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Indy Connect Economic Impact Analysis

Final Report

Indianapolis, IN
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1 Executive Summary

The Indy Connect Central Indiana Transit Plan includes three bus rapid transit (BRT) routes and enhanced local bus service in Marion County. These enhancements will support economic growth while meeting the expected demand for frequent, reliable, and safe transit service in the region.

This document describes the economic impacts of the Plan, which includes the Red Line in Marion County (from county line to county line), the Blue Line, the Purple Line, and the increase in local bus service. It is assumed that the first year of service will be 2022.

The project team analyzed the impacts of the Plan through 2040, and then compared then against the existing status quo in order to estimate benefits.¹ The status quo scenario assumes that the existing bus service is provided through 2040.² All values provided in this report are shown in 2016 dollars.

1.1 Is the Plan a Good Investment?

Yes.

The Plan has a projected benefit-cost ratio of 1.13. Any project with a benefit-cost ratio over 1.0 is considered to be a good investment.

1.2 Will the Plan Support Economic Growth?

Yes.

Indy Connect is expected to create jobs, increase the gross regional product, attract commercial real estate development, and increase residential property values.

Table 1: Summary of Economic Impacts through 2040

Benefit	
New temporary jobs	430
New permanent jobs	1,153
Increase in Gross Regional Product (millions)	\$1,736
New real estate development (square feet)	3,998,000
Potential increase in residential property values	\$41 to \$541 million

¹ The 20-year analysis time period is consistent with standard practices in economic analysis.

² Benefits are calculated as the impact of the Plan scenario minus the impacts of a baseline scenario. Therefore the definition of the baseline scenario is important. For example, if the baseline scenario was defined as a cut in existing bus service, all of the benefits of the Plan provided in this document would increase.

2 Introduction and Global Assumptions

The Indianapolis Metropolitan Planning Organization (Indy MPO), in conjunction with IndyGo and CIRTAs are collaborating on the Indy Connect Central Indiana Regional Transit Initiative. This initiative aims to increase the level of bus service in Marion County by 70 percent, while simultaneously creating 3 bus rapid transit (BRT routes) (Red Line, Blue Line and Purple Line) in order to meet the increased demand for frequent, reliable and safe transit in the region.

Generally speaking, the increased service and additional lines will provide the following:

- Increased accessibility to areas not currently served during certain times of the day;
- Connect people with jobs;
- Provide better service to the transit dependent;
- Improve overall transportation in the County by better linking different transportation options;
- Increase capacity and connectivity of the transit system;
- Connect people with major recreational destinations and regional attractions;
- Improve regional connectivity; and
- Support the vision established in the region's long range transportation plan.

The remainder of this document presents the results of a detailed assessment of the economic impacts of Indy Connect. The analysis is consistent with the guidance provided in the FHWA's *Economic Analysis Primer*.³

The analysis focuses on the impacts in Marion County, and addresses the following elements: the Red Line in Marion County (from county line to county line), the Blue Line, the Purple Line, and the increase in local bus service. It is assumed that the first full year of operation will be 2022, and that initial construction costs will be \$438.5 million.

The impacts were assumed to end in 2040 and are compared against a baseline scenario in order to estimate the incremental increase in benefits and impacts. The 2040 timeframe is consistent with industry best practice, which is to consider a 20 year time frame. All ridership figures were provided by IndyGO. And all values provided in this document are reported as 2016 dollars.

3 Literature Review

This section presents the results of a literature review related to assessing the benefits of providing public transportation services. Special attention is given to medium-sized systems and impacts of bus rapid transit (BRT), as these are most similar to the IndyGO transit system and the proposed expansion.

³ FHWA, *Economic Analysis Primer*, September 2003.
http://www.webpages.uidaho.edu/~mlowry/Teaching/EngineeringEconomy/Supplemental/USDOT_Economic_Analysis_Primer.pdf

3.1 Overview

Public infrastructure, in general, provides a foundation for economic activity. The location and level of public investments can enhance individual opportunities and broader community vitality. Beyond potential social and economic benefits, there are also funding and regulatory considerations to balance and efficiently allocate public investment.

One factor that drives the need for the efficient allocation of public infrastructure funding is the unmatched demand for public transportation. According to data compiled by the American Public Transportation Association (APTA), Americans took a record 10.8 billion trips on public transportation in 2014, the highest ridership in 58 years; this reflects a 39 percent increase in transit ridership between 1995 and 2014, which is almost double the rate of population growth (21 percent).⁴ As APTA President and CEO Michael Melaniphy stated, “people are changing their travel behavior and want more travel options.” He cited expanding transportation options beyond traditional bus and personal vehicles and noted that “expanded and improved public transit services also played a role in attracting more riders” and that “since nearly 60 percent of the trips taken on public transportation are for work commutes, public transportation increases are seen in areas where the economy is growing.”⁵

Another factor is the increased focus on delivering safe and reliable transportation services and the resulting regulatory requirements for agencies receiving federal funds. Safe, reliable and cost-effective public transportation is important for all citizens across the nation, not just for those who live in large urban areas with the greatest transit demand. In fact, the Moving Ahead for Progress in the 21st Century Act (MAP-21) safety rulemaking applied to all recipients of federal financial assistance under 49 U.S.C. Chapter 53, regardless of agency size and demand/ ridership. Therefore, safety and reliability aspects of transportation have increasingly been drawing public attention.

To efficiently allocate public transportation funding, it is necessary to assess the social, economic, and environmental costs and benefits of these investments on different industries and segments of the population. Traditionally, research focuses on the following three benefit categories:

- **Travel Time/Congestion Impacts** – Benefits resulting from a reduction in vehicle ownership and operating cost (VOC), travel time, accidents, and environmental emissions due to less congestion and fewer vehicle miles traveled.
- **Access Impacts** – Benefits of providing low-cost mobility to “transit-dependent” as well as “choice” riders.⁶ They include: (i) income from employment, which is made at a minimum more convenient by transit; (ii) the economic value of access to services, such as healthcare, education, shopping, and attractions; and (iii) budget savings for welfare and social services due to the presence of transit.

⁴ http://www.apta.com/mediacenter/pressreleases/2015/Pages/150309_Ridership.aspx

⁵ Ibid.

⁶ “Transit-dependent” riders are people who either cannot drive due to age, physical condition, or other factors, do not have access to an automobile, or cannot afford to use one. “Choice” riders are people who have access to an automobile but elect to use transit instead.

- **Community Development Benefits** – Proximity to rail transit can have a positive effect on residential property and commercial values due to the increased availability of travel opportunities and ease of accessing activity centers by transit.

Some studies measure the different benefits listed in all three categories, while others focus on one or a few of the benefits within a category. Different types of benefits require different evaluation methods. Some benefits are relatively difficult to measure. As a result of relying on the benefit estimates, conventional planning practices may undervalue public transit by considering just a portion of total potential benefits. The following review reorganizes the previously defined benefits into broader terms to address the need for analysis that recognizes wider social and economic impacts of transportation services.

3.2 Transportation Benefits

From federal government agencies to local community organizations, many institutions conduct transit benefit studies to assess and justify potential investments. A number of the studies highlight the benefits of low-cost mobility and congestion management effects that enable people to move from welfare to work. The following sections outline research on the low-cost mobility and other social benefits of transit.

3.2.1 Transportation Cost Savings

The Economic Impact of Public Transportation Investment (EDGR 2014) quantified the benefits of public transit nationwide. Benefits include reduced energy consumption and air pollution associated with lower motor vehicle use, budgetary savings from not having to add more highway capacity, low-cost mobility to access jobs, and thus reduced welfare and unemployment rolls. The report estimates that annual transit benefits outpace costs with \$5.4 billion per year in reduced vehicle ownership costs.

