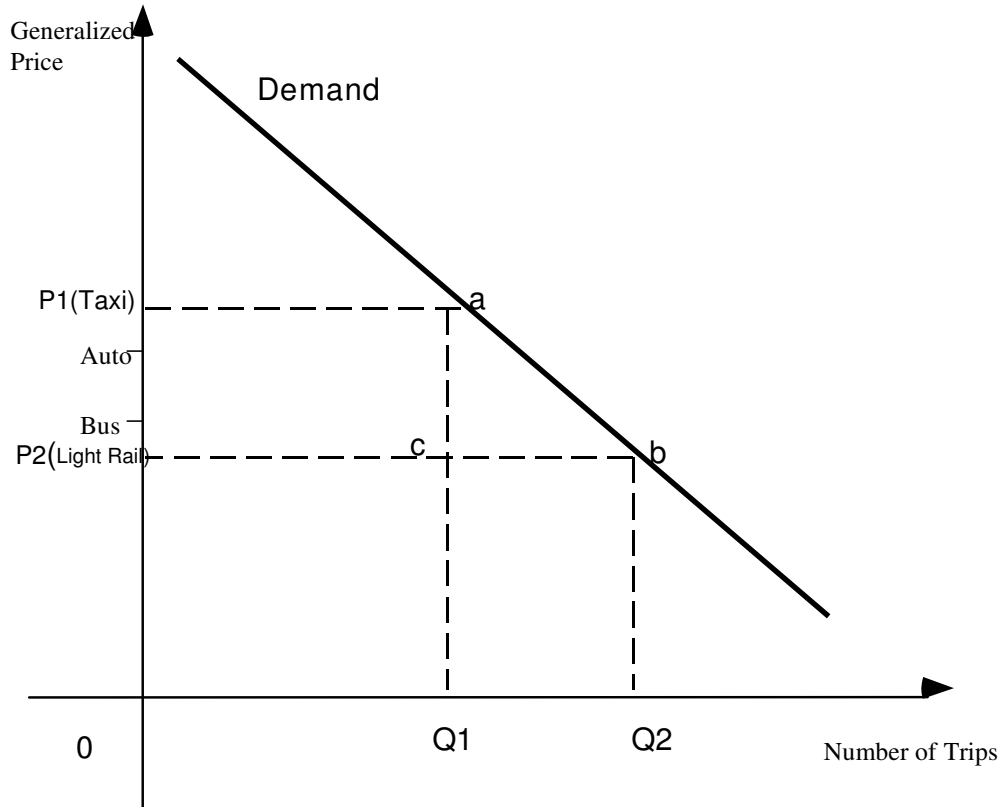
Table 4: Distribution of Transportation Use, by Income Category

Income Category	Bus or Trolley (%)	Taxi (%)	Bike (%)	Walk (%)	Auto (%)
<$5,000	19.0	1.6	2.1	16.6	60.6
$5,000-9,999	11.7	1.0	0.8	8.0	78.1
$10,000-12,499	7.2	1.2	1.1	8.5	80.4
$12,500-14,999	7.2	1.2	1.1	8.5	80.4
$15,000-17,499	8.3	1.5	2.5	4.0	83.0
$17,500-19,999	8.3	1.5	2.5	4.0	83.0
$20,000-22,499	5.0	0.8	0.6	5.1	88.3
$22,500-24,999	5.0	0.8	0.6	5.1	88.3
$25,000-27,499	3.8	1.1	0.5	3.0	91.3
$27,500-29,999	3.8	1.1	0.5	3.0	91.3
$30,000-32,499	3.2	1.0	0.8	2.3	92.2
$32,500-34,999	3.2	1.0	0.8	2.3	92.2
$35,000-37,499	3.4	1.2	0.5	1.7	92.8
$37,500-39,999	3.4	1.2	0.5	1.7	92.8
$40,000-42,499	4.7	0.9	0.2	2.8	91.2
$42,500-44,999	4.7	0.9	0.2	2.8	91.2
$45,000-47,499	2.8	0.7	0.4	1.8	93.9
$47,500-49,999	2.8	0.7	0.4	1.8	93.9
$50,000-54,999	1.5	0.5	0.0	2.9	94.6
$55,000-59,999	2.0	1.1	0.3	2.0	94.1
$60,000-74,999	2.0	1.3	0.7	1.2	94.6
$75,000-99,999	3.7	1.7	0.2	1.5	92.5
$100,000-124,999	4.7	2.2	0.2	1.8	90.7
$125,000-149,999	4.7	2.2	0.2	1.8	90.7
>=$150,000	4.7	2.2	0.2	1.8	90.7

Source: Nation-wide Personal Transportation Survey (NPTS), 1997.

Economists call the difference between the amount people pay for something and the amount they would pay if they used the next most costly alternative, "consumers' surplus." Consumers' surplus is a monetary quantity that equates to the economic value of the mobility afforded to people by the availability of transit. Consumer surplus depends on the number of journeys that people elect to make by transit; the number of journeys they make; the fares charged; the relative cost, time and inconvenience of using the next best alternative; and the elasticity of demand of people from different income groups. This is illustrated in the Figure 4 on the next page.

Figure 5: Consumer Surplus Benefits of Light Rail



FTA researchers have developed a consumer surplus model that estimates the value of transit mobility according to the principles of consumer surplus. Figure 12 implies that, for the taxi example, if P1 is the initial price, (aP1) is a perfectly elastic supply of taxi services, and (bP2) is a perfectly elastic supply of transit services. With the opening of transit services, the price falls to P2, and the change in consumer surplus is *P1abP2*. However, the rectangle *P1acP2* is the change in revenue to the taxi industry, and so this component of value is just a transfer from the taxi industry to consumers. Assuming that displaced taxi employees will not be unemployed, but will be employed elsewhere with a value of marginal product as least as great as this rectangle (probably safe in today's labor market), we can focus on area *abQ2Q1*, which is the change in low income mobility benefits from the expansion of the light rail services. Area *cbQ2Q1* is the increased cost to serve this group, and is accounted for elsewhere. Triangle *abc* is the part of the change in consumer surplus that is considered incremental for this group.

The model in application to the streetcar investment option under consideration here yields the results summarized in the Table 5. As indicated, the economic value of affordable mobility in 2010 is an estimated $1.83 million, rising in proportion to estimated streetcar ridership growth thereafter.

Table 5: Affordable Mobility Benefits

Millions of 2007 Dollars	2010	2015	2020	2030
Annual Savings	$1.3	$1.9	$2.1	$2.4
Number of Low Income People Served	2,183	3,207	3,483	3,994

4.2 Cross Sector Benefits

The FTA model of cross sector benefits accounts for savings in home-based services and social service agency transportation systems associated with the availability of mass transit. Home-based and other social services included in the model are:

- Unemployment Compensation (local agency share);
- Home health care visits (Medicare/Medicaid).

In order to assess cross-sector benefits for the proposed streetcar, the model quantifies the number of reduced homecare visits and the number of working trips that otherwise wouldn't occur and might lead to unemployment. The inputs used to employ the cross-sector benefit analysis framework are summarized in Table 6.

Table 6: Model Input Values

Model Input	Input Value (Median Estimate)
Opening Year Daily Passenger Trips	4,850
% Of Trips by Low Income Individuals [a]	45%
% Of Trips for Work [a]	60%
% Of Lost Work Trips Leading to Unemployment [a]	30%
Average Unemployment Compensation/Recipient [b]	$1,750
% Of Trips for Medical Purposes [a]	15%
% Of Lost Medical Trips Resulting in Home Health Care [d]	60%
Incremental Cost of Home Care ($) [e]	$100

The results of the analysis are summarized in Table 7 on the next page. The streetcar system along the operable segment is expected to save more than $13.7 million of welfare costs and $5.9 million of home care costs in the opening year (2010), and up to $25.2 million of welfare costs and $10.8 home care costs in year 2030, saving estimates growing with projected ridership and consumer price inflation.

Table 7: Cross-Sector Benefits

Thousands of 2007 Dollars	2010	2015	2020	2030
Welfare Costs	$13.7	$20.2	$21.9	$25.2
Home Care Costs	$5.9	$8.7	$9.4	$10.8

4.3 Summary

Streetcars improve mobility in two ways. First is the availability of affordable transportation to low-income people. Many of Cincinnati's transit users live in households without an automobile and many more are without access to a car. A disproportionate number of people from low-income households depend upon expensive taxis or circuitous bus routes that put many jobs and other opportunities beyond affordable reach. The second mobility-related effect of the streetcar is the budgetary saving that arises from reduced social service agency outlays on home-based health and welfare services (such as unemployment compensation and home health care).

Total mobility benefits over a 35-year period are expected to reach $36.3 million of year 2007 dollars (in present value terms), with a 10 percent probability of exceeding $24.6 million and a 90 percent probability of exceeding $48.8 million. Affordable mobility, with an expected $35.2 millions, accounts for more than 90 percent of these benefits. These results are summarized in Table 8 below.

Table 8: Present Value of Mobility-Related Benefits

Millions of 2007 Dollars	Mean Expected	90% Probability of Exceeding	10% Probability of Exceeding
Affordable Mobility Benefits	**$35.2**	**$23.9**	**$47.4**
Cross Sector Benefits			
Welfare Cost Savings	$0.7	$0.5	$1.0
Home Care Cost Savings	$0.3	$0.2	$0.4
Total Mobility Benefits	**$36.3**	**$24.7**	**$48.8**

5. ECONOMIC DEVELOPMENT BENEFITS

Empirical research shows that transit-oriented development yields social and economic benefits for communities. These community development benefits are typically reflected through the appreciation of property values for both commercial and residential sectors.

Federal Transit Administration (FTA) research[5] indicates that households located in transit-oriented communities (within a half-mile to a mile of a fixed guide-way station) save an average of approximately $250 per month or $3,000 per year per household in auto-related costs as compared to households in auto-oriented areas. These savings are associated chiefly with the ability to walk to a wider range of destinations and, to a lesser extent, to transit access itself.

Benefits stemming from transit investments are typically categorized into user and non-user benefits. User benefits typically refer to benefits accrued to system users through the reduction of travel time and travel costs. In addition to user benefits, the prevailing evaluation framework also recognizes non-user benefits – benefits that accrue to non-riders, such as reduction of road congestion, environmental benefits, employment impacts, etc. The non-user benefit category is reflective of the belief that transit improvements generate external economies – public benefit accruing broadly in addition to the benefit accruing to the direct users of the investment. Economic development benefits can accrue to local resident and businesses (and other landowners), but may also accrue to the greater metropolitan area through increasing tax revenues, improved land use, and increasing economic welfare.

These benefits, where they occur, result from agglomeration economies: increasing economic activity that results from the concentrated location of activities. Some scholars have pointed to the benefits of intellectual concentration and improved likelihood of both chance and arranged exchanges of ideas, while others have pointed to the efficiencies of shared labor pools which can move more easily from firm to firm.[6] As the review of economic development impacts from transit investment indicates, both residents and employers value the existence of transit and are willing to pay a premium to locate near it, in excess of the estimated travel time savings incurred. In fact, evidence indicates that a significant proportion of residents within walking distance of transit do not use it to regularly commute to work, recreation, or school. None the less, these residents continue to value proximity to transit and are willing to pay a premium for that proximity. This indicates an incremental economic development benefit above and beyond the capitalization of travel time savings.

This chapter estimates the community economic development benefits that the streetcar is likely to create for the city of Cincinnati. It is organized as follows: first the evaluation approach is reviewed, second, a comprehensive valuation of community development benefits is discussed; then, the community development benefits for residential and commercial sectors in Cincinnati due to the proposed streetcar system are separately assessed; finally, a risk analysis of total community economic development benefits is presented.

[5] Federal Transit Administration, 1996 Report: An Update, U.S. Department of Transportation

[6] See, Sassen, Saskia, The Global City: New York, London, Tokyo, Princeton University Press (1991) and Storper, Michael, Regional World: Territorial Development in a Global Economy, Guilford Press (1997) for example.

5.1 Community Economic Development Evaluation Approach

This section reviews the methodology and evaluation approach used to estimate economic development benefits attributable to a streetcar investment.

5.1.1 Methodology

When assessing economic development potentials of transit investment, researchers have used three main predictive economic development estimation methods. They are survey-based approach, hedonic approach, and the input-output approach. The first, based on surveys of residents, businesses, and system users attempts to estimate potential future property values by asking property owners and users how much they would be willing to pay for properties with bundles of location attributes or by using expert opinion in a survey of development potential. The second methodology relies on post-hoc hedonic studies of existing investments to create a database of economic development impacts and location, property, and neighborhood attributes. Future investments could then be compared to the collected data and ranges of possible outcomes be estimated on a parcel by parcel basis, based on similarity to characteristics and outcomes in prior study areas. The third methodology, the input-output approach, uses commercial software to estimate multiplier impacts from an initial investment. It uses existing economic relationship among sectors to estimate the impact of development on other sectors when you invest in the transit sector.

The third method, the input-output (IO) approach can be very useful in specifying detailed investment impacts. However it does face several limitations. First, the leading IO provider, REMI is relatively costly, and is typically cost prohibitive for early feasibility studies. Secondly, and perhaps more germane, IO analysis is conducted based on IO tables which are assembled at the county level. This can be useful for assessing corridor-level investments, but may make inferring results to sub-levels difficult and possibly misleading. Finally, the level of data required to get to incremental impacts using the IO approach is often beyond the level of collection feasible in an initial planning study.

The approach used for this study is based on the first and second approaches. In other words, the approach used hedonic modeling, based on experience from other cities, together with a survey of the region and the engagement of local stakeholders. Through its research, HDR | HLB Decision Economics found that this approach is the most accurate and the most technically correct to assess the economic development potential. The use of hedonic models and a survey of local dynamics provide an assessment of the incremental economic development benefits.

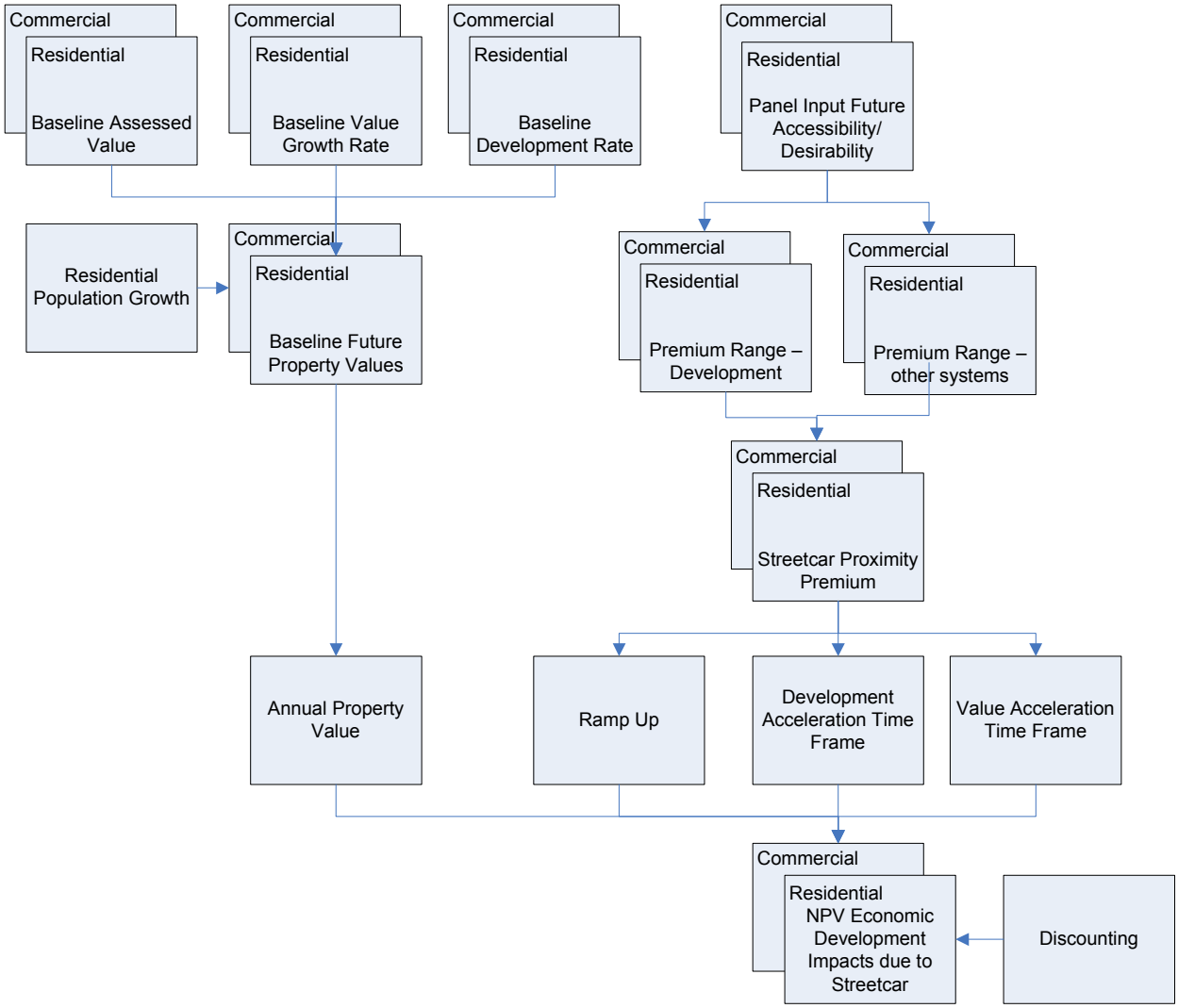
The hedonic pricing method ensures incrementality by using regression analysis to examine the impact of transit on property values while controlling for other variables that may influence property value, such as location attributes and property characteristics. Distance from transit (either walking or linear) is often the key variable used in determining transit's effect on property values. The hedonic approach together with local survey and engagement of local businesses, therefore, provides a fundamentally sound approach, as it can accurately estimate the incremental effects of transit systems.

5.1.2 Evaluation Approach

Evaluation of incremental economic development hinges on two primary variables – growth of usable units and growth of value per unit. HDR relied on prior hedonic studies, calibrated using a survey of expert opinion to estimate value premiums. Usable unit growth rates were estimated using analogous experience from other communities implementing streetcar and light rail alternatives and also from local market knowledge collected during the economic development workshop (see Appendix 2 for detail on the workshop outputs). These estimates were related to known factors, including the underlying growth rate, population change estimates, and current thinking on streetcar development timeframes. When taken together, these data points enable the estimation of development results strictly from streetcar implementation and ultimately property value premiums for Cincinnati.

Figure 6 below illustrates the structure and logic of the economic development evaluation approach.

Figure 6: Structure and Logic of Economic Evaluations



To facilitate the collection of information and create specificity, the development area was broken into three market zones and seven sections along the alignment. Development and premium effects were estimated for a three block radius around the alignment in these seven areas.

Zone A consists of A3, North of Findlay Street, A2, between Findlay and Liberty and A3, South of Liberty. Zone B has two parts: B2, Between Central Parkway and 13th and B1, 9th to Central Parkway. Zone C encompasses downtown: C3: 9th down to 6th, C2, 6th to 3rd, and C3, the Banks, South of 3rd. Figure 7 illustrates the 3 market zones.

Panelist input on a variety of development-influencing factors was sought for each of the seven evaluation areas. Full results of the panel's evaluation are presented in Appendix 2. Panel responses were taken on a continuum from Low (L) to Medium (M) to High (H). Table 9 summarizes the average panelist response for each development-impacting area surveyed in the seven assessed areas.

Table 9: Summary of Economic Development Assessment Panel Responses

	Current Market Strength	Expected Accessibility Improvement	Residential Desireability	Commercial Desireability	Supportive Zonning	Availabile Land for Redevelopment	Major Attractions	Public Sector Investment/ Support	Private Sector Investment/ Support
Zone C | 1									
Panel Average	LM	H	H	H	H	H	H	MH	MH
Zone C | 2									
Panel Average	MH	ML	M	H	MH	LM	MH	H	H
Zone C | 3									
Panel Average	MH	ML	MH	MH	MH	MH	M	MH	M
Zone B | 1									
Panel Average	L	M	ML	L	MH	H	LM	M	ML
Zone B | 2									
Panel Average	ML	H	MH	ML	ML	H	M	MH	MH
Zone A | 1									
Panel Average	ML	H	M	ML	M	H	MH	MH	ML
Zone A | 2									
Panel Average	LM	H	H	ML	MH	H	ML	MH	ML
Zone A | 3									
Panel Average	LM	H	ML	ML	MH	H	LM	ML	M

Panelist assessment of current conditions was used to infer baseline conditions in each sub-zone (section) given historical data on usable property growth (decline) and value change. The next section discusses the valuation of property premiums and the application of hedonic studies to infer effects for Cincinnati's with Streetcar development scenario.

5.2 Valuation of Community Economic Development Effects

FTA and other research have shown that the benefits associated with transit access are captured or "capitalized" in the price (market value) of commercial and residential properties. The property value appreciation associated with transit access is typically referred to as the value premium.

Because transit reduces automobile-travel dependence and provides households with a number of amenities, it stimulates the demand for residential units located in the vicinity of transit stops, and, other things being equal, raises property market values. Most, although not all, studies of transit's impacts on residential properties have recorded premiums. Studies show that premiums usually occur to those houses and condominiums within ¼ to ½ mile of a transit station.

Recent case studies illustrating the impact of transit access on residential property value are summarized below.

- Boston: Armstrong (1994) examined single-family residential properties in Boston, Massachusetts. Results indicate that there is an increase in single-family property values for approximately 6.7% by virtue of being located within a community having a commuter rail station.

- Portland, Oregon: A study undertaken by Al-Moisand and so on analyzed sales prices of homes in metropolitan Portland, Oregon. The study showed that a premium of 10.6% for homes within ¼ mile of proximity to light rail station.

- Santa Clara: Cervero and Duckan (2002a) studied the benefits of proximity to rail in Santa Clara County, California All else being equal, large apartments within a quarter mile of a light-rail station commanded land-value premiums as high as 45 percent.

- San Diego: Another research effort undertaken by Cervero and Duckan (2002b) found appreciable land-value premiums for different land uses in different rail-transit corridors in San Diego County. The most appreciable benefits were: 46% premiums for condominiums and 17% for single-family housing near Coaster commuter rail stations in the north county; 17% and 10% premiums, respectively, for multifamily hosing near East Line and South Line Trolley stations; and for commercial properties, 91% premiums for parcels near downtown Coaster stations and 72% for parcels near Trolley stations in the Mission Valley.

- Philadelphia: Voith (1993) found a premium for single family homes with access to rail stations of 7.5% to 8.0% over the average home values.

- San Francisco: The Sedway Group's review of studies on the benefits associated with BART service in the Bay Area identified positive residential and office property impacts. Single family homes were reported worth from $3,200 to $3,700 less for each mile distant from a BART station in Alameda and Contra Costa counties. Apartments near BART stations were found typically to rent for 15 to 26 percent more than apartments more distant from BART stations.

- Chicago: A report done by Gruen (1997) found proximity to CTA and Metra stations positively affects the value of single family homes with a premium of 20% in Chicago.

- Dallas: A study by Weinstein and Clower (2002) examined the 1997 to 2001 time period; the study revealed that proximity to a DART station exerts a positive influence on property valuations. Median values of residential properties increased 32.1 percent near the DART rail stations compared to 19.5 percent in the control group areas. For office buildings, the

increase was 24.7 percent for the DART properties versus 11.5 percent for the non-DART properties.

Similarly, because the price a commercial enterprise is willing to pay for a site is a function of its future expected return when operating at the site, and because the proximity of transit typically raises future expected return (through improved access to customers and workers), transit typically increases the value of nearby commercial units.

- Atlanta: In 1989, rents at a major development located near a transit station were $3 to $5 higher per square foot than those at other office of comparable quality a block away (Cervero et al., 1994).[7]

- Los Angeles: Commercial property values near *planned* transit corridors appreciated faster than similar properties away from the corridors during the 1980's, when the transit system was being planned and developed: property values near transit appreciated by more than 78 percent, properties away from transit gained only 38 percent (Fejarang, 1994).[8]

- New York City: On average, commercial property values increase by $2.7 per square foot, for every *meter* closer to a transit station (Anas, 1993).

- Washington DC Area: In the district, interviews with real estate brokers and appraisers revealed that commercial land prices near transit stations increased by around 100 percent several years after services began and by as much as 400 percent in some locales (Damm et al., 1980; Rice Center, 1987). At transit stations, in Bethesda and Ballston, projects immediately adjacent to station entrances commanded a $2 to $4 per square foot rent premium, relative to similar projects just a few blocks away.

Table 10 summarizes the results of the studies reviewed for this analysis.

[7] Reported in TCRP Report 16, Transit and Urban Form
[8] Reported in TCRP Report 16, Transit and Urban Form

Table 10: Property Premium Studies Reviewed for the Economic Development Analysis

System	Year	Res/ Comm	Premium	Distance Measured
San Diego Trolley	1992	C	16.70%	200 (feet)
San Diego Trolley	1992	R	2.00%	200
Portland MAX	1993	R	10.60%	1,500
MAX	1993	R	10.60%	1/4 mile
Philadelphia	1993	R	7.50%	
Boston	1994	R	6.70%	
Sacramento Light Rail	1995	R	6.20%	900
Santa Clara County Light Rail	1995	R	-10.80%	900
Chicago	1997	R	20.00%	
BART	1999	R	15%-26.0%	
Santa Clara	2002	R	45.00%	1/4 mile
San Diego Trolley	2002	R	10%-46.0%	
San Diego Trolley	1992	R-Rental	5.00%	200
San Francisco BART	1978	C	10.00%	600
BART	1978	C	1.00%	500
Washington Metrorail	1981	C	9 to 14%	300
Metrorail	1993	C	13.70%	300
Metrorail	1993	C	12.30%	300
Atlanta MARTA	1993	C	11 to 15.1%	300
BART	1970	R	2 to 14.0%	800
Toronto	1976	R	18.00%	1,750
BART	1979	R	5.00%	1,500
Philadelphia-NJ	1986	R	7.80%	10,000
BART	1991	R-Rental	5.00%	1,320

5.3 Effects on Residential Properties

Table 10 shows the estimated total residential property values in the future years within the analysis period for each market zone in the study area.

The estimates are based on existing land value and potential transit oriented development in the study area. Table 11 also presented the premiums accruing to each market zone. The premiums for each market zone are estimated based on the empirical research statistics and the panel's judgment on the potential growth for each market zone.

As Table 11 shows, market zone C1 will likely experience the most substantial increase in residential property value, while the market zone of B1 is expected to incur the least substantial increase.

Table 11: Total Residential Property Values
Millions of 2007 Dollars

Market Zone	2010	2015	2020	2025	Total Premium
A1	$64.5	$72.9	$78.5	$84.5	11.7%
A2	$19.0	$28.9	$36.1	$45.0	13.5%
A3	$4.7	$5.4	$5.7	$5.9	9.5%
B1	$34.7	$40.2	$43.2	$46.4	8.8%
B2	$58.4	$68.8	$75.0	$81.9	11.2%
C1	$411.7	$538.5	$632.5	$743.1	15.2%
C2	$71.0	$100.8	$135.8	$183.6	9.4%
C3	$52.0	$72.3	$94.3	$124.0	10.9%

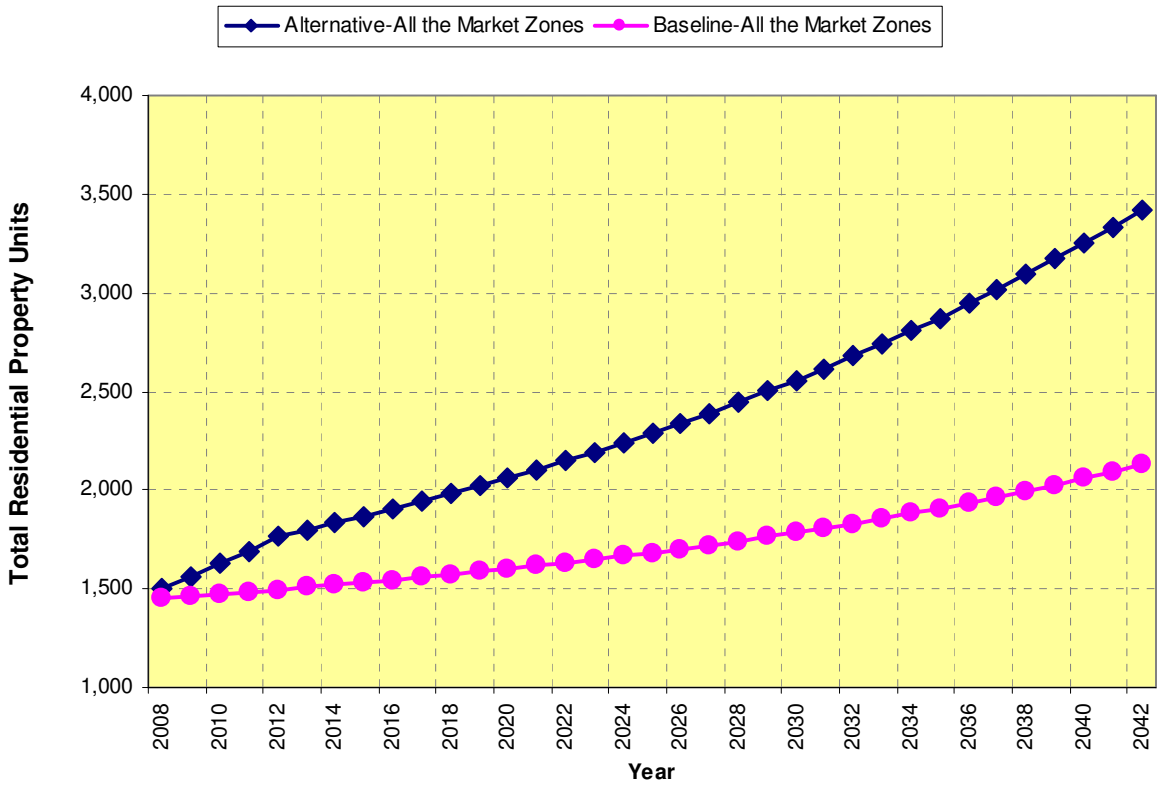
Table 12 presents the growth in number of residential units incrementally allocatable to the streetcar investment for the selected years over the study period of 2008-2042.