3.2.2 Impacts on the Environment

Public transportation helps to promote cleaner air by reducing automobile use, which can in turn reduce smog and public health problems. According to the U.S. Environmental Protection Agency (EPA), asthma attacks lead to 2 million emergency room visits and 5,000 deaths per year in the U.S. Asthma account for more than 14 million missed school days. In terms of related healthcare costs and lost productivity, asthma costs are estimated to be \$14 billion annually.⁷

For each mile traveled, fewer pollutants are emitted by transit vehicles than by a single-passenger automobile. On average, buses emit 80 percent less carbon monoxide than cars. According to the Sierra Club (2001), seven of the twelve cities with the highest grades for low car and truck smog per person (New York, Chicago, Los Angeles, San Diego, San Francisco, Sacramento and Washington, D.C.) are located in states that spend the most on clean transportation choices.

Litman (2011) stated that even though a variety of strategies are utilized to reduce congestion or vehicle miles on roads, the full benefits can be undervalued if analysis only focuses on a few categories. He argued that a more comprehensive approach could

⁷ U.S. Environmental Protection Agency, *Asthma and Indoor Environments: About Asthma*, 2006.

lead to greater benefits. His paper provides a guide to standardizing comprehensive impact assessments of transportation planning, including the effects on energy conservation.

3.2.3 Energy Conservation

Public transportation can significantly reduce dependency on fuel and energy. In fact, an average of 26 gallons of gasoline was “wasted” per traveler in 2005 due to congestion (TTI, 2007). Many U.S. transit systems are investing in environmentally safer alternatives such as compressed natural gas, low-sulfur burning buses or diesel- electric hybrid buses.

A study by Shapiro, Hassett and Arnold (2002) focused on the environmental and resource management side of transit sector investments. They asserted that the role of transportation in our nation’s energy consumption and environmental quality is immense. Their study estimated that public transportation is nearly twice as energy-efficient as private automobiles, with 2,514 British thermal unit of energy saved on each passenger mile traveled on public transportation.

3.2.4 Travel Time, Cost and Convenience Benefits

Public transportation also helps to alleviate our nation’s crowded roadways by providing transportation choices. Without these choices, in areas with populations over one million, there would be an additional 493 million hours of delays if travelers used their personal vehicles instead (TTI, 2007). The average urban traveler spent 38 hours stuck in traffic in 2005, an increase from 14 hours in 1982. Half the drivers spent the same amount of time stuck in traffic as they did on vacation. The negative impacts that congestion has on quality of life will likely to grow if transportation demand is kept unmet.

There are quantitative benefits associated with travel time, costs and convenience to several groups when investments are made in public transportation. These groups consist of new transit users, existing transit users and non-transit users (Littman, 2015). The benefits to each are listed below:

- New Transit Users
 - Decrease in time traveled as transit allows the user to reach destination quicker
 - Decrease in costs due to fewer vehicle trips (fuel, oil, and tire changes)
- Existing Transit Users
 - Improved convenience and time savings from improved operating efficiency
 - Improved security and comfort from additional persons waiting at stops
- Non-Transit Users
 - Added value of having an additional option of travel
 - Travel time savings due to less traffic on road
 - Increased road safety due to less accidents as there is less congestion

The study found that 78 percent of transit riders experience cost savings, while 43 percent experience time savings and 82 percent find the experience more convenient.

3.2.5 Access Impacts

A 2014 report prepared for the American Public Transportation Association, Economic Development Research Group, Inc. (EDRG, 2014) identifies a range of benefits associated with public transportation. These benefits include increases in mobility and access as reportedly 22 percent of transit riders surveyed would not be able to make their trip without public transportation access and only 3.2 percent of surveyed riders would have used an alternative mode of transit.

The foregone trips can have significant social impacts. Public transportation provides access to jobs, health care, education, and other social services. It is a vital link for populations with limited mobility- seniors, the disabled and children. Additionally, it provides a choice of travel modes, economic opportunities, and savings for social services programs. However, most of the studies provide qualitative arguments rather than quantitative results.

Access to Healthcare

Local community organizations publicize the transportation needs of lower-income segments of the population. For instance, a study led by the Transportation and Land Use Coalition (2002) documents the poor state of the public transportation system in Southern California and the need for immediate action. The TLUC study, *Roadblocks to Health: Transportation Barriers to Healthy Communities*, drew attention to the socio-economic problems of inadequate public transportation services for low-income communities. The TLUC report demonstrated that the Bay Area's most disadvantaged communities face significant transportation barriers to activities. In low-income communities, where car-ownership rates are low, inadequate public transportation limits access to job centers, hospitals, supermarkets, and recreational parks.

The aging of the population is another issue to consider. For example, a report published in 2002 the American Public Transportation Association and the Public Transportation Partnership for Tomorrow emphasizes that as people age, isolation becomes a growing problem, and access and mobility become increasingly critical needs. Kleffman (2002) also argues that for some residents without cars, access to healthcare and healthful food could be a frustrating, and time-consuming experience.

According to a study conducted by the Victoria Transport Policy Institute (Littman, 2015), there are additional health benefits associated with public transportation. It is noted that on average, users of public transportation are more active than those who do not use public transportation. It is also noted that this is due to the fact that often times there is walking or biking as part of the public transportation link. This has health benefits which, in turn, may lead to lower healthcare costs.

3.2.6 Access to Education

About 12 percent of public transportation users are en-route to schools of various types (APTA, 2007). Across the country, "Unlimited Access" transit pass programs at many universities provide free, system-wide transportation service to college students, faculty and staff, by expanding access, reducing auto-related expenditures, and thus saving universities millions of dollars according to APTA. Examples from the APTA report include:

- Salt Lake City's University TRAX serves 46,000 students and faculty;
- Duluth, MN's UPASS program provides student access to the Duluth Transit Authority;
- The Milwaukee County Transit System's UPASS program includes four schools; during the first two years of the program, the percent of students traveling by transit to the University of Wisconsin-Milwaukee doubled; and
- The Worcester Regional Transit Authority connects 26 training facilities and two General Educational Development (GED) test centers, as well as 26 major employers and 24 child-care facilities.

3.2.7 Welfare Recipients

Public transportation allows welfare recipients access to jobs. An estimated 94 percent of welfare recipients attempting to move into the workforce do not own cars and rely on public transportation. In 2002, the \$75 million federal Job Access and Reverse Commute (JARC) initiative provided grants to transit service providers to help low-income residents get to work where existing transit was unavailable, inappropriate, or insufficient.⁸ JARC and other programs have impacted the lives of thousands of welfare recipients and low-income families.

3.3 Residential Property Value Impacts

Public transportation provides opportunity, access, choice, and freedom, all of which contribute to improved quality of life. For transit riders, transit access can translate to significant household spending savings. American families spend about 18 percent of household spending on transportation, making it the second largest household expenditure after housing.⁹ Public transportation can significantly reduce the amount of money a family spends getting to work, school and other activities. The high cost of driving, insuring and parking a car results in a reduction in individual economic opportunities.

Limitation to transportation services can restrict access to employment and recreational opportunities. This is because public transportation provides an affordable and, for many, necessary alternative to driving. According to APTA (2005), it is estimated that a sustained program of transit capital investment would generate an increase of \$800,000 in personal income for each \$10 million in the first year. After 20 years, these benefits would increase to \$18 million in personal income.¹⁰ The impact that transportation has on household income is crucial in driving people's quality of life when having to choose between work and play.

Moreover, transit connects economic and social activities to help create and sustain neighborhood centers so that non-users also benefit. Specifically, public transportation

⁸ Surface Transportation Policy Partnership, *Transportation and Jobs*, http://transact.org/wp-content/uploads/2014/04/Transportation_And_Jobs-Factsheet.pdf

⁹ U.S. Department of Labor, Bureau of Labor Statistics, *2006 Consumer Expenditure Survey*.