Table 12: Growth in Total Numbers of Usable Residential Units Resulting from the Investment

Market Zone	Base Year	2010	2015	2020	2025
A1	528	546	572	597	623
A2	188	236	333	405	493
A3	54	57	61	63	64
B1	58	61	66	69	72
B2	304	321	351	369	388
C1	193	214	258	295	337
C2	78	85	102	118	138
C3	94	104	126	148	176
total	**1,495**	**1,625**	**1,870**	**2,063**	**2,290**

Growth in usable residential properties shows a significant shift from the current trend, including reversing a downward trend in several key areas, particularly Over the Rhine. Figure 7 shows the relative growth rates in the Baseline and Alternative scenarios for residential properties.

Figure 7: Projected Useable Residential Unit Growth (2008-2042)



Figures 8-10 illustrate estimated Baseline and Alternative (with Streetcar) growths scenarios in the three Zone A sections (Over the Rhine).

Figure 8: Projected Useable Residential Unit Growth, A-1

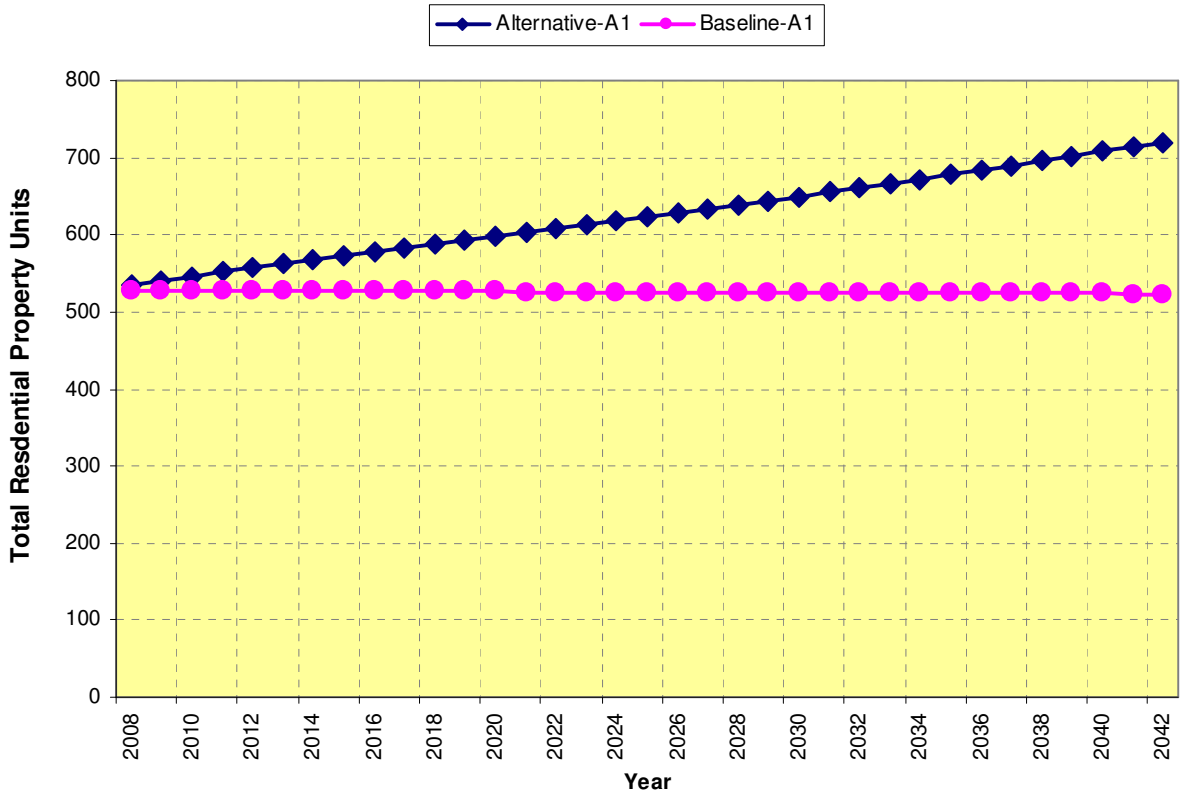


Figure 9: Projected Useable Residential Unit Growth, A-2

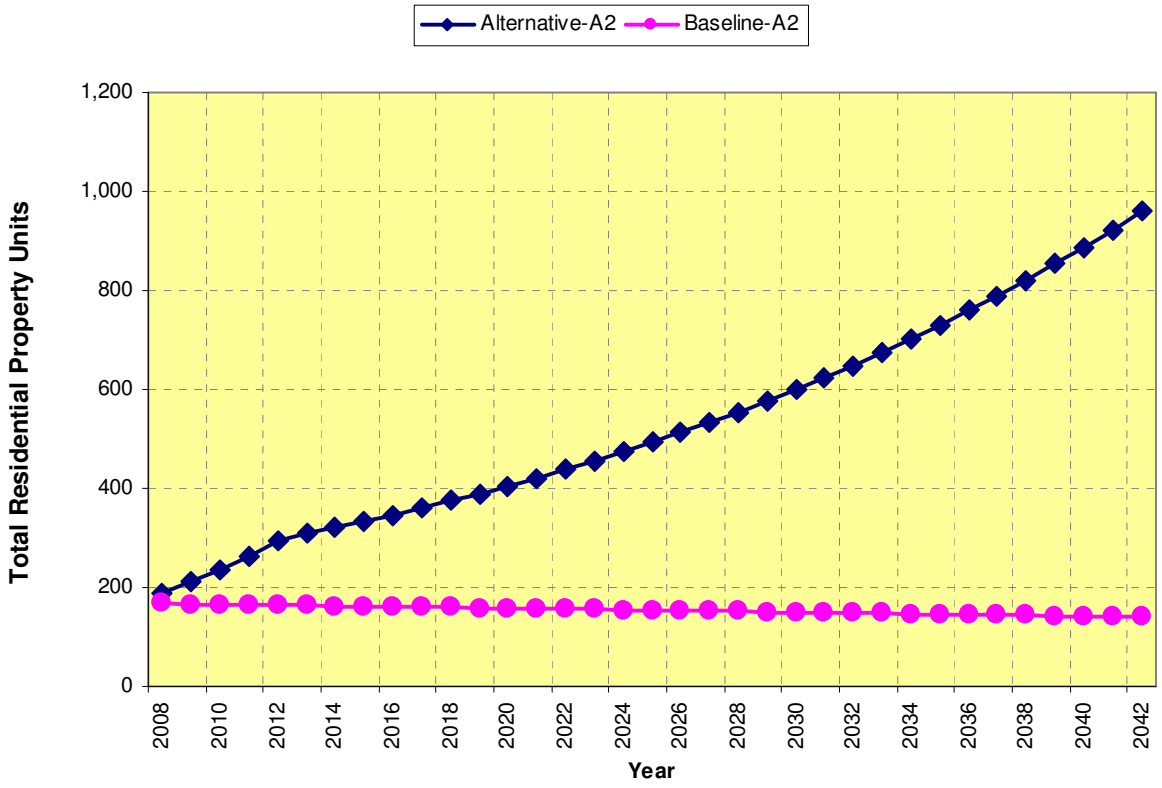
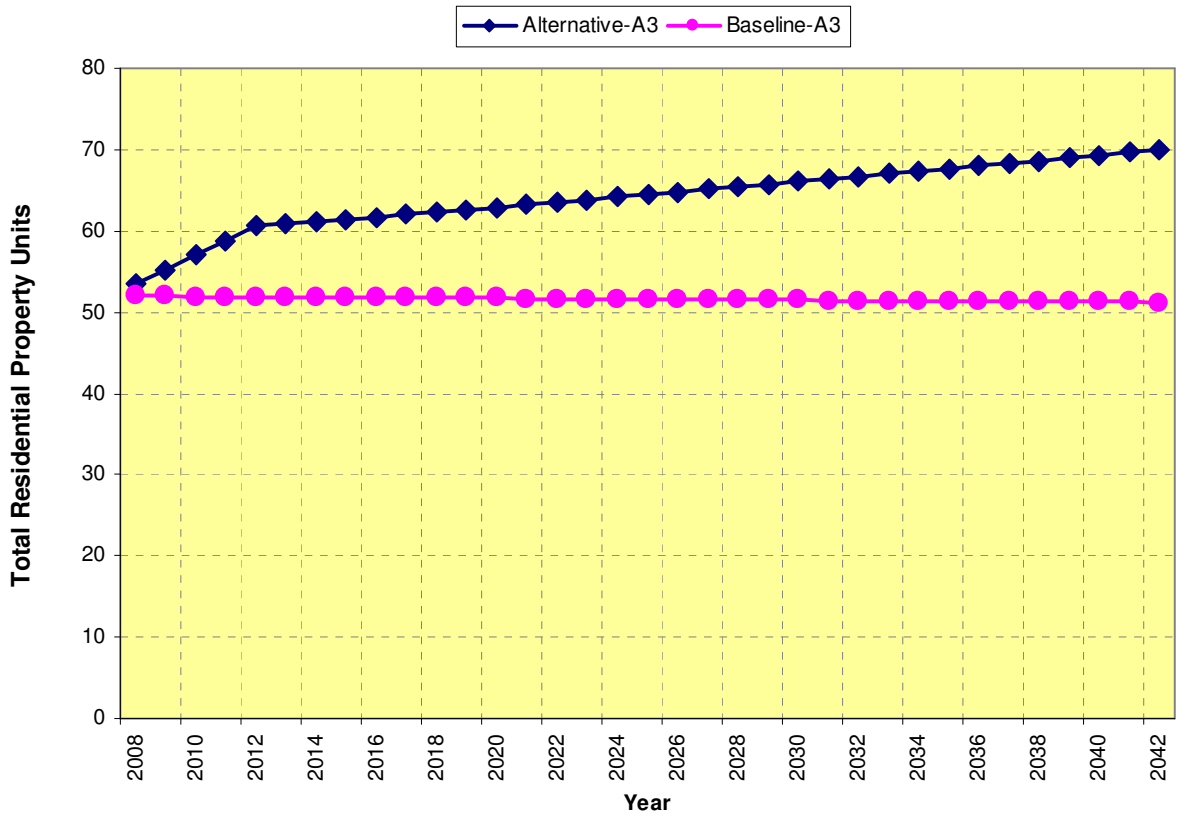


Figure 10: Projected Useable Residential Unit Growth, A-3



Hidden within the usable unit effects is redevelopment of currently usable properties. A property currently on the tax rolls that is redeveloped and re-purposed to a higher and better use would not be indicated as a "new" unit. Redevelopment was roughly estimated as the pressure for unit growth that could not be accommodated by available vacant/unused property. Redevelopment results may not be fully incremental to the investment. These estimates were used only for informational purposes and do not inform the economic benefits, which already capture the impact of improvements through the value premiums estimated. Table 13 describes the estimated additional residential redevelopment that will occur with Streetcar implementation in the three block radius surrounding the alignment.

Table 13: Estimated Redevelopment Effects for Residential Properties

Market Zone	Aggregate Number of Redeveloped Properties					
	2015			2025		
	Low	Median	High	Low	Median	High
Residential Property						
A1	36	62	91	70	118	174
A2	15	26	38	26	44	65
A3	6	10	15	9	15	23
B1	9	15	22	13	21	31
B2	24	40	59	49	83	122
C1	23	39	57	35	60	89
C2	6	10	15	13	22	33
C3	8	14	21	18	31	45

5.4 Effects on Commercial Properties

Similar to residential development, the streetcar investment stimulates commercial development because of the increased attractiveness of these locations for commerce, including the amenity benefits to individuals of walking, shopping, interaction and other aspects of multi-activity-oriented work places.

Table 14 shows the total commercial property values in the selected years of study period for each market zone. It also presents the premiums accruing to each market zone. As is shown, market zone C1 will likely experience a substantial increase in land value.

Table 14: Total Commercial Property Values
Millions of 2007 Dollars

Market Zone	2010	2015	2020	2025	Total Premium
A1	$60.0	$65.3	$67.8	$70.4	9.7%
A2	$28.5	$31.0	$31.9	$32.9	10.4%
A3	$7.0	$7.7	$8.0	$8.4	9.5%
B1	$262.0	$281.9	$289.1	$296.4	9.8%
B2	$99.2	$109.2	$113.9	$118.8	10.2%
C1	$122.3	$135.6	$140.0	$144.7	15.2%
C2	$1,367.8	$1,521.6	$1,615.2	$1,714.6	11.4%
C3	$524.2	$577.6	$607.3	$638.5	10.9%

Table 15 presents the growth in total number of commercial units allocatable to the streetcar investment for the selected years over the study period of 2008-2042.

Table 15: Growth in Total Numbers of Commercial Units Resulting from the Investment

Market Zone	2010	2015	2020	2025	Premium
A1	514	525	535	538	540
A2	352	360	366	368	370
A3	89	91	94	96	98
B1	366	374	379	379	379
B2	500	513	524	527	529
C1	62	64	65	65	66
C2	700	708	716	720	723
C3	643	650	655	656	656
total	**3,226**	**3,286**	**3,335**	**3,348**	**3,361**

As with impacts to residential properties, streetcar implementation was seen to have significant reversal effects on growth in the more depressed parts of the study area. Figures 11 through 13 illustrate estimated Baseline and Alternative total useable units over the evaluation period.