¹⁰ American Public Transportation Association, *News Releases*, "«We Make Communities Go» Campaign To Highlight Transit's Benefits To National And Local Economies," February 17, 2005.

fuels local development by connecting people and driving social and economic interactions. As a result, the benefits of transportation services are often found to be capitalized in property values of those near transit access. A number of studies have shown increases in the value of properties located near public transportation systems than in similar properties not located near public transportation (Smith and Gihring, 2016).

3.3.1 Land Use Policies and Property Values

Land use and transportation are inter-related. Land uses affect transportation through the placement of activities that people want to access. Changes in the location, type, and density of land uses change people's travel decisions. This dependency in turn, changes transportation patterns. On the other hand, transportation affects land uses by providing a means of moving goods and people from one place to another. Changes in transportation networks make some places more accessible and therefore, more attractive to for development.

The connection of land use and transportation is through concepts of accessibility and mobility. Accessibility refers to the number of opportunities, also called activity sites, available within a certain distance from origination or travel time to the destination. Improvements in transportation enhance mobility- enabling people to travel longer distances in the same amount of time, which has resulted in the growing segregation of activity sites, especially those between home and work.¹¹ The value of land therefore is dependent on the transportation network providing access to it.

Beyond driving land use patterns, transportation is found to directly impact property values. Transit in particular is found to enhance accumulation of social capital (increase in productivity due to enhanced intellectual exchanges in more livable communities) and various features of neighborhood form such as retail establishments, entertainment services, and public infrastructure and services, are indirectly attributable to transit development.

Research has shown that transit effects on property values can vary widely depending on property type, transit type, and neighborhood attributes. Comparability among studies is complicated because analysts have applied different statistical models, data structures, specifications of transit proximity, explanatory variables, and study/ time-periods (Duncan, 2008; and Mohammad et al., 2013). Most studies apply conventional hedonic pricing methods to estimate a premium for proximity to transit (Smith and Gihring, 2016).

For rail transit, many studies indicated that premiums are found within one-quarter mile to one-half mile of a station. In addition, commercial properties appear to have higher price premiums in short distances from transit as compared to residential properties (Cervero and Duncan 2001; Debrezion et al. 2007). At the same time, some researchers found that proximity to transit has no appreciable price effect, or a negative effect, due to nuisance (Goetz et al. 2010; Hess and Almeida 2007).

¹¹ <https://www4.uwm.edu/cuts/ce940/primer1.pdf>

3.3.2 Agglomeration Impacts

Another impact measured in the literature includes agglomeration effects (TCRP, 2012). Agglomeration is the productivity increases that are associated with employment density created by transit improvements. The Transit Cooperative Research Program (TCRP) (2012) found that transit capacity was associated with increases in central city employment density and population increases. Employment density and population growth were found to be correlated with increases in employee productivity in a second stage of analysis. Specifically, they found that for every one percent increase in track mileage, there was a 0.04 percent net increase in productivity region-wide.

3.4 Economic Impacts of Transit

Spending local resources on public transit can impact the local economy. It has been estimated that for every \$1.00 spent on public transit, there is a \$4.00 return to the community (HNTB, 2015). Dollars spent on public transit may entail construction of facilities, purchasing of goods and services as well as hiring of new employees. These spending impacts can be broken up into short term construction and long term economic impact benefits.

3.4.1 Short-term impacts

The construction activities associated with the transit investment will lead to construction jobs as well as purchases on goods and services needed for construction such as materials and equipment. The construction and capital expenditures will lead to direct, indirect and induced impacts.

3.4.2 Long-term impacts

In addition to the short term construction impacts described above, a transit agency purchases local goods and services as well as provides its employees with wages which they can then spend on additional goods and services. The spending on operations and maintenance will allow for direct, indirect and induced impacts as long as these expenditures continue on in the future.

Direct impacts come directly from the spending associated with transit. Indirect impacts come from the goods and services purchased by suppliers to these industries. Induced impacts relate to the spending of labor income by employees of the directly and indirectly affected firms. In an economic impact analysis (EIA) these impacts are referred to as “multiplier” effects, as they can make the total impacts much larger than the direct effect alone.

A 2013 National Center for Transit Research project created a tool for assessing the economic impacts of spending on public transit using test data from Central Florida. The tool relies on data from the National Transit Database, including the average annual capital and operating and maintenance expenditures for each agency as well as the distribution of total spending by source of funds, to assess how much of the local economy is supported by the annual transit spending in the community. Qualitative results of the study show that expenditure impacts vary by source and use of funds. Only funds from sources inside the study area that were spent outside the study area had

negative impacts, all other funds – both inside and outside sources – resulted in either neutral or positive economic impacts. This indicates that funding spent on transit supports the local community.

A study completed in 2012 (Morris, 2012) measured the associated spending impacts of the Indy Connect transit plan. This study employed the use of the IMPLAN economic modeling software developed by MIG, Inc. IMPLAN is an input-output (I-O) based regional economic impact assessment tool. An I-O model is essentially an accounting table that traces the linkages of inter-industry purchases (inputs) and sales (outputs) within a given area. IMPLAN is a useful tool that is often the modeling software of choice when undertaking an EIA to measure impacts of transit related projects.

3.5 Bus Rapid Transit (BRT)

Bus Rapid Transit, or BRT, is a relatively new type of fixed-transit system in the United States, though it is quickly gaining popularity. The fixed-guideway system provides the confidence of perceived permanence of service at a fraction of the cost of light-rail transit (LRT). BRT systems are flexible and can be built more economically and incrementally than LRT and other systems, making them a cost-effective way to provide high-quality mass transit services (Deng and Nelson, 2010). BRT systems have comparable capacity to LRT (Deng and Nelson, 2010), and may be considered substitutes. Typical characteristics of a BRT system may include: unique buses, clearly defined stops and stations, variety of right-of-way, pre-board fare collection, information technology, frequent service, and brand identity (NITC, 2015).

While the literature and analytical evidence related to BRT are still somewhat sparse, evidence from existing studies at least partially validates the hypothesis that in the right circumstances, BRT impacts can be similar to light-rail impacts.

3.5.1 Transportation Benefits

Most of the research on access-related outcomes was conducted on fixed-route bus service, as discussed earlier in this literature review. While BRT is a subset of fixed-route bus service, the impacts associated with the fixed-guideway service may be different. The primary research on accessibility impacts was conducted by Faulk and Hicks (2009), with their investigation of public transit impacts on economic outcomes in small to medium Midwest cities. They determined the relationship between public transit and key labor market variables, including measures of socio-economic well-being and economic development in counties with small cities, including the role of public transit on influencing transfer payments and worker outcomes. This study found that relative to counties without bus transit, those with the services have lower unemployment rates, lower growth in the value of family assistance payments, lower growth in per-capita food stamp payments (\$1.50 to \$2.00 less per capita), and higher population and employment growth. They also noted that high commuting costs and unreliable transit systems may affect employment levels, punctuality, and unemployment spells for transit-dependent workers (Faulk and Hicks, 2009). These impacts may be offset by the improved reliability of BRT systems, though this has not been studied.

A further study by Hicks, Faulk and Kroll (2013) calculated the economic benefits of fixed-route bus systems in Indiana. Again, this study was focused on general fixed-route

bus service and not specifically on BRT. For this study, the authors calculated four general categories of benefits:

- Public costs deferred or reduced through the presence of the fixed-route bus system (construction of parking, demand-response transportation, social services);
- Miscellaneous private costs reduced due to the fixed-route bus system (vehicle operating costs, congestion, pollution);
- Private sector benefits of the system (employee turnover); and
- Federal, state and local tax revenues (sales tax, income taxes) due to the system.