Figure 11: Projected Useable Commercial Unit Growth, A-1

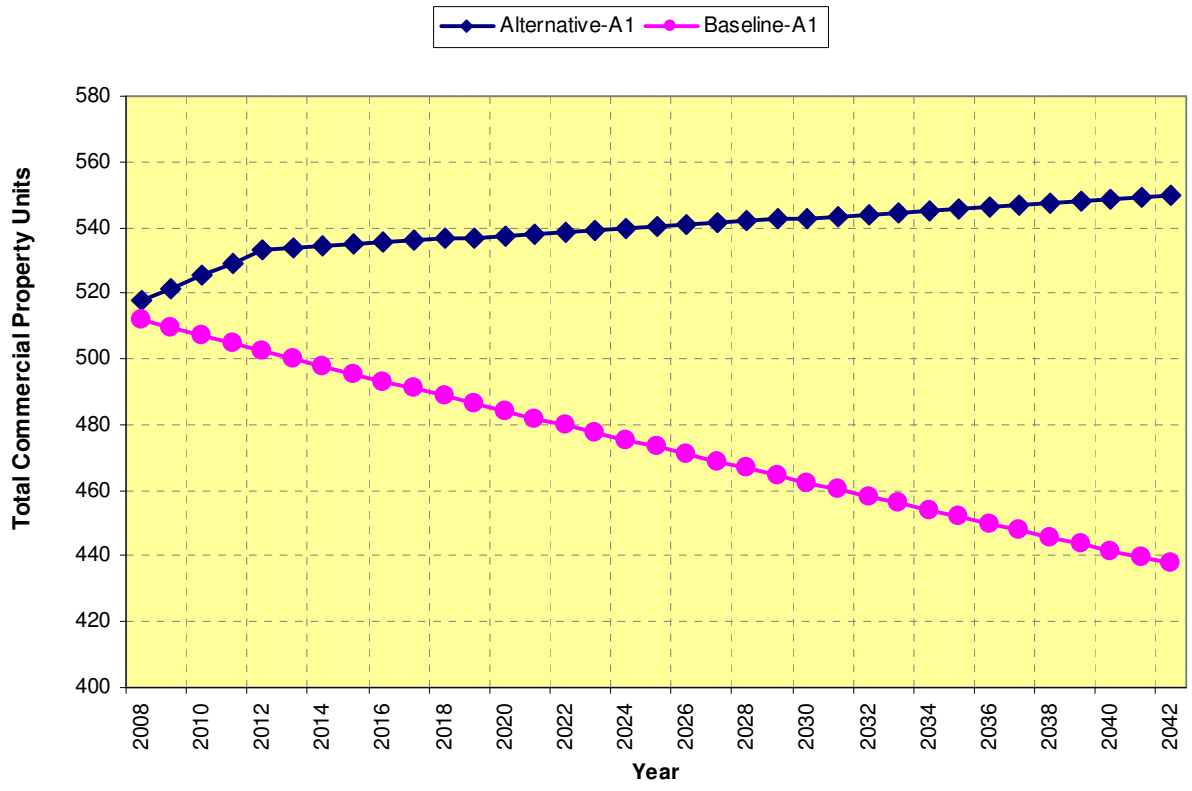


Figure 12: Projected Useable Commercial Unit Growth, A-2

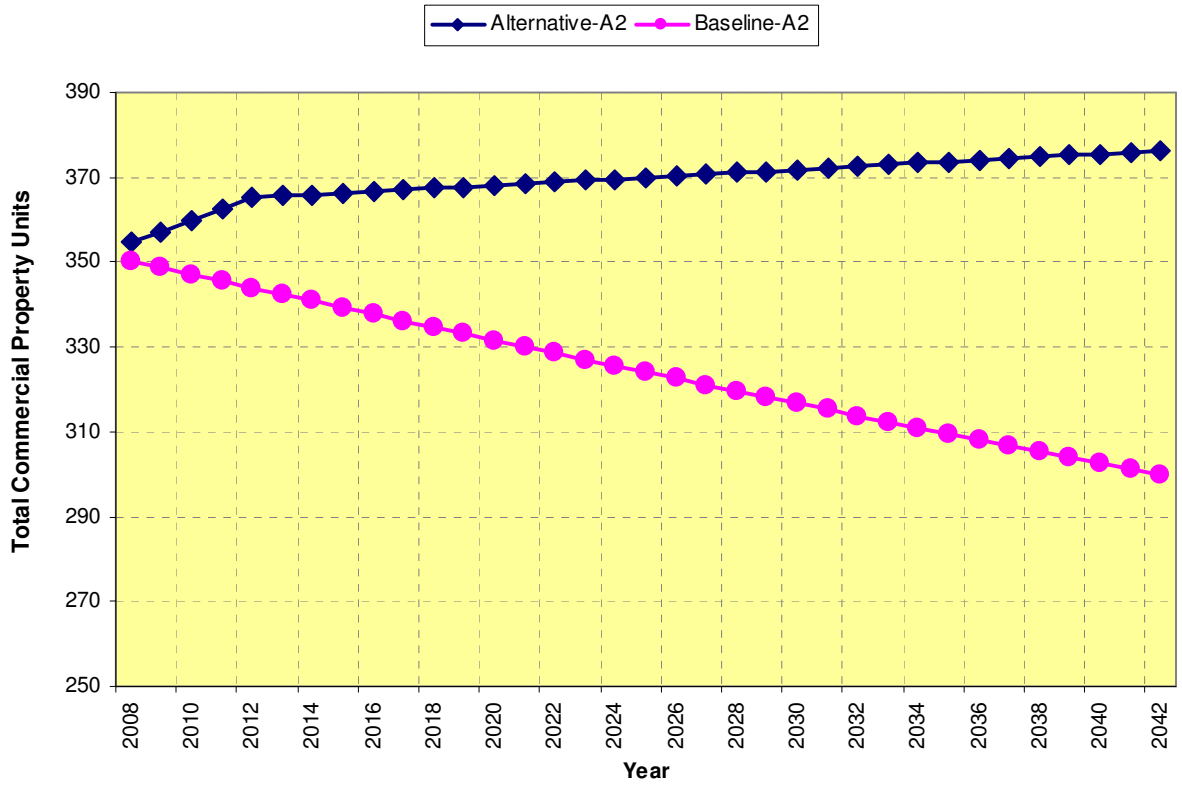


Figure 13: Projected Useable Commercial Unit Growth, A-3

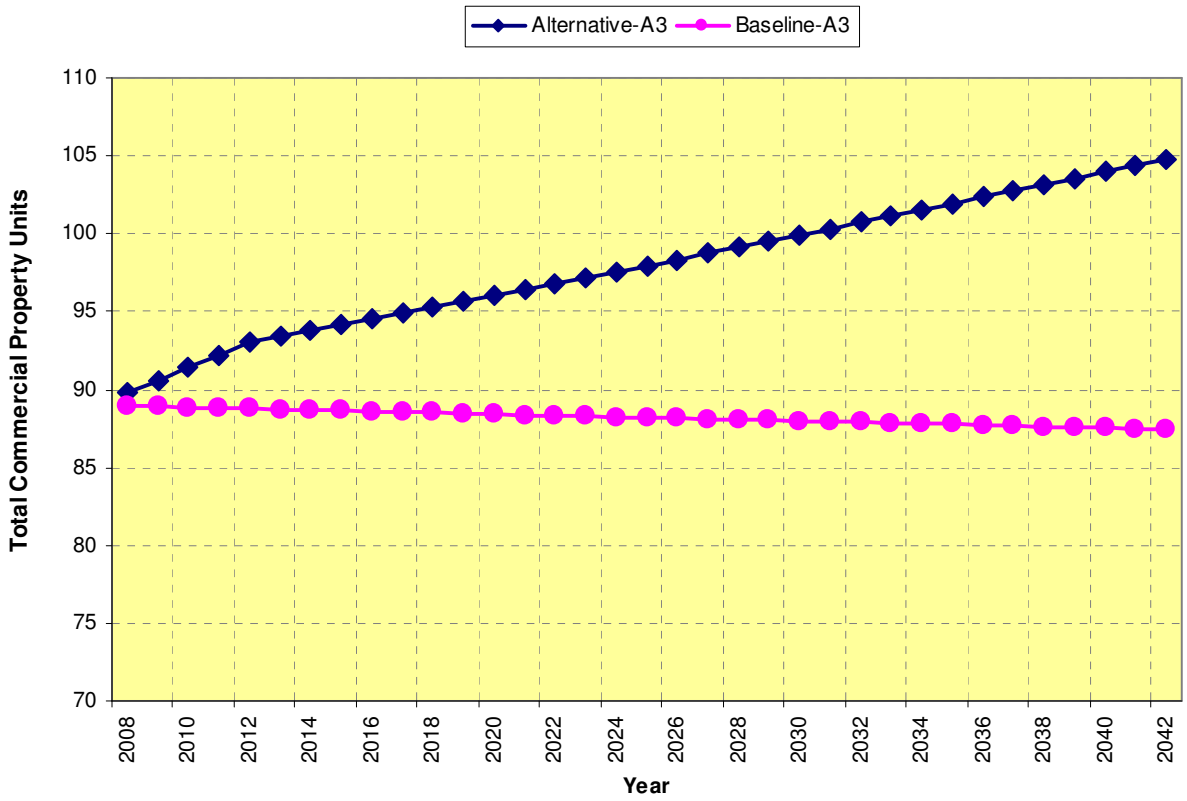


Table 16 presents the estimated commercial property redevelop patterns for the three block area surrounding the alignment.

Table 16: Estimated Redevelopment Effects for Commercial Properties

Market Zone	Aggregate Number of Redeveloped Properties					
	2015			2025		
	Low	Median	High	Low	Median	High
Commercial Property						
A1	19	33	49	67	114	167
A2	15	26	38	47	81	119
A3	4	7	11	10	17	26
B1	17	28	42	49	83	122
B2	38	65	96	86	146	215
C1	7	12	18	15	25	37
C2	26	44	65	66	113	166
C3	23	39	57	59	100	146

5.5 Summary of Findings

Table 17 summarizes the present value of total benefits accruing to residential and commercial sectors over the period 2008-2042 for each market zone due to the streetcar system.

Table 17: Total Community Development Benefits 2008-2042
Millions of Year-2007 Dollars

Market Zone	Residential	Commercial
A1	$8	$6
A2	$4	$3
A3*	$0	$1
B1	$4	$23
B2	$8	$10
C1	$65	$17
C2	$10	$156
C3	$8	$56
Total	**$107**	**$272**

* Note Residential Benefits in Zone A3 are projected as less than $1M largely due to the fact that so few properties currently exist in this zone.

Figures 14 and 15 demonstrate the total property values in the baseline and alternative scenarios for residential and commercial sectors, respectively.

As is shown, total property values will likely experience a rapid growth during the period 2008-2012 and then remain at stable growth afterwards. The impacts of a streetcar system are expected to happen during a five year time frame. It begins two years before the availability of the streetcar system (2008) (anticipatory growth) and continues to three years after the streetcar system is opened (2012). After this five year growth period, the growth rates of property values will remain at stable levels.

Figure 14: Projected Total Residential Property Values

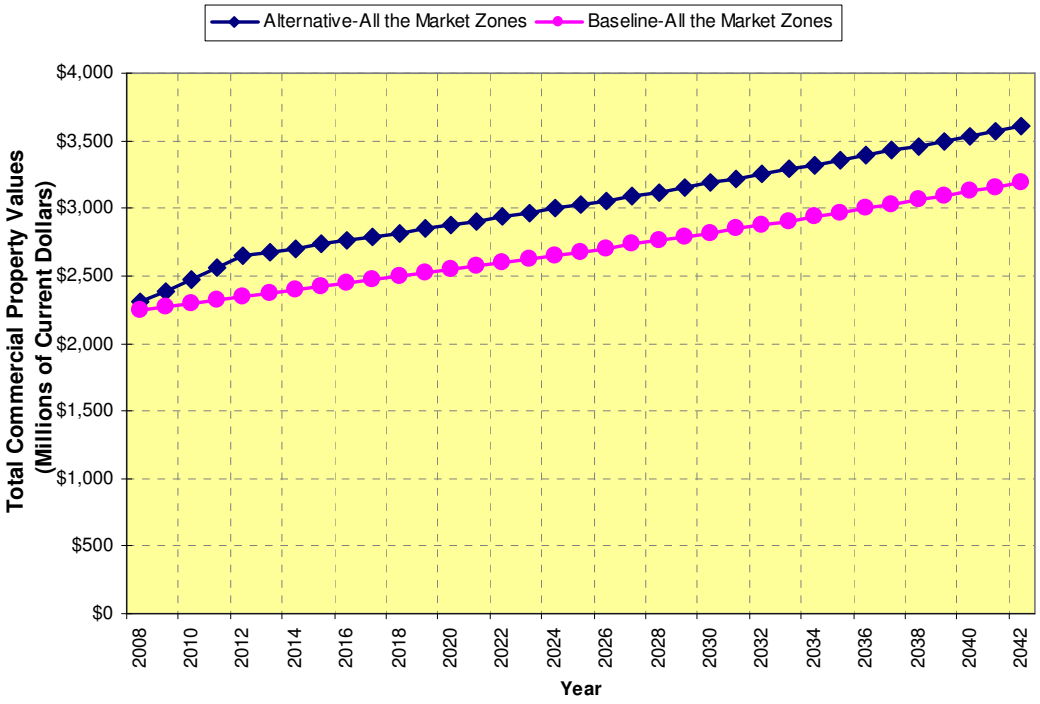
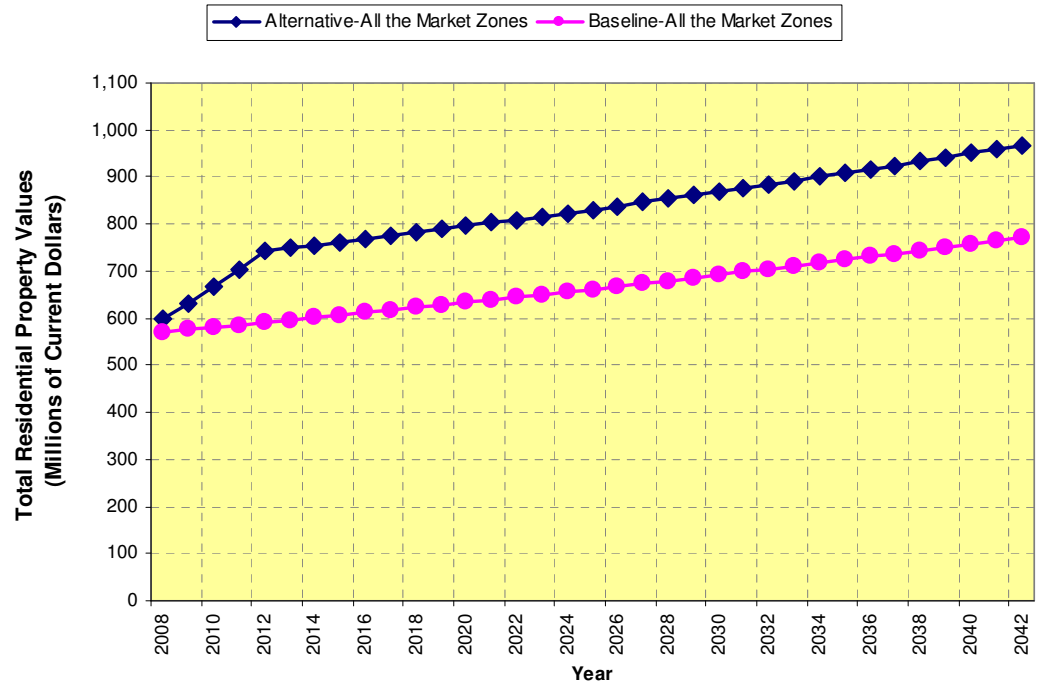


Figure 15: Projected Total Commercial Property Values



Figures 16 and 17 demonstrate the unit growth rate in the baseline and alternative scenarios for residential and commercial sectors, respectively.