The authors calculated benefits for riders, non-riders and the government. Rider benefits include direct use, indirect income, consumption, and public services due to the presence of the system. Non-rider benefits include reduced congestion, reduced pollution and reduced highway infrastructure damages. The local, state and federal governments benefit from added tax revenues and reduced costs in health care or social services due to the bus service. All told, the benefits of public transit account for an average of \$16.3 million per year for Indiana. This generates a total of more than \$3 in total benefits for every dollar invested in the system. The authors note that employee turnover is significantly lower in counties with a bus system, as users without vehicles can access their employment opportunities.

3.5.2 Economic Development Impacts

One of the benefits of transit systems, particularly fixed-guideway systems, has been an increase in community development and land use in the areas surrounding the stations. Plentiful research has been done on the impacts of light-rail transit on property values and economic development in areas surrounding stations, some of which is presented in the Community Development Benefits section of this report. Similar research for BRT is emerging, though several studies have been undertaken in recent years. The Government Accountability Office (GAO, 2012) studied 20 BRT systems in the United States that have been in place since at least 2005 to assess features and performance of these BRT systems that have been funded by the Federal Transit Administration. During the course of this study, they conducted five case studies to evaluate the effect of BRT on economic development. Overall, the agencies believe that BRT is having a positive effect on development, though they had difficulty isolating whether the development was strictly related to BRT. The outcomes of four of the five case studies that noted development impacts are highlighted in Table 2. The study report notes that economic development potential was a consideration when building the system, but not a primary objective in three of the five locations. Overall, the cities found that the operational flexibility and shorter implementation timelines are advantages for communities seeking to enhance their transit services.

Table 2: BRT Case Study Outcomes

Service	City	Outcomes
Healthline	Cleveland, OH	Noted rail-like economic development with \$4-5 billion in investment; note that much is associated with nearby hospitals and universities.
Franklin EmX	Eugene, OR	\$100 million of construction projects underway near line; includes hotel, office, and community college; difficult to isolate BRT impacts.
Troost MAX	Kansas City, MO	Troost Avenue is better positioned for development, including a \$25 million federal urban reinvestment grant received due to proximity of BRT.
RapidRide A Line	Seattle, WA	Development has been limited with most interest due to the planned light-rail; other BRT corridors in the region are attracting TOD and BRT will connect most of the region's high-growth centers in the near future.

Other research by Deng and Nelson (2010) provides an overview of recent BRT developments across the globe, with a focus on changes in property values and land development. They have noted that property value increases are especially strong when there are a large number of transit-dependent low-income residents using services to access employment. The authors cited several studies, but of particular note was the TransMilenio service in Bogota, Colombia, where after two years of operation, residential rental costs decreased by 6.8 to 9.3 percent for every additional 5-minutes of walking time to a BRT station. This is driven by the fact that reducing commuting time is a major consideration for households and businesses when selecting their locations, so competitive markets are expected to command higher real estate premiums.

Overall, the evidence for the impact of BRT on land development has been largely unexplored and may be relatively limited compared to other mass transit systems. The predominant hypothesis in the literature is that a more permanent-seeming a bus system translates to greater certainty of the return on investment, which in turn means that the more likely the outcomes will be similar to light-rail transit (Deng and Nelson, 2010). There is a growing body of evidence that BRT can successfully promote higher-density land use. A 2015 analysis by the National Institute for Transportation and Communities (NITC, 2015) noted that since the economic recession, transit corridors with BRT have increased new office space by one-third, from 11.4 percent to 15.2 percent of land use within the study area. They also noted that the share of multi-family construction within 0.5 miles of BRT is small but growing, having more than doubled during the economic recovery. BRT systems may be better at supporting developments that are often priced out of rail station areas, including small-scale retail and residential, affordable housing, and medical facilities (GAO, 2012). Often, transit agencies do not own large amounts of land surrounding the BRT stations, which may impact development; however, BRT systems may contribute to development along their corridors simply by providing better connections to major employment centers (GAO, 2012).

Empirical evidence to date has noted several factors that will influence economic development surrounding BRT systems. Circumstantial evidence shows that more technologically advanced BRT systems contribute to positive economic development outcomes (NITC, 2015). Many planners believe that BRT systems will have positive impacts, particularly when operating on dedicated busway (Deng and Nelson, 2010). Finally, the 2012 GAO study noted several factors that will enhance BRT related economic development similar to rail transit. These include:

- Physical features that convey a sense of permanence for developers;
- Proximity to major institutions, employment, or activity centers that may drive ridership and connect employment and activity centers, increasing opportunity; and
- Transit supportive local policies and development incentives.

3.5.3 Business Attraction and Retention

Two of the studies reviewed examined the influence of BRT systems on economic development prospects of firms and industry mix in the surrounding areas. The NITC study (2015) conducted a shift-share analysis¹² of jobs based on wage generation before and after the great recession. This study shows that during the recovery, BRT stations saw larger changes compared to counter-factual locations without BRT systems for all jobs. The BRT station areas had the largest positive shift in the share of upper-wage jobs during the recovery while the share of lower-wage jobs in BRT station areas fell relative to the outside areas in the same county (NITC, 2015). This may indicate a shift in the type of industries locating along the BRT corridors. The study also found that BRT positively influences employment in the manufacturing sector, which may provide opportunity to attract small manufacturing industries along the corridor. The research also found evidence that office-rents had a slight premium of \$1.57 to \$4.85 per square foot within 0.5 miles of BRT for most of the metro areas studied, which is about 14 to 31 percent of the mean office-rent. This may indicate an increased attractiveness for office space in close proximity to transit.

The second study was a case study of the extent of the link between BRT, job growth, and station proximity for the Eugene-Springfield EmX BRT in Oregon (Nelson et al, 2013). The EmX BRT system was opened in 2007. The study looked at jobs by proximity to the BRT in 2004 and 2010, representing 3 years before and after the implementation of service. Eugene opted to construct a BRT system rather than a light-rail, as it was deemed the best option for service level and price given the relatively small size of the metropolitan area. The authors evaluated employment change within 0.25 and 0.5 miles of BRT stations using both descriptive statistics and shift-share analysis, generating employment sheds based on census blocks. They evaluated jobs at the 2-digit level North American Industrial Classification System (NAICS). Overall, the authors found that jobs decreased by about 5 percent outside of the 0.5 mile buffer of the station area. Within 0.25 and 0.5 miles, the jobs stayed about the same and within 0.25 miles of the station, jobs increased by approximately 10 percent. The job increases were primarily in the information, professional, education, health-care and lodging sectors, according to

¹² A shift-share analysis is a standard regional analysis method that determines what portion of regional economic changes are due to national trends and how much is due to unique local or regional factors.

the descriptive statistics. The shift-share analysis found that jobs in a number of sectors, including construction, manufacturing, and wholesale trade, were displaced by other sectors, such as retail trade, finance and insurance that are trying to locate close to the BRT areas (Nelson et al, 2013). They found that manufacturing jobs were relatively displaced compared to jobs in other industries, which is contradictory to the findings of the NITC study. This difference may reflect overall differences in industry mix or demographics between the specific case study and the larger set of BRT systems. This may also be due to time horizon, as the Nelson study did not isolate the impacts of the economic recession.

Overall, research on economic development impacts of BRT systems is still relatively lacking, largely due to the relative newness of the systems. The limited results have shown that the more similar a BRT system is to a light-rail system, in terms of perceived permanence and amenities, the greater the likelihood of similar economic development impacts. This is not universal, and supportive land-use policies and community environment will also contribute to the economic success of these BRT systems.