Figure 16: Projected Total Residential Property Units

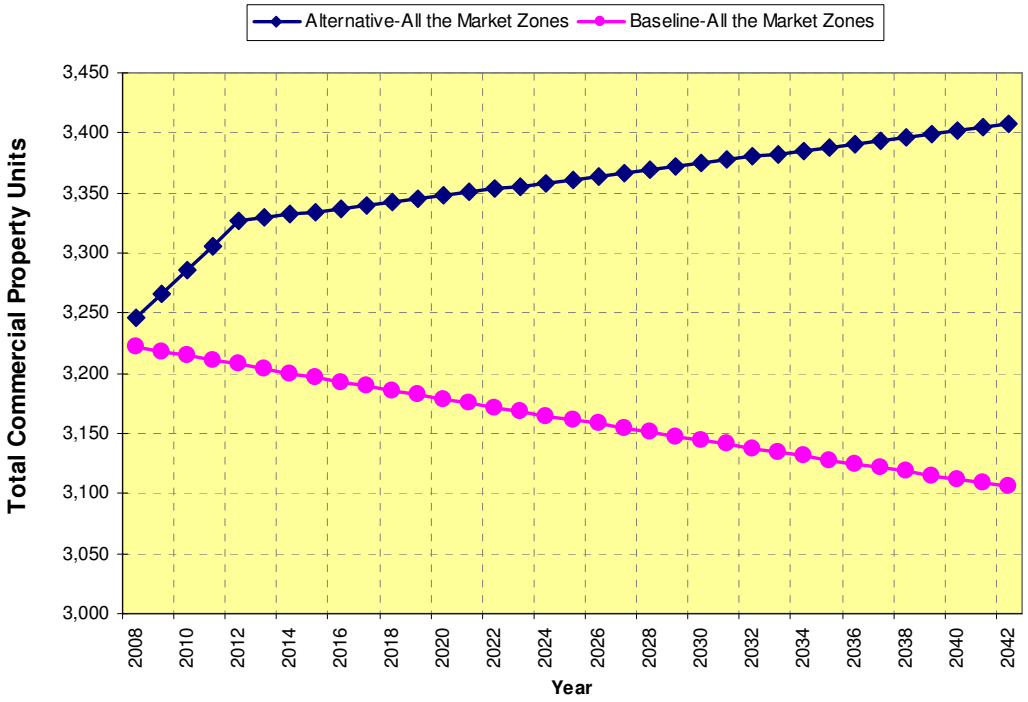


Figure 17: Projected Total Commercial Property Units

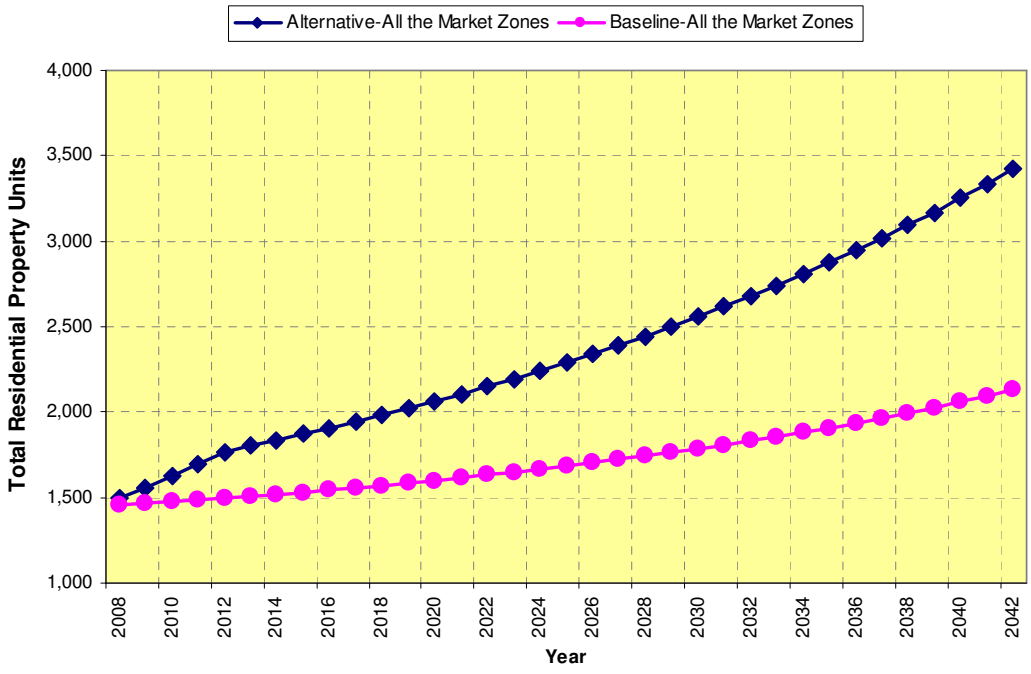


Table 18 presents the estimated net new units plus redeveloped units in each evaluation section.

Table 18: Development Profile by Market Zone and Section

Market Zone	Aggregate Number of Redeveloped + New Units					
	2015			2025		
	Low	Median	High	Low	Median	High
Commercial Property						
A1	30	51	75	80	136	200
A2	22	38	55	56	96	141
A3	8	13	19	14	23	34
B1	23	39	57	55	94	138
B2	50	86	126	101	171	252
C1	10	17	25	18	30	44
C2	34	58	85	78	133	195
C3	29	49	72	65	110	162
Residential Property						
A1	52	89	130	88	150	221
A2	20	33	49	30	51	75
A3	10	16	24	12	21	31
B1	12	21	31	16	27	40
B2	47	80	118	91	154	227
C1	33	56	83	47	79	117
C2	12	21	31	23	38	57
C3	15	26	38	29	48	71

Effort was also undertaken to estimate the potential value in property tax collections resulting from the value premiums. This analysis was also undertaken for informational purposes and was included in the benefit and return on investment analysis as it would effect double counting of the value of the property value improvements. The property tax evaluation assumed current millage rates and no abatement of tax in order to project total available collectible dollars.

Figure 18: Estimated Additive Property Tax Available

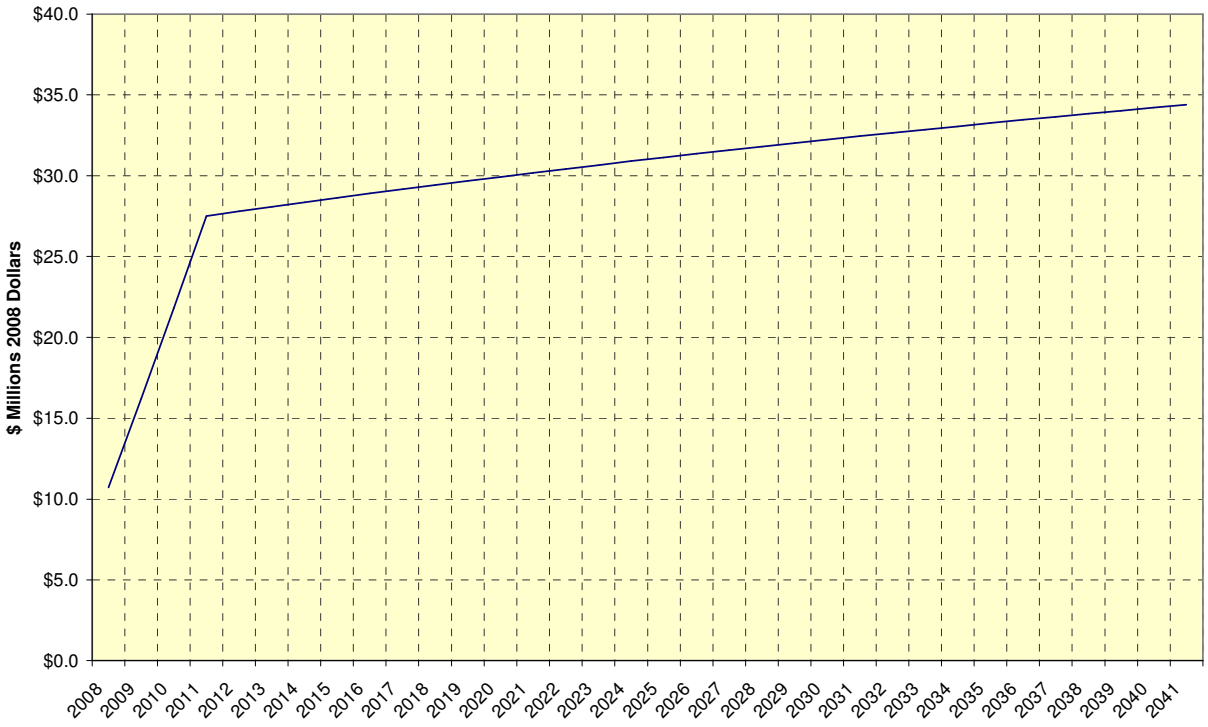


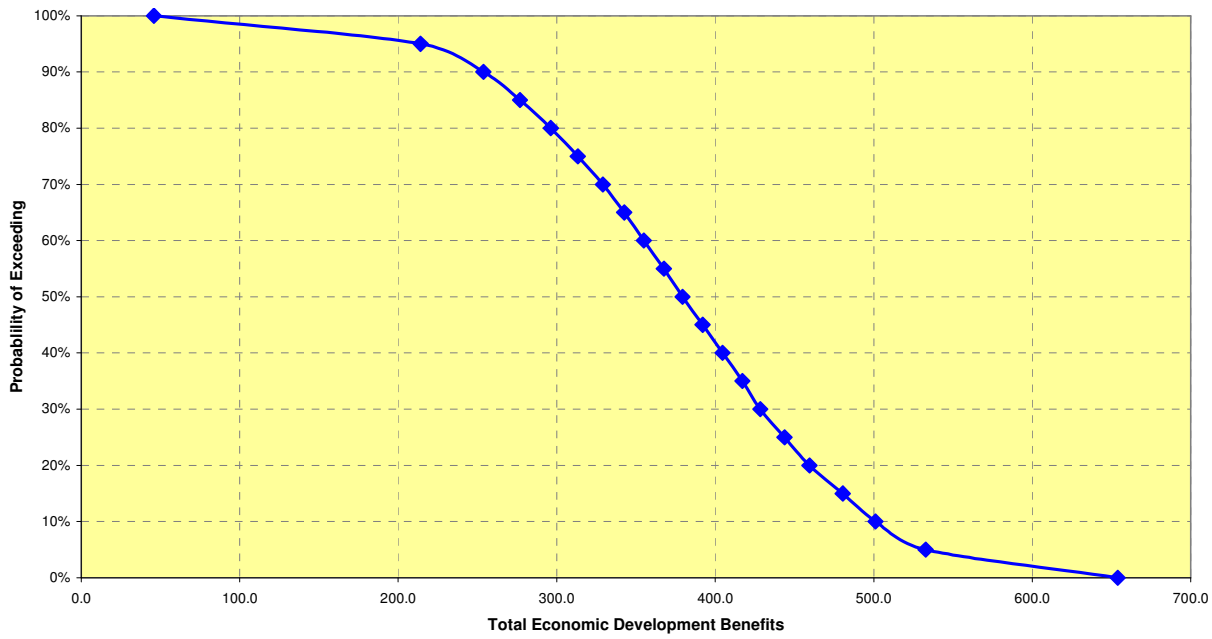
Table 19 summarizes the present value of economic development benefits resulting from investment in the streetcar system over the period 2008-2042. As the table indicates, the total economic development benefits for both residential and commercial sectors are expected to be $378.2 million, with a 10 percent probability of exceeding $509.1 million.

Table 19: Present Value of Economic Development Benefits (2008-2042)

Millions of 2007 Dollar	10% Lower Limit	Median Estimate	10% Upper Limit
Residential	$70.8	$107.2	$143.0
Commercial	$148.5	$270.4	$398.3
Total	$249.5	$378.2	$509.1

Figure 19 presents the probability distribution for the present value of total economic development benefits over the period 2008-2042.

Figure 19: Risk Analysis of Total Economic Development Benefits
In Millions of 2007 dollars: 2008-2042



6. STREETCAR LIFE CYCLE COSTSS

This chapter presents the estimated costs of streetcar implementation including capital expenses for the acquisition of right-of-way, construction, and the acquisition of vehicles and equipment. The costs also include the yearly expense of operating the system and keeping it in good repair. Firstly, cost component assumptions are presented. Following this, the risk analysis of total project costs is presented.

6.1 Cost Component Assumptions

Total capital costs have been broken down into several components: guideway, stations, systems, special conditions, yards and shops, vehicles and soft costs. To account for the uncertainty surrounding the estimation of these costs, a probability distribution has been determined for each of them. These distributions can be thought of as a listing of all possible cost outcomes together with the probability that these outcomes materialize. The distributions are defined with three values or parameters: the median estimate, the 10% upper limit and the 10% lower limit.