4 Transportation Benefits

Transportation benefits represent the overall social well-being generated by the total investment in building, maintaining and operating the improved transportation service. They include the following:

- **Regional Mobility Benefits**
 - **Travel Time Savings:** The most prominent component of traffic congestion costs is the delay associated with circuitous travel paths that add to travel length and travel time, high levels of roadway congestion, start-and-stop traffic flows, and in extreme cases, gridlock. These delays represent an opportunity cost of time – time that could be spent both at work and for leisure. Travel time includes access time, waiting time, in-vehicle time, transfer time as well as egress time.
 - **Vehicle Operation Cost Savings:** Traffic congestion leads to higher vehicle operating costs, primarily as a result of increased fuel use due to idling or start-and-stop traffic flows, both of which consume more fuel than driving at steady speeds.
- **Sustainability and Safety Benefits**
 - **Safety Improvements:** Vehicle crashes embody major societal costs. They impose costs not only on people who are involved, but also on the rest of the traffic on that and adjoining roadways.
 - **Reduced Environment Impacts:** A major impact of vehicle use is exhaust emissions – an externality that imposes wide-ranging social costs on people and the environment. 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 pollution is released.

- Access Impacts
 - **Affordable Mobility Benefits:** Improved transportation access allows those who cannot afford a personal vehicle to reach destinations that would otherwise be unreachable.
 - **Cross-Sector Benefits:** Transit investments may improve overall access to educational facilities, employment centers, healthcare facilities, etc. This category represents the budget savings generated from home care, medical institutionalization and welfare.

In addition, the reduction in congestion associated with transit investments results in less pavement wear and tear and therefore pavement cost savings. Those benefits are relatively small however.

4.1 Methodology

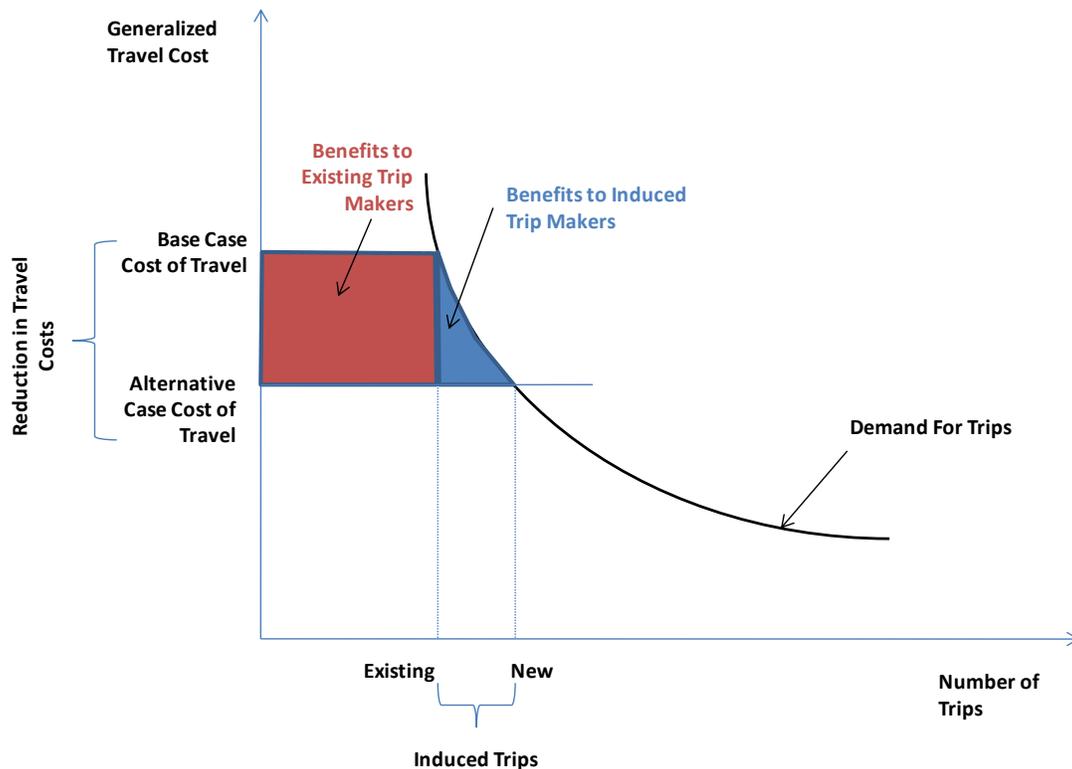
Public transit can enhance economic competitiveness by improving mobility within the service area as a result of reductions in generalized travel costs. In estimating transportation cost savings, impacts to a variety of roadway users (automobile drivers, transit riders, taxi riders, bicyclists, and pedestrians) are considered. The framework we use to estimate user benefits is based upon the theory of demand.

Demand for travel is composed of the number of trips taken and the associated willingness-to-pay or cost for each trip. Holding everything else constant, the greater the number of trips taken, the lower the cost associated with each trip. Figure 1 illustrates this concept. Benefits to existing trip-makers are represented by the red rectangle under the travel demand curve in the figure. They are estimated as the difference between the generalized cost of travel in the No-Build case and the Build scenario, times the number of existing trips.

In addition, as the generalized cost of travel is reduced, additional trips (beyond those diverted from other modes) are expected. These induced trip-makers represent a portion of all potential trip-makers who did not make a trip (or as many trips) in the No-Build scenario, but are now “attracted” to the lower generalized cost allowed by the new service.

User benefits resulting from new trips are depicted by the blue triangle in Figure 1. They are estimated using the “rule-of-a-half”, which halves the change in cost times the change in the number of trips taken. This is represented by the area in the triangle under the demand curve. The change in generalized cost from the No-Build scenario to the Build scenario only represents the change in user costs (travel time plus out-of-pocket costs). Social costs, including air emissions, accident occurrences, and congestion externalities are assumed to not affect trip making or modal decisions in the analysis of generalized travel costs.

Figure 1: Framework for the Estimation of User Benefits



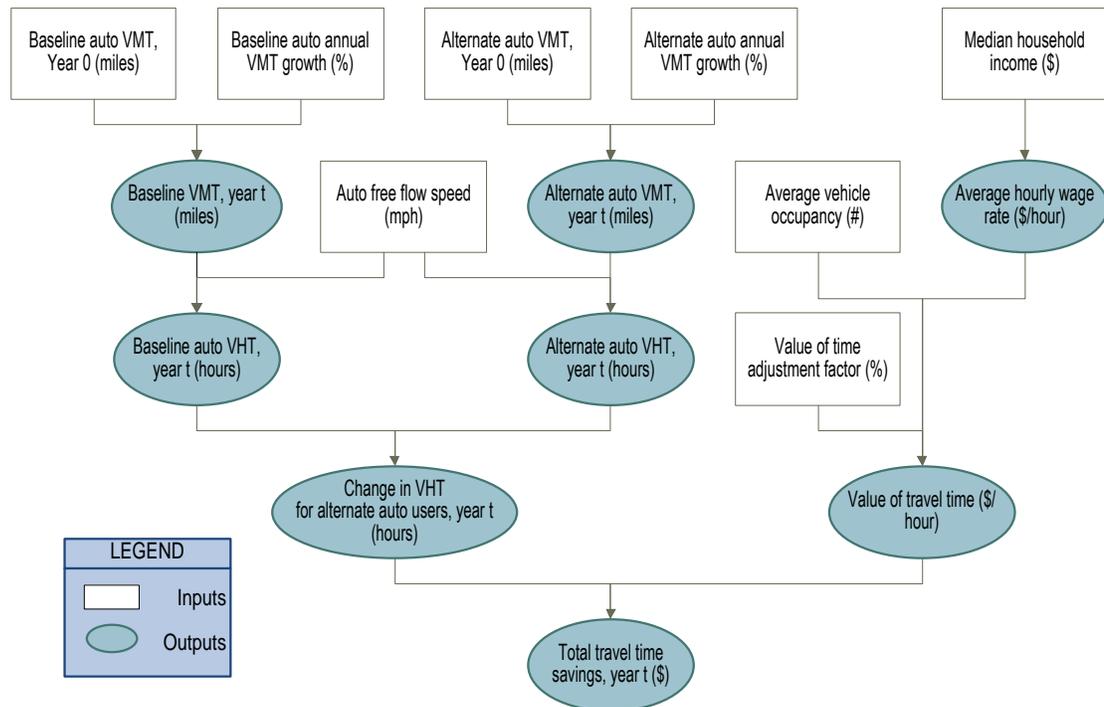
Using the framework presented above, we estimated generalized travel cost savings for:

- Automobile users diverting to BRT;
- Remaining automobile users;
- Bus riders diverting to BRT; and
- Bicyclists and pedestrians diverting to BRT.

4.1.1 Estimating Travel Time Savings Benefits

Generalized travel costs have two components: travel time costs and out-of-pocket costs. Travel time costs for travelers are dependent on the reduction in time spent traveling (travel time) and travelers' value of time (VOT). Auto users who remain on the roadway network can experience a reduction in travel time as a result of the reduction in congestion that arises as capacity improves and travel routes are optimized. We applied their VOT to each reduction in travel time to estimate the reduction in travel time costs. We used the structure and logic diagram depicting in Figure 2 to estimate travel time savings based on changes in vehicle miles traveled (VMT).

Figure 2: Structure and Logic for Estimating Automobile Travel Time Savings



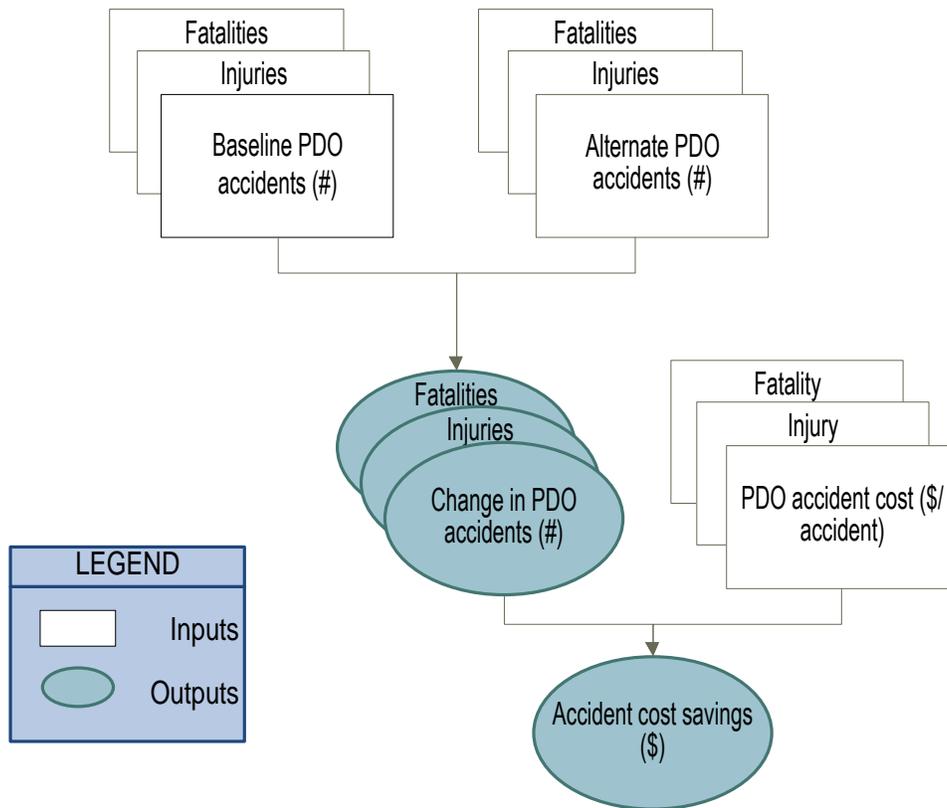
We estimated out-of-pocket costs based on changes in trip costs involved in operating and maintaining autos. The changes will reflect how transit has impacted roadway conditions for drivers. We combined the out-of-pocket costs with parking costs to estimate the total out-of-pocket cost per trip for auto users. The decrease in out-of-pocket costs in the Build scenario represents out-of-pocket cost savings for the remaining auto users. For travelers who divert from other modes to BRT, we estimated out-of-pocket savings based on changes in fare payments (if applicable) and out of vehicle time costs.

4.1.2 Estimating Safety Benefits

BRT can reduce the likelihood of surface transportation-related accidents, as roadway conditions improve with fewer automobiles. Changes in automobile VMT are expected to lead to changes in the probability of accidents on the roadway network. Additionally, if the BRT is operated on exclusive right of way, it will be significantly safer than other transportation modes. Given the alternative of a safer mode of transport along with improved roadway conditions, the number of accidents is expected to decrease, which in turn results in a net societal safety benefit.

Changes in the number of accidents, like other variables, are dependent on the type of transport infrastructure improvement and expansion. The rates for fatal, injury, property damage only (PDO) accidents are combined with VMT estimates. We estimated safety benefits as the difference between the total cost of accidents under the Build scenario and that under the No-Build scenario using changes in VMT. A structure and logic diagram depicting our analytical process is provided in Figure 3.