Table 20 presents the median estimates of annual capital costs during construction periods with 10% upper and lower limits.

Table 20: Annual Capital Costs

Millions of 2007 Dollars	10% Lower Limit	Median Estimate	10% Upper Limit
2008	$3.0	$3.4	$3.7
2009	$5.3	$5.9	$6.5
2010	$13.6	$15.1	$16.6
2011	$33.1	$36.8	$40.5
2012	$22.1	$24.6	$27.0
2012	$2.2	$2.4	$2.7

Annual operating and maintenance costs include all the costs necessary to operate and maintain the light rail system. Table 21 presents the median estimates of annual capital costs during construction periods with 10 percent upper and lower limits.

Table 21: Annual O&M Costs

Millions of 2007 Dollars	10% Lower Limit	Median Estimate	10% Upper Limit
Annual O&M Costs	$1.9	$2.2	$2.4

The results of Monte Carlo simulations combining multiple realizations of the above probability distributions are shown in the next section.

6.2 Simulation Results

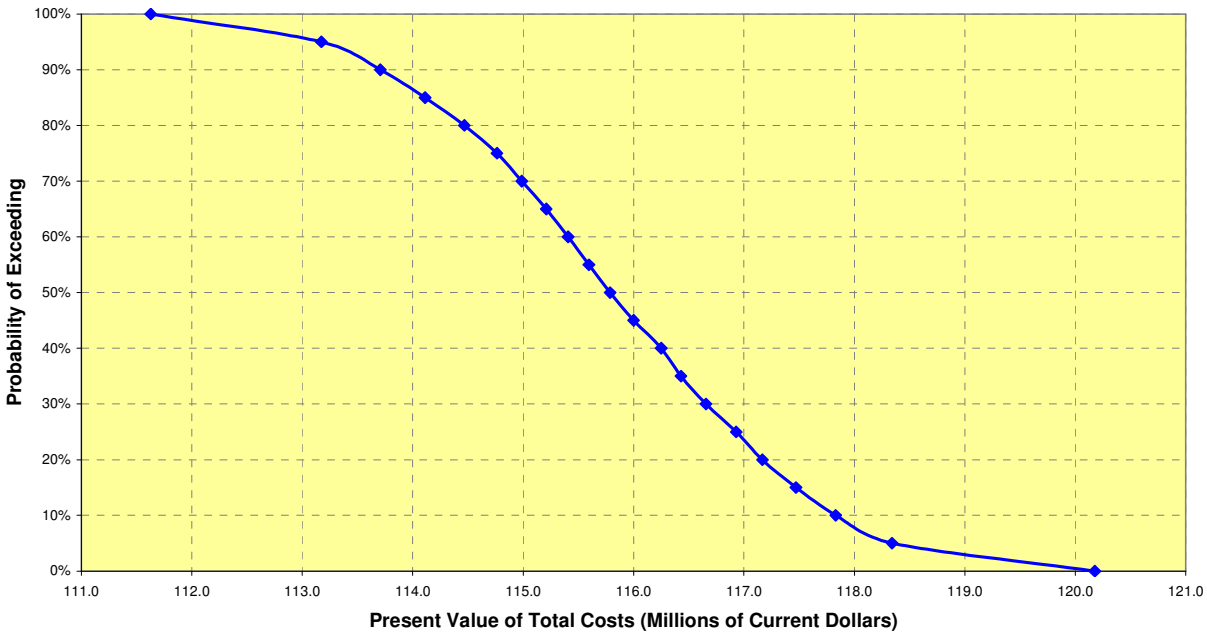
Table 2 presents the present value of total capital costs and project costs over the life cycle. As is shown, the mean estimate for capital costs is $75.7 million. With a 90 percent probability the capital costs will exceed $73.6 million.

Figure 20 demonstrates the probability distribution for the present value of total life cycle costs. The median estimate of total life cycle costs (capital costs plus operating and maintenance costs) is $115.8 million. There is a 90 percent probability that the total life cycle costs will be between $113.7 million and $117.8 million.

Table 22: Risk Analysis of Total Costs (2008-2042)

Present Value of Costs ($Millions of 2007 Dollars)	10% Lower Limit	Median Estimate	10% Upper Limit
Capital Costs	$73.6	$75.7	$77.7
Total Costs	$113.7	$115.8	$117.8

Figure 20: Risk Analysis of Total Costs



7. BENEFIT COST ANALYSIS

Building on the previous chapters, this chapter presents the Benefit-Cost Analysis of the streetcar system in Cincinnati within a risk analysis framework.

7.1 Benefit-Cost Analysis Results

The benefits, costs, net present value and benefit cost ratio for the streetcar system are summarized in Table 23. The table indicates that, relative to the Base Case, the median present value of the total benefits is expected to be $430.9 million over the 35 years between 2008 and 2042. This value is expected to exceed the median total costs by $315.1 million. This represents a return on investment of 2.7 times.

Table 23: Benefit Cost Analysis of the Streetcar System (2008-2042)

In Millions of 2007 Dollars, Discounted	Mean Expected	90% Probability of Exceeding	10% Probability of Exceeding
Congestion Management Benefits			
VOC Savings	$13.0	$10.5	$16.4
Emission Savings	$0.4	$0.2	$0.7
Accident Cost Savings	$3.0	$0.7	$5.7
Total Congestion Management Benefits	**$16.4**	**$12.2**	**$21.1**
Affordable Mobility Benefits			
Trip Cost Savings	**$35.2**	**$24.3**	**$47.6**
Cross Sector Benefits			
Welfare Cost Savings	$0.3	$0.2	$0.4
Home Care Cost Savings	$0.0	$0.0	$0.0
Total Cross Sector Benefits	**$0.3**	**$0.2**	**$0.4**
Community Development Benefits			
Residential	$106.9	$72.4	$141.5
Commercial	$272.0	$151.2	$388.8
Total Community Development Benefits	**$378.9**	**$253.7**	**$501.2**
Grand Total Benefits	**$430.9**	**$304.4**	**$554.9**
Project Costs			
Capital Expenditures	$75.7	$73.6	$77.7
Incremental O&M + Disruption Costs	$40.1	$39.7	$40.5
Total Costs	**$115.8**	**$113.7**	**$117.8**
Net Present Value	**$315.1**	**$188.8**	**$440.1**
Benefit-Cost Ratio	**2.7**	**1.6**	**3.8**

Note: Present Values are calculated based on a four percent discount rate.

The Risk Analysis is given numerically in the final two columns of Table 23. It is also presented graphically in Figures 21 and 22. It is shown that with a 90 percent probability the net present value will exceed $188.8 million and the benefit cost ratio will be above 1.6. This finding

suggests that investing in streetcar system is economically worthwhile with minimal risk of economic failure.

Figure 21: Risk Analysis of Total Benefits
(Millions of 2007 Dollars: 2008-2042)

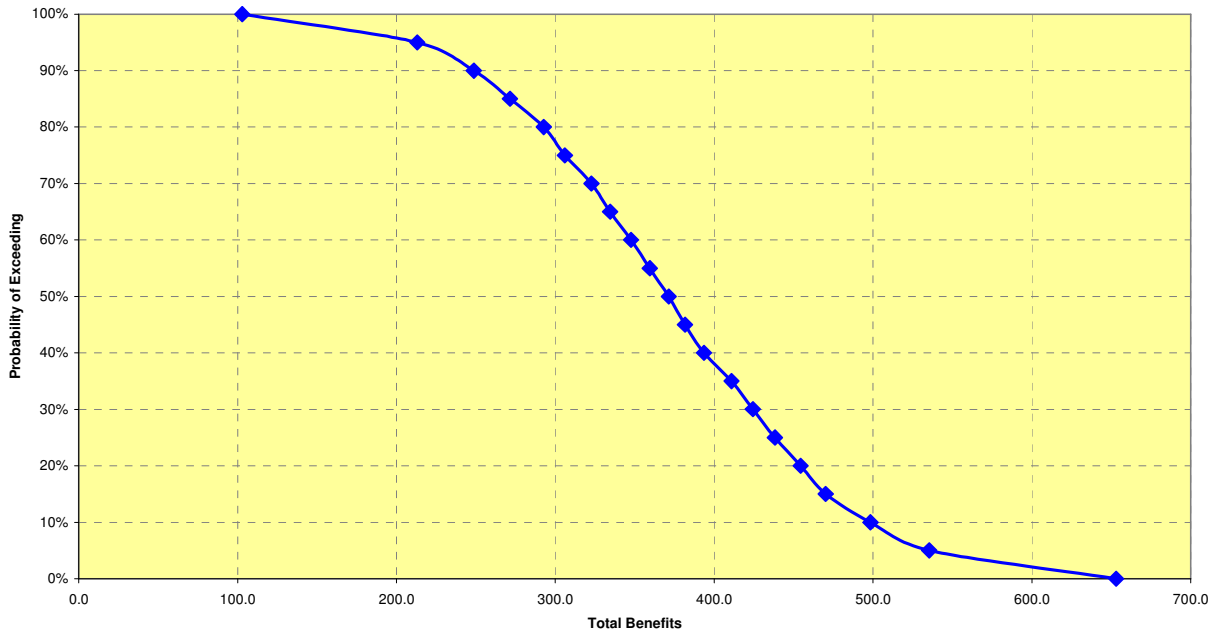
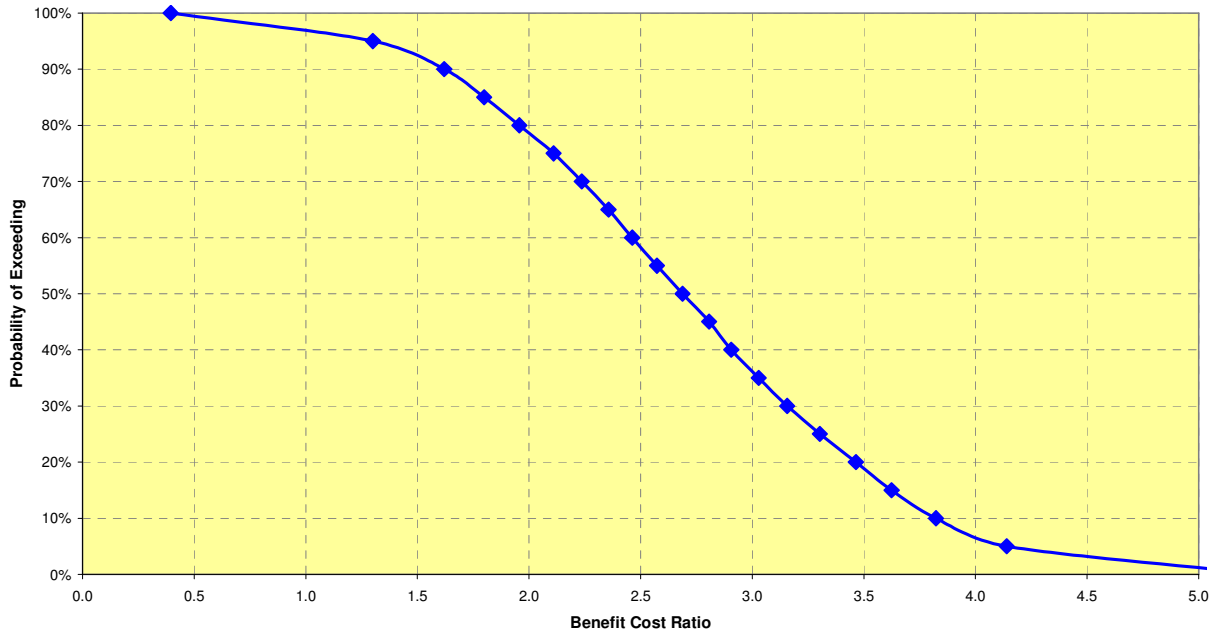


Figure 22: Risk Analysis of Benefit Cost Ratio



APPENDIX A: RISK ANALYSIS ASSUMPTIONS

Traffic Assumptions	Lower	Central	Upper
Daily Ridership in Opening Year	3100.0	4850.0	6600.0
Perc. of Ridership in Peak Period, %	48.60%	54.00%	59.40%
Avg. Annual Ridership Growth - Year 1..5, %	6.00%	8.00%	10.00%
Avg. Annual Ridership Growth - Year 6..10, %	1.03%	1.67%	2.27%
Avg. Annual Ridership Growth - Year 11..20, %	1.00%	1.37%	1.80%
Avg. Annual Ridership Growth - Year 21..30, %	0.93%	1.00%	1.00%
Perc. of Off-Peak Trips Diverted from Auto, %	48.00%	60.00%	72.00%
Perc. of Off-Peak Trips Diverted from Other Transit (Bus), %	27.20%	34.00%	40.80%
Perc. of Off-Peak Trips Diverted from Taxi, %	4.80%	6.00%	7.20%
Perc. of Off-Peak New Trips, %	0.00%	0.00%	0.00%
Perc. of Peak Trips Diverted from Auto, %	48.00%	60.00%	72.00%
Perc. of Peak Trips Diverted from Other Transit (Bus), %	27.20%	34.00%	40.80%
Perc. of Peak Trips Diverted from Taxi, %	4.80%	6.00%	7.20%
Perc. of Peak New Trips, %	0.00%	0.00%	0.00%
Avg. Transit Trip Length (Peak), miles	3.8	3.8	3.8
Opening Year traffic (Peak) w/o transit, mph	20.0	20.0	30.0
Opening Year Traffic Speed (Off-Peak) w/o transit, mph	25.0	25.0	35.0
Opening Year traffic (Peak) w transit, mph	20.0	20.0	30.0
Opening Year Traffic Speed (Off-Peak) w transit, mph	25.0	25.0	35.0
Representative Facility Type (1..12)	**8**	**8**	**8**
First Year Average Daily Traffic	6674	8343	10012
Perc. of ADT in Peak Time, %	55.00%	60.00%	65.00%
Perc. of Peak ADT - Auto, %	95.00%	95.00%	95.00%
Perc. of Peak ADT - Bus, %	1.00%	1.00%	1.00%
Perc. of Peak ADT - Taxi, %	1.00%	1.00%	1.00%
Perc. of Peak ADT - Truck, %	3.00%	3.00%	3.00%
Avg. ADT Growth - Year 1..5, %	1.00%	1.50%	2.00%
Avg. ADT Growth - Year 6..10, %	0.50%	1.00%	1.50%
Avg. ADT Growth - Year 11..20, %	0.00%	0.50%	1.00%
Avg. ADT Growth - Year 21..30, %	0.00%	0.25%	0.50%
Perc. of Off Peak ADT - Auto, %	90.00%	90.00%	90.00%
Perc. of Off Peak ADT - Bus, %	2.00%	2.00%	2.00%
Perc. of Off PeaK ADT - Taxi, %	1.00%	1.00%	1.00%
Perc. of Off Peak ADT - Truck, %	7.00%	7.00%	7.00%
Avg. Vehicle Occupancy - Auto including driver	1.1	1.2	1.3
Avg. Vehicle Occupancy - Bus including driver	15.0	20.0	25.0
Avg. Vehicle Occupancy - Taxi including driver	2.1	2.2	2.3
Avg. Vehicle Occupancy - Truck including driver	1.0	1.0	1.0
(1=Freeway, 2=Expressway, 3=Artery, 4=Collector)	3.0	3.0	3.0
Highway Free Flow Speed, mph	30.0	30.0	30.0
(0=Default, 1=BPR, 2=MTC, 3=Updated BPR)	2.0	0.0	0.0
Bus PCE Factor	3.0	3.0	3.0

Travel User Cost Assumptions	Lower	Central	Upper
Fuel Cost - Auto, $ per gallon	$3.03	$3.03	$3.03
Oil Cost - Auto, $ per quart	$4.42	$4.42	$4.42
Tire Cost - Auto, $ per tire	$80.60	$80.60	$80.60
Avg. Maintenance and Repair Cost - Auto, $	$130.27	$130.27	$130.27
Avg. Vehicle Depreciable Value - Auto, $thousands	$25.77	$25.77	$25.77
Fuel Cost - Bus, $ per gallon	$2.86	$2.86	$2.86
Oil Cost - Bus, $ per quart	$1.77	$1.77	$1.77
Tire Cost - Bus, $ per tire	$582.14	$582.14	$582.14
Avg. Maintenance and Repair Costs - Bus, $	$434.97	$434.97	$434.97
Avg. Vehicle Depreciable Value - Bus, $thousands	$106.66	$106.66	$106.66
Fuel Cost - Truck, $ per gallon	$2.86	$2.86	$2.86
Oil Cost - Truck, $ per quart	$1.77	$1.77	$1.77
Tire Cost - Truck, $ per tire	$582.14	$582.14	$582.14
Avg. Maintenance and Repair Cost - Truck, $	$434.97	$434.97	$434.97
Avg. Vehicle Depreciable Value - Truck, $thousand	$106.66	$106.66	$106.66
Accident Cost Toggle (0=No, 1=Yes)	**1**	**1**	**1**
Fatal Accident Cost, $thousand per accident	$2,000.00	$3,930.00	$6,000.00
Injury Accident Cost, $thousand per accident	$25.00	$52.00	$75.00
Property Damage Cost, $thousand per accident	$1.50	$3.00	$4.50
Transit Accident Cost Toggle (0=No, 1=Yes)	1.00	1.00	1.00
Transit Deaths per million passengers-miles	0.01	0.01	0.02
Transit Injuries per million passengers-miles	1.07	1.33	1.60
Transit PDO per million passengers-miles	0.00	0.00	0.00
Other Transit Deaths per million passengers	0.02	0.02	0.02
Other Transit Injuries per million passengers	7.48	7.48	7.48
Other Transit PDO per million passengers	0.00	0.00	0.00

Environmental Cost Assumptions	Lower	Central	Upper
NOX Cost, $/ton	$4,179.00	$4,179.00	$4,179.00
HC Cost, $/ton	$500.00	$1,000.00	$2,000.00
VOC Cost, $/ton	$3,170.00	$3,170.00	$3,170.00
SO2 Cost, $/ton	$9,683.00	$9,683.00	$9,683.00
PM2.5 Cost, $/ton	$5,562.00	$5,562.00	$5,562.00
PM10 Cost, $/ton	$5,562.00	$5,562.00	$5,562.00
CO Cost, $/ton	$115.00	$115.00	$115.00
CO2 Cost, $/ton	$10.00	$25.00	$100.00
Avg. Annual Population Growth - Year 1..5, %	0.56%	0.70%	0.77%
Avg. Annual Population Growth - Year 6..10, %	0.40%	0.50%	0.55%
Avg. Annual Population Growth - Year 11..20, %	0.40%	0.50%	0.55%
Avg. Annual Population Growth - Year 21..30, %	0.40%	0.50%	0.55%
Perc. Cars Gasoline Fueled, %	85.59%	85.59%	85.59%
Perc. Cars Diesel Fueled, %	14.19%	14.19%	14.19%
Perc. Pick-Ups And Commercial Vans, %	0.20%	0.20%	0.20%
Perc. Trucks Gasoline Fueled, %	54.50%	54.50%	54.50%
Perc. Trucks Diesel Fueled < 8500 Lbs, %	0.00%	0.00%	0.00%
Perc. Trucks Diesel Fueled > 8500 Lbs, %	45.50%	45.50%	45.50%

Affordable Mobility Assumptions	Lower	Central	Upper
% of Low Income People in Total Ridership	30.00%	45.00%	60.00%
% of Low Income Ridership, Peak	30.00%	45.00%	60.00%
% of Low Income Ridership , Off-Peak	30.00%	45.00%	60.00%
Value of Time for Low Income People, $/hour	$10.00	$12.50	$15.00
Avg. Fare - Streetcar, $/trip	$0.60	$0.73	$1.25
Avg. Fare - Bus, $/trip	$0.60	$0.73	$1.25
Avg. Fare - Taxi, $/trip	$6.00	$10.00	$12.00
Avg. Parking Cost, $/day	$4.00	$5.00	$6.00
% of Peak Trips Diverted from Auto	9.00%	10.00%	12.00%
% of Peak Trips Diverted from Bus	79.20%	88.00%	96.80%
% of Peak Trips Diverted from Taxi	1.80%	2.00%	2.20%
% of New Peak Trips	0.00%	0.00%	0.00%
% of Off-Peak Trips Diverted from Auto	25.20%	28.00%	30.80%
% of Off-Peak Trips Diverted from Bus	63.00%	70.00%	77.00%
% of Off-Peak Trips Diverted from Taxi	1.80%	2.00%	2.20%
% of New Off-Peak Trips	0.00%	0.00%	0.00%

Cross Sector Benefit Assumptions	Lower	Central	Upper
Perc. of Trips for Medical Purposes, %	10.80%	12.00%	13.20%
Perc. of Medical Trips Foregone without Transit, %	27.00%	30.00%	33.00%
Perc. of Lost Medical Trips leading to Home Care, %	4.50%	5.00%	5.50%
Incremental Cost of Home Care, $/visit	$90.00	$100.00	$110.00
Perc. of Trips for Work Purposes, %	54.00%	60.00%	66.00%
Perc. of Work Trips Foregone without Transit, %	1.80%	2.00%	2.20%
Perc. of Lost Work Trips leading to Unemployment, %	10.80%	12.00%	13.20%
Welfare Cost per Recipient, $/year	$1,000.00	$1,750.00	$2,500.00

Community Development Assumptions	Lower	Central	Upper
First Year Nb. of Res. Properties - Zone A			
Section 1	440		
Section 2	168		
Section 3	46		
First Year Nb. of Res. Properties - Zone B			
Section 1	42		
Section 2	188		
First Year Nb. of Res. Properties - Zone C			
Section 1	183		
Section 2	27		
Section 3	39		
Avg. Annual Growth in Nb. Res. Properties (no-built)- Zone A, %			
Section 1	-0.20%	-0.05%	0.10%
Section 2	-2.00%	-0.50%	1.00%
Section 3	-0.20%	-0.05%	0.10%
Avg. Annual Growth in Nb. Res. Properties (no-built) - Zone B, %			
Section 1	-0.20%	-0.05%	0.10%
Section 2	-0.20%	-0.05%	0.10%
Avg. Annual Growth in Nb. Res. Properties (no-built) - Zone C, %			

Community Development Assumptions	Lower	Central	Upper
Section 1	1.25%	2.50%	5.00%
Section 2	2.50%	5.00%	10.00%
Section 3	2.50%	5.00%	10.00%
Avg. Annual Growth in Nb. Res. Properties (built)- Zone A, %			
Section 1	0.61%	0.76%	0.91%
Section 2	9.60%	12.00%	14.40%
Section 3	1.59%	3.19%	4.78%
Avg. Annual Growth in Nb. Res. Properties (built) - Zone B, %			
Section 1	1.59%	3.19%	4.78%
Section 2	1.06%	2.13%	3.19%
Avg. Annual Growth in Nb. Res. Properties (built) - Zone C, %			
Section 1	2.50%	5.00%	10.00%
Section 2	3.50%	6.00%	11.00%
Section 3	3.50%	6.00%	11.00%
Avg. Annual Growth in Nb. Res. Properties (post-built)- Zone A, %			
Section 1	0.50%	1.00%	1.50%
Section 2	2.00%	4.00%	6.00%
Section 3	0.25%	0.50%	1.00%
Avg. Annual Growth in Nb. Res. Properties (post-built) - Zone B, %			
Section 1	0.50%	1.00%	1.50%
Section 2	0.50%	1.00%	1.50%
Avg. Annual Growth in Nb. Res. Properties (post-built) - Zone C, %			
Section 1	1.25%	2.50%	5.00%
Section 2	2.50%	5.00%	10.00%
Section 3	2.50%	5.00%	10.00%
Avg. Res. Property Value - Zone A, $thousands			
Section 1	$106.07	$106.07	$106.07
Section 2	$73.71	$73.71	$73.71
Section 3	$71.68	$71.68	$71.68
Avg. Res. Property Value - Zone B, $thousands			
Section 1	$655.88	$655.88	$655.88
Section 2	$178.65	$178.65	$178.65
Avg. Res. Property Value - Zone C, $thousands			
Section 1	$1,738.67	$1,738.67	$1,738.67
Section 2	$1,757.22	$1,757.22	$1,757.22
Section 3	$737.52	$737.52	$737.52
Avg. Res. Property Baseline Growth Rate-Zone A, %			
Section 1	0.33%	0.65%	0.98%
Section 2	0.25%	0.50%	0.75%
Section 3	0.25%	0.50%	0.75%
Avg. Res. Property Baseline Growth Rate-Zone B, %			
Section 1	0.25%	0.50%	0.75%
Section 2	0.38%	0.75%	1.13%
Avg. Res. Property Baseline Growth Rate-Zone C , %			
Section 1	0.28%	0.55%	0.83%
Section 2	0.55%	1.10%	1.65%

Community Development Assumptions	Lower	Central	Upper
Section 3	0.50%	1.00%	1.50%
Avg. Res. Property Growth Rate with Premium - Zone A, %			
Section 1	2.27%	2.84%	3.40%
Section 2	2.41%	3.01%	3.61%
Section 3	1.83%	2.29%	2.75%
Avg. Res. Property Growth Rate with Premium - Zone B, %			
Section 1	1.74%	2.18%	2.61%
Section 2	2.27%	2.84%	3.40%
Avg. Res. Property Growth Rate with Premium - Zone C, %			
Section 1	2.70%	3.37%	4.04%
Section 2	2.27%	2.84%	3.40%
Section 3	2.41%	3.01%	3.61%
Avg. Res. Property Growth Rate post-Premium - Zone A, %			
Section 1	0.33%	0.65%	0.98%
Section 2	0.25%	0.50%	0.75%
Section 3	0.25%	0.50%	0.75%
Avg. Res. Property Growth Rate post-Premium - Zone B, %			
Section 1	0.25%	0.50%	0.75%
Section 2	0.38%	0.75%	1.13%
Avg. Res. Property Growth Rate post-Premium - Zone C, %			
Section 1	0.28%	0.55%	0.83%
Section 2	0.55%	1.10%	1.65%
Section 3	0.50%	1.00%	1.50%
First Year Nb. of Com. Properties - Zone A			
Section 1	514		
Section 2	352		
Section 3	89		
First Year Nb. of Com. Properties - Zone B			
Section 1	366		
Section 2	500		
First Year Nb. of Com. Properties - Zone C			
Section 1	62		
Section 2	700		
Section 3	643		
Avg. Annual Growth in Nb. Com. Properties (no built) - Zone A, %			
Section 1	-0.75%	-0.50%	0.00%
Section 2	-0.75%	-0.50%	0.00%
Section 3	-0.20%	-0.05%	0.10%
Avg. Annual Growth in Nb. Com. Properties (no built) - Zone B, %			
Section 1	-0.20%	-0.10%	0.10%
Section 2	-0.20%	-0.05%	0.10%
Avg. Annual Growth in Nb. Com. Properties (no built) - Zone C, %			
Section 1	0.05%	0.10%	0.15%
Section 2	0.05%	0.10%	0.15%
Section 3	-0.20%	0.00%	0.25%
Avg. Annual Growth in Nb. Com. Properties (built) - Zone A, %			
Section 1	0.59%	0.74%	0.89%

Community Development Assumptions	Lower	Central	Upper
Section 2	0.59%	0.74%	0.89%
Section 3	0.44%	0.89%	1.33%
Avg. Annual Growth in Nb. Com. Properties (built) - Zone B, %			
Section 1	0.41%	0.71%	0.85%
Section 2	0.44%	0.89%	1.33%
Avg. Annual Growth in Nb. Com. Properties (built) - Zone C, %			
Section 1	0.44%	0.89%	1.33%
Section 2	0.20%	0.40%	0.60%
Section 3	0.19%	0.38%	0.56%
Avg. Annual Growth in Nb. Com. Properties (post-built) - Zone A, %			
Section 1	0.05%	0.10%	0.15%
Section 2	0.05%	0.10%	0.15%
Section 3	0.20%	0.40%	0.60%
Avg. Annual Growth in Nb. Com. Properties (post-built) - Zone B, %			
Section 1	-0.20%	0.00%	0.20%
Section 2	0.05%	0.10%	0.15%
Avg. Annual Growth in Nb. Com. Properties (post-built) - Zone C, %			
Section 1	0.05%	0.10%	0.15%
Section 2	0.05%	0.10%	0.15%
Section 3	-0.20%	0.00%	0.25%
Avg. Com. Property Value - Zone A, $thousands			
Section 1	$106.07	$106.07	$106.07
Section 2	$73.71	$73.71	$73.71
Section 3	$71.68	$71.68	$71.68
Avg. Com. Property Value - Zone B, $thousands			
Section 1	$655.88	$655.88	$655.88
Section 2	$178.65	$178.65	$178.65
Avg. Com. Property Value - Zone C, $thousands			
Section 1	$1,738.67	$1,738.67	$1,738.67
Section 2	$1,757.22	$1,757.22	$1,757.22
Section 3	$737.52	$737.52	$737.52
Avg. Com. Property Baseline Growth Rate-Zone A, %			
Section 1	0.33%	0.65%	0.98%
Section 2	0.25%	0.50%	0.75%
Section 3	0.25%	0.50%	0.75%
Avg. Com. Property Baseline Growth Rate-Zone B, %			
Section 1	0.25%	0.50%	0.75%
Section 2	0.38%	0.75%	1.13%
Avg. Com. Property Baseline Growth Rate-Zone C, %			
Section 1	0.28%	0.55%	0.83%
Section 2	0.55%	1.10%	1.65%
Section 3	0.50%	1.00%	1.50%
Avg. Com. Property Premium - Zone A, %			
Section 1	1.97%	2.47%	2.96%
Section 2	1.97%	2.47%	2.96%
Section 3	1.83%	2.29%	2.75%