Figure 3: Structure and Logic for Estimating Accident Cost Savings

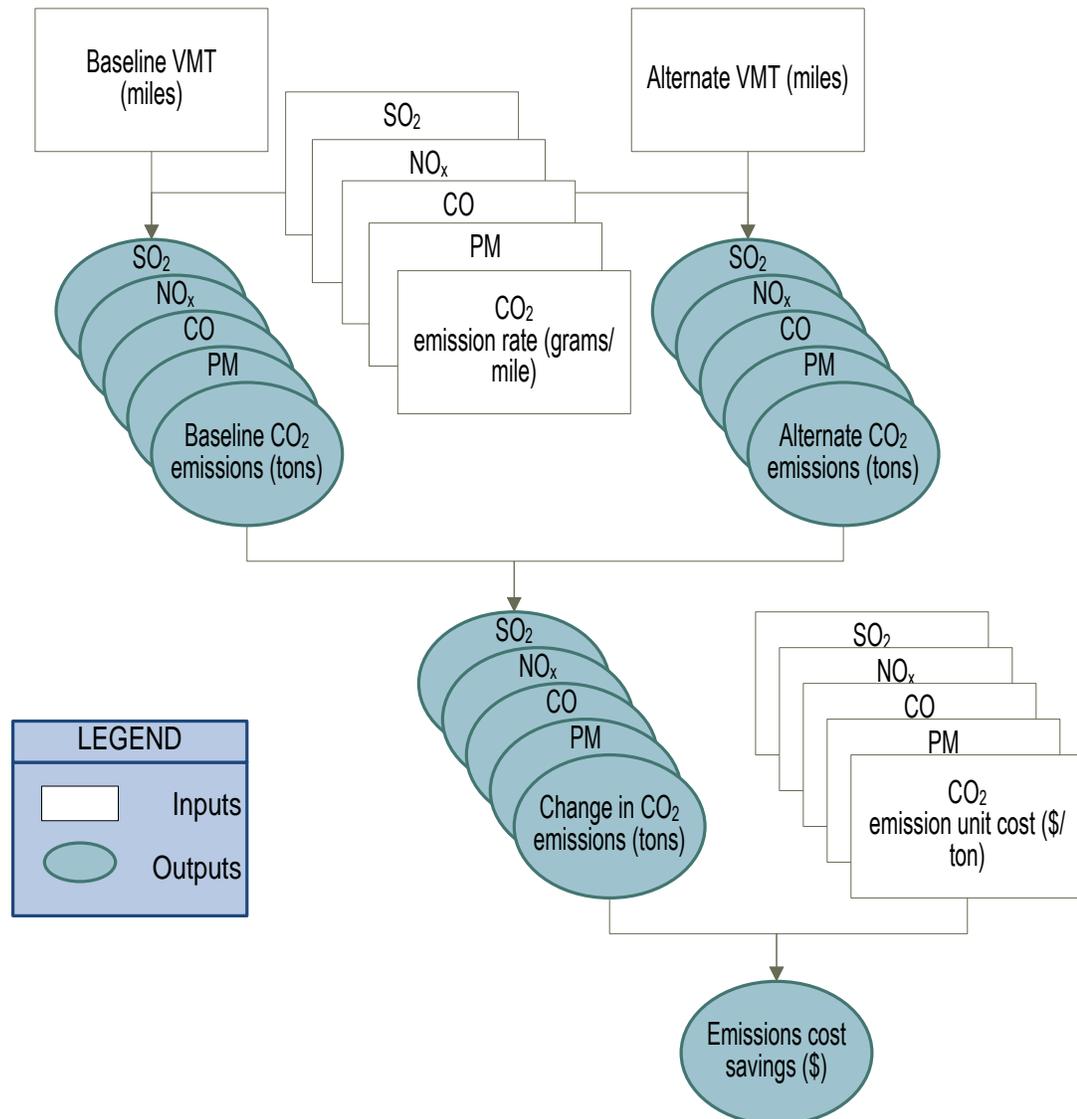


4.1.3 Estimating Environmental Sustainability Benefits

The BRT may generate positive environmental impacts in addition to the roadway impacts by altering motorized vehicle usage and thus changing fossil fuel consumption. For this effort, we considered two types of environmental impacts: reduction in greenhouse gas emissions and reduction in air pollutant emissions. Greenhouse gas emissions are measured in carbon dioxide (CO₂) equivalent and air pollutants include carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂), volatile organic compounds (VOC) and fine particulate matter (PM_{2.5}).

Reductions in emission volumes are dependent upon the fuel efficiency of automobiles on the roadway network. We obtained emission rates specific to the study area from Environmental Protection Agency's (EPA) Motor Vehicle Emission Simulator (MOVES). We then applied per-unit emission to the changes in emission volumes due to changes in roadway conditions. A structure and logic diagram depicting our analytical process is provided in Figure 4.

Figure 4: Structure and Logic for Estimating Emissions Cost Savings



4.1.4 Estimating Affordable Mobility Benefits

The calculation of affordable mobility benefits is based on the conventional consumer surplus theory mentioned above. Economists call the difference between the amount people actually pay for something and the amount they would pay for the next most costly alternative “consumer surplus.” In this particular case, the consumer surplus is the monetary quantity that equates to the economic value of the mobility afforded to people by the availability of public transit. Formally, it can be expressed in the following way:

$$EV = (P_1 - P_0)Q_1 + \frac{1}{2} [(P_1 - P_0)(Q_0 - Q_1)]$$

$$= \frac{1}{2} (Q_0 - Q_1)(P_1 - P_0)$$

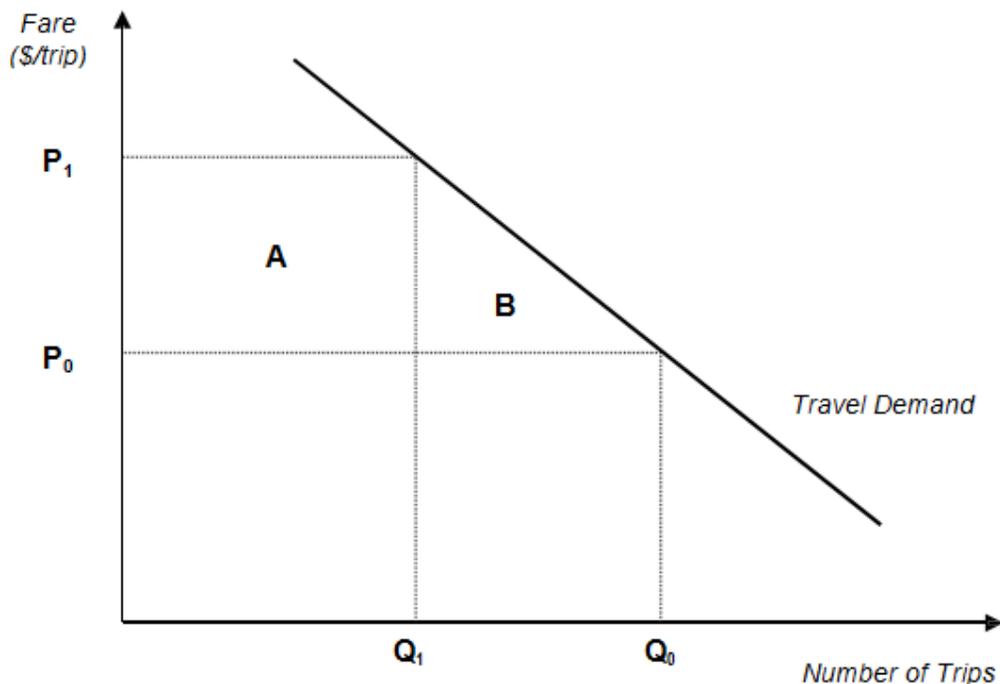
Where:

- EV is the economic value of low-cost mobility;

- P_0 is the average fare paid by transit riders;
- P_1 is the fare that people pay when using other transportation modes (personal vehicle, taxi, etc.);
- Q_0 is the number of passenger trips (ridership); and
- Q_1 is the number of passenger trips when using other transportation modes.

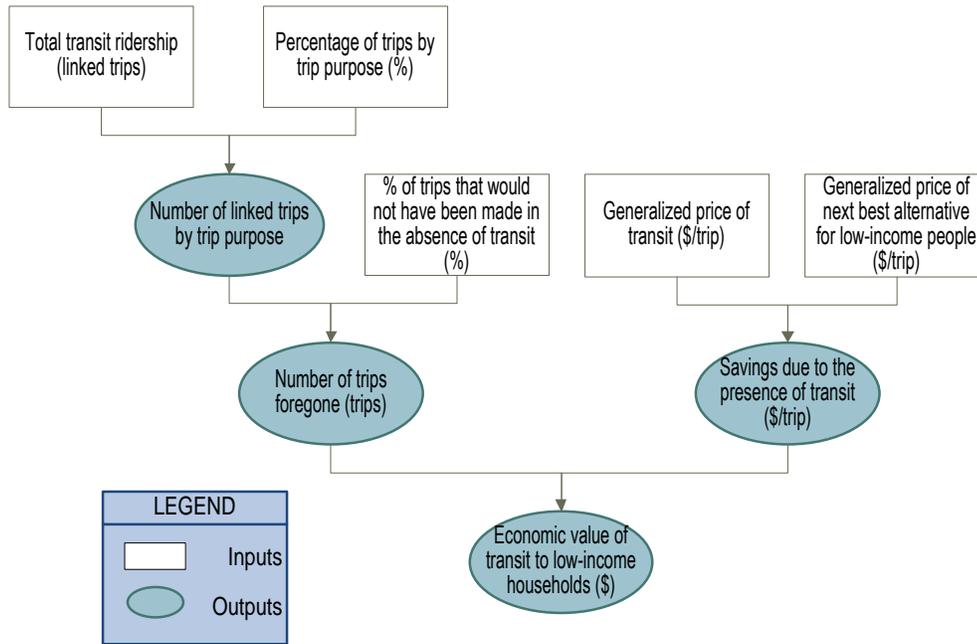
The level of demand for public transit and the price difference between public transit and other transportation modes measure the consumer surplus, or economic value of low-cost mobility. This is illustrated in Figure 5. In the presence of public transit, riders pay P_0 and demand Q_0 number of trips. When public transit is eliminated, transit-dependent (or low-income) riders have no choice but to forego their trips while other riders shift to more costly transportation modes. P_1 is the new fare per trip using other modes and Q_1 is the corresponding trip demand. The difference between P_1 and P_0 is the increase in fare, while the difference between Q_0 and Q_1 is the number of foregone trips. The economic value of low-cost mobility is represented by areas A and B. Rectangle area A represents the benefits accrued to travelers switching to public transit (i.e., out-of-pocket cost savings). Triangle area B represents the benefits accrued to transit-dependent people. Note that, to avoid any double-counting, we only estimated triangle area B as part of affordable mobility benefits calculations.