Community Development Assumptions	Lower	Central	Upper
Avg. Com. Property Premium - Zone B, %			
Section 1	1.37%	2.35%	2.82%
Section 2	2.13%	2.66%	3.19%
Avg. Com. Property Premium - Zone C, %			
Section 1	2.70%	3.37%	4.04%
Section 2	2.55%	3.19%	3.83%
Section 3	2.41%	3.01%	3.61%
Avg. Com. Property post-Premium - Zone A, %			
Section 1	0.33%	0.65%	0.98%
Section 2	0.25%	0.50%	0.75%
Section 3	0.25%	0.50%	0.75%
Avg. Com. Property post-Premium - Zone B, %			
Section 1	0.25%	0.50%	0.75%
Section 2	0.38%	0.75%	1.13%
Avg. Com. Property post-Premium - Zone C, %			
Section 1	0.28%	0.55%	0.83%
Section 2	0.55%	1.10%	1.65%
Section 3	0.50%	1.00%	1.50%
First Year Nb. of Con. Properties - Zone A			
Section 1	88		
Section 2	0		
Section 3	6		
First Year Nb. of Con. Properties - Zone B			
Section 1	14		
Section 2	107		
First Year Nb. of Con. Properties - Zone C			
Section 1	0		
Section 2	47		
Section 3	50		
Avg. Annual Growth in Nb. Con. Properties (no built) - Zone A, %			
Section 1	0.05%	0.10%	0.15%
Section 2	-0.20%	0.00%	0.20%
Section 3	-0.20%	0.00%	0.20%
Avg. Annual Growth in Nb. Con. Properties (no built) - Zone B, %			
Section 1	-0.20%	0.00%	0.20%
Section 2	0.50%	1.00%	1.50%
Avg. Annual Growth in Nb. Con. Properties (no built) - Zone C, %			
Section 1	0.50%	1.00%	1.50%
Section 2	0.50%	1.00%	1.50%
Section 3	0.50%	1.00%	1.50%
Avg. Annual Growth in Nb. Con. Properties (built) - Zone A, %			
Section 1	2.27%	2.84%	3.40%
Section 2	2.41%	3.01%	3.61%
Section 3	1.83%	2.29%	2.75%
Avg. Annual Growth in Nb. Con. Properties (built) - Zone B, %			
Section 1	1.74%	2.18%	2.61%
Section 2	2.13%	4.25%	6.38%

Community Development Assumptions	Lower	Central	Upper
Avg. Annual Growth in Nb. Con. Properties (built) - Zone C, %			
Section 1	2.53%	5.06%	7.58%
Section 2	1.98%	3.97%	5.95%
Section 3	2.11%	4.21%	6.32%
Avg. Annual Growth in Nb. Con. Properties (post-built) - Zone A, %			
Section 1	0.05%	0.10%	0.15%
Section 2	-0.20%	0.00%	0.20%
Section 3	-0.20%	0.00%	0.20%
Avg. Annual Growth in Nb. Con. Properties (post-built) - Zone B, %			
Section 1	-0.20%	0.00%	0.20%
Section 2	0.50%	1.00%	1.50%
Avg. Annual Growth in Nb. Con. Properties (post-built) - Zone C, %			
Section 1	0.50%	1.00%	1.50%
Section 2	0.50%	1.00%	1.50%
Section 3	0.50%	1.00%	1.50%
Avg. Con. Property Value - Zone A, $thousands			
Section 1	$120.63	$120.63	$120.63
Section 2	$0.00	$0.00	$0.00
Section 3	$124.17	$124.17	$124.17
Avg. Con. Property Value - Zone B, $thousands			
Section 1	$150.36	$150.36	$150.36
Section 2	$147.50	$147.50	$147.50
Avg. Con. Property Value - Zone C, $thousands			
Section 1	$0.00	$0.00	$0.00
Section 2	$153.10	$153.10	$153.10
Section 3	$228.92	$228.92	$228.92
Avg. Con. Property Baseline Growth Rate-Zone A, %			
Section 1	0.33%	0.65%	0.98%
Section 2	0.25%	0.50%	0.75%
Section 3	0.25%	0.50%	0.75%
Avg. Con. Property Baseline Growth Rate-Zone B, %			
Section 1	0.25%	0.50%	0.75%
Section 2	0.38%	0.75%	1.13%
Avg. Con. Property Baseline Growth Rate-Zone C, %			
Section 1	0.28%	0.55%	0.83%
Section 2	0.55%	1.10%	1.65%
Section 3	0.50%	1.00%	1.50%
Avg. Con. Property Premium - Zone A, %			
Section 1	2.27%	2.84%	3.40%
Section 2	2.41%	3.01%	3.61%
Section 3	1.83%	2.29%	2.75%
Avg. Con. Property Premium - Zone B, %			
Section 1	1.74%	2.18%	2.61%
Section 2	2.27%	2.84%	3.40%
Avg. Con. Property Premium - Zone C, %			
Section 1	2.70%	3.37%	4.04%

Community Development Assumptions	Lower	Central	Upper
Section 2	2.27%	2.84%	3.40%
Section 3	2.41%	3.01%	3.61%
Avg. Con. Property post-Premium - Zone A, %			
Section 1	0.33%	0.65%	0.98%
Section 2	0.25%	0.50%	0.75%
Section 3	0.25%	0.50%	0.75%
Avg. Con. Property post-Premium - Zone B, %			
Section 1	0.25%	0.50%	0.75%
Section 2	0.38%	0.75%	1.13%
Avg. Con. Property post-Premium - Zone C, %			
Section 1	0.28%	0.55%	0.83%
Section 2	0.55%	1.10%	1.65%
Section 3	0.50%	1.00%	1.50%

APPENDIX B: RESULTS OF THE COMMUNITY ECONOMIC DEVELOPMENT WORKSHOP

As part of the evaluation of expected economic development benefits, an economic development workshop was conducted on April 5, 2007. Panelists were asked to rank market zone sub sections on the following criteria using a ranking of Very High (HH), High (H), Medium High (MH), Medium (M), Medium Low (ML), Low Medium (LM), Low (L) and Very Low (LL) :

Evaluation Category	Description	Format
Current Market Strength	Are properties in the analysis zone selling well and do they have high absorption rates or healthy lease rates?	L / M / H
Expected Improvement in Accessibility	Will the streetcar make the analysis zone more convenient and easy to travel to? What alternative access modes are available now?	L / M / H
Residential Desirability	Does the analysis zone have the capacity to attract residential development?	L / M / H
Commercial Desirability	Does the analysis zone have the capacity to attract commercial development?	L / M / H
Supportive Zoning	Does the analysis zone have transit-oriented zoning (which encourages increased development densities, endorses mixed-use development, reduces parking requirements and is pedestrian friendly)?	L / M / H
Available Land for Development or Redevelopment	Does the analysis zone have properties available for development or redevelopment?	L / M / H
Major Attractions	Does the analysis zone contain (or is close to) major attractions that create a destination for riders?	L / M / H
Public Sector Investment / Support	Does the analysis zone have public sector support and ongoing or proposed public sector investment in place to support operations? Will all necessary infrastructure be in place?	L / M / H
Private Sector Investment / Support	Does the analysis zone have private sector support and ongoing or proposed private development projects in place, which will support TOD?	L / M / H

The information collected in the session was used to calibrate the expected incremental development rates and property value premiums in the community economic development benefit evaluation. The following is a summary of the respondents' views.

	Current Market Strength	Expected Accessibility Improvement	Residential Desireability	Commercial Desireability	Supportive Zonning	Availabile Land for Redevelopment	Major Attractions	Public Sector Investment/ Support	Private Sector Investment/ Support
Zone C | Section 1									
Initial Assessment	N/A	H	MH	H	MH	H	H	L	M
Panel 1		H	H	H	H	H	H	H	H
Panel 2	M	H	MH	H	MH	H	H	L	M
Panel 3	L	H	MH	H	ML	H	H	M	MH
Panel 4	L	M	MH	MH	H	H	H	M	MH
Panel 5	L	H	H	H	H	H	H	H	H
Panel 6	M	H	MH	M	H	H	H	H	L
Panel 7	L	H	MH	MH	H	H	H	MH	MH
Panel 8	LL	H	H	MH	H	H	H	H	M
Panel 9	L	H	H	H	H	H	H	H	M
Panel 10	M	M	H	MH	H	H	H	H	H
Zone C | Section 2									
Initial Assessment	H	M	M	H	H	L	H	H	H
Panel 1	H	L	MH	MH	ML	I	MH	MH	MH
Panel 2	M	ML	M	H	H	M	H	H	H
Panel 3	H	L	ML	H	ML	L	MH	H	H
Panel 4	H	L	ML	H	ML	L	MH	H	H
Panel 5	M	M	H	H	H	L	M	M	M
Panel 6	M	M	H	H	L	MH	M	M	H
Panel 7	MH	M	ML	H	H	L	H	H	H
Panel 8	M	H	MH	H	H	M	H	H	H
Panel 9	MH	M	M	H	H	ML	H	H	H
Panel 10	M	M	M	M	M	M	H	M	M
Zone C | Section 3									
Initial Assessment	M	MH	MH	M	H	MH	ML	M	M
Panel 1	H	H	H	M	H	M	M	M	M
Panel 2									
Panel 3	M	M	M	H	H		H	ML	ML
Panel 4	M	M	MH	M	ML	MH	ML	M	M
Panel 5	M	M	M	M	H	L	H	H	M
Panel 6	M	M	H	H	L	H	M	M	L
Panel 7	M	M	MH	MH	H	H	ML	M	M
Panel 8	M	ML	M	MH	ML	H	M	M	M
Panel 9	M	M	M	MH	H	H	ML	H	H
Panel 10									

	Current Market Strength	Expected Accessibility Improvement	Residential Desireability	Commercial Desireability	Supportive Zonning	Availabile Land for Redevelopment	Major Attractions	Public Sector Investment/ Support	Private Sector Investment/ Support
Zone B | Section 1									
Initial Assessment	L	MH	L	L	M	H	L	?	?
Panel 1	L	L	M	L	M	H	L	M	M
Panel 2		MH	MH						
Panel 3	L	MH	L	L	M	H	M	L	L
Panel 4	L	H	L	LM	M	H	L	LM	L
Panel 5	L	H	M	L	H	H	L	M	L
Panel 6	L	M	M	LM	M	H	L	H	M
Panel 7	L	MH	ML	L	MH	H	L	M	M
Panel 8	L	ML	L	L	H	H	L	M	M
Panel 9	L	M	L	L	M	M	L	M	L
Panel 10									
Zone B | Section 2									
Initial Assessment	L	MH	MH	M	M	H	L	??	??
Panel 1	M	M	M	M	M	H	L	M	M
Panel 2	M	MH	MH	M	M	H	MH	MH	MH
Panel 3	L	H	H	M	M	H	MH	H	H
Panel 4	M	MH	MH	MH	M	H	M	M	M
Panel 5	H	H	M	LM	L	H	M	H	H
Panel 6	MH	H	MH	LM	L	H	MH	M	H
Panel 7	M	MH	M	MH	M	H	MH	H	MH
Panel 8	L	H	H	MH	M	H	M	H	MH
Panel 9	L	M	L	LM	L	L	L	M	LM

	Current Market Strength	Expected Accessibility Improvement	Residential Desireability	Commercial Desireability	Supportive Zonning	Availabile Land for Redevelopment	Major Attractions	Public Sector Investment/ Support	Private Sector Investment/ Support
Zone A | Section 1									
Initial Assessment	L	H	M	M	MH	HH	H	??	??
Panel 1	M	H	M	M	MH	HH	H	M	M,
Panel 2	M	H	H	MH	MH	HH	H	MH	MH
Panel 3	L	H	M	M	MH	HH	MH	MH	MH
Panel 4	M	H	MH	M	M	H	H	MH	MH
Panel 5	M	H	M	L	M	H	M	M	L
Panel 6	M	H	M	L	MH	H	M	M	L
Panel 7	L	H	M	M	MH	H	H	MH	ML
Panel 8	L	M	M	M	M	H	H	H	M
Panel 9	L	M	L	LM	M	M	MH	H	M
Panel 10									
Zone A | Section 2									
Initial Assessment	L	H	MH	M	MH	HH	L	??	??
Panel 1	M	H	MH	M	MH	H	L	M	M
Panel 2	ML	H	MH	M	MH	HH	MH	MH	MH
Panel 3	L	H	MH	M		H	ML	H	M
Panel 4	L	H	H	ML	MH	H	LM	LM	L
Panel 5	L	H	MH	L	MH	H	L	M	L
Panel 6	L	H	H	LM	MH	H	M	MH	M
Panel 7	L	H	MH	ML	MH	H	L	M	ML
Panel 8	L	H	M	M	MH	H	MH	MH	ML
Panel 9	L	M	M	L	MH	M	L	H	M
Panel 10									
Zone A | Section 3									
Initial Assessment	LL	H	L	L	MH	HH	LL	??	??
Panel 1	M	M	M	M	MH	HH	M	M	M
Panel 2	M	H	MH	MH	MH	HH	M	MH	MH
Panel 3	L	H	M	L	MH	HH	LL	ML	M
Panel 4	L	H	LM	LM	MH	HH	M	ML	ML
Panel 5	L	H	L	L	MH	HH	LL	L	L
Panel 6	L	H	H	M	H	H	L	L	M
Panel 7	L	H	L	M	MH	H	LM	M	M
Panel 8	L	H	L	L	MH	H	L	M	M
Panel 9	LL	H	L	L	M	MH	L	M	M
Panel 10									

APPENDIX C: REFERENCES

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