Figure 5: The Concept of Consumer Surplus



Our complete methodology for estimating affordable mobility benefits is illustrated in Figure 6 below.

Figure 6: Structure and Logic for Estimating Affordable Mobility Benefits

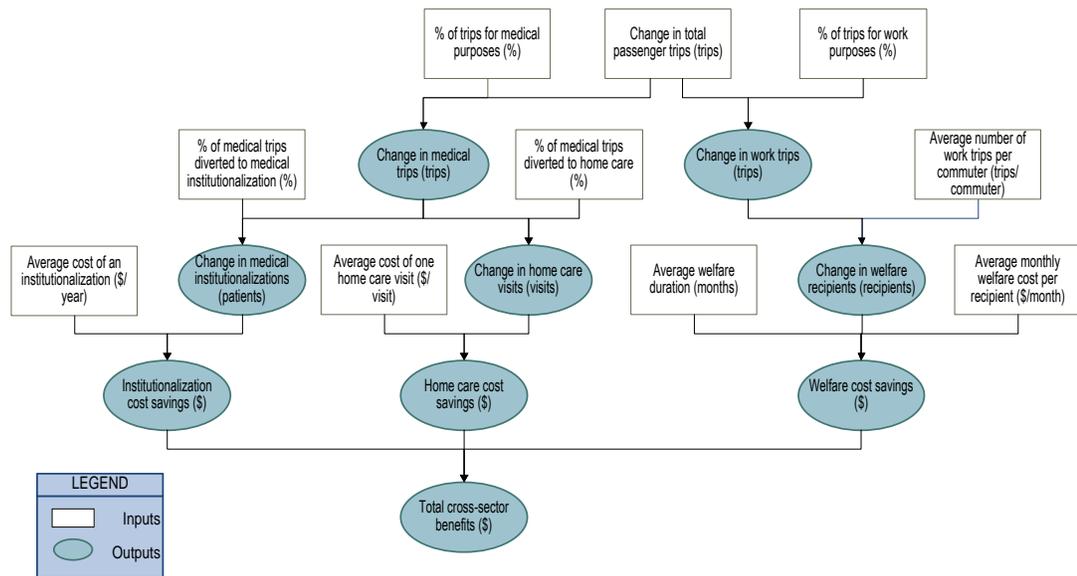


4.1.5 Estimating Cross-Sector Benefits

Cross-sector benefits represent benefits achievable in other sectors of the economy as a result of spending in the public transit sector. In particular, by providing low-cost mobility, public transit can generate home care cost savings (for people on dialysis, for instance), medical institutionalization cost savings (for the elderly or people with disabilities) and welfare cost savings (in particular, for low-income people who rely on public transit to go to work).

Figure 7 below provides a graphical illustration of the methodology we used to estimate cross-sector benefits. The starting point assumes a number of passenger trips forgone in the absence of public transit. We broke these trips down trip purpose. We then used 1) the percentage of lost medical trips leading to home care or medical institutionalization and 2) the average number of work trips per commuter to estimate the number of added home care visits, medical institutionalizations and welfare recipients (or job losses). We multiplied the average cost of a home care visit by the number of added visits to estimate the monetary value of these trips, and multiply the average cost of a medical institutionalization by the number of trips diverted to medical institutionalization to estimate the monetary value of these trips. Likewise, we multiplied the added welfare costs per recipient by the number of welfare recipients and the average welfare duration to estimate the monetary value of lost employment. We then summed the resulting home care cost savings, medical institutionalization cost savings and welfare cost savings in order to estimate total cross-sector benefits.

Figure 7: Structure and Logic for Estimating Cross-Sector Benefits



4.1.6 Estimating Benefit-Cost Ratio

We calculated the benefit-cost ratio by discounting the annual stream of expected transportation benefits and costs using a discount rate of 7 percent, and then comparing the results. This discount rate is consistent with national guidance, and represents the opportunity cost of investing in a project. National guidance also suggests that only transportation benefits be included in the benefit-cost analysis. Therefore, the calculations focused on the benefits presented in this section. Any project with a benefit-cost ratio over 1.0 is considered to be a good investment.

4.2 Results

Transportation benefits are mostly made up of travel time savings, vehicle operating cost savings and cross-sector benefits. The Indy Connect Plan is projected to have almost \$2 billion in transportation benefits through 2040. Table 3 provides a breakdown of these benefits.

Table 3: Transportation Benefits, through 2040 (Millions of 2016 Dollars)

Category	
Travel Time Savings	\$832.72
Vehicle Operating Cost Savings	\$584.96
Cross-Sector Benefits	\$236.78
Safety Benefits	\$228.18
Affordable Mobility Benefits	\$54.04
Environmental Benefits	\$12.71
Pavement Maintenance Savings	\$1.17
Total	\$1,949.57

Based on the annualized stream of benefits and a standard discount rate of 7 percent, the Indy Connect Plan has a benefit-cost ratio of 1.13.

5 Residential Property Value Impacts

Transit services and associated station area development are often expected to enhance network connectivity and community vitality. The social and economic impacts of the investment are found to be capitalized into station area property values. In this section, we report the results of the property value impacts due to the BRT investment.

The findings are based on the current residential housing profile and do not take into account the projections provided in the Economic Development Projections sub-section.

5.1 Methodology

To estimate the property value benefits, we applied a benefit transfer approach where impact values found in other comparable transit systems are applied to property values in the study area. (Details on benefit transfer are provided as an Appendix in Section 10 of this report). To standardize the results from various studies, we weight premium rates based on each system’s ridership and city population. We multiplied property prices by the BRT premium rates to compute lifetime amount of value appreciation due to the proposed project. We assumed that it will take 20 years for all premiums to be realized for any given property (an assumption based on average mortgage term for residential homes). This time period is independent of the analysis horizon. We then computed the

rate at which the premium amount is realized over time using the equation provided below. For our analysis, we assumed that the first ten years of BRT service is a ramp-up period and have choose ramp-up parameters (a and b) for formulation continuity. The formulation represents a gradual realization of premiums.

First Ten Years

$$\begin{aligned} \text{Adjusted Property Price} = & \left[a \times \text{Property Price} \times \frac{\text{BRT Premium Rate}}{b} \right] + \\ & \left[(1 - a) \times \text{Property Price} \times \frac{\text{Transit Premium Rate}}{b} \right. \\ & \left. \times \frac{\text{Years of Service} + 1}{\text{Years of Gradual Realization} + 1} \right] \end{aligned}$$

Additional Years

$$\text{Adjusted Property Price} = \text{Property Price} \times \frac{\text{Transit Premium Rate}}{b}$$

Where:

- $a = 0.3$
- $b = 26.5$

The key input for the benefits analysis is BRT premium rate, or rate of increase in property value due to the nearby BRT, is applied through single value benefit transfer, based on estimates of historic impacts of transit on property values found in the literature and stakeholder interviews. Since there are a number of assumptions involved in the estimation, we took a conservative approach to minimize the uncertainty of the results by developing scenarios for the potential premium rates. The scenario approach recognizes interrelationships between variables and their associated uncertainty when forecasting into the future.

The other inputs include: property number and growth rate, property value and growth rate. They are derived through historic, current, and forecast (or planned) land use and property data for the study area. Data sources include parcel data from Marion and Hamilton counties as well as Moody's Analytics Case-Shiller home price index for the Indianapolis metropolitan area.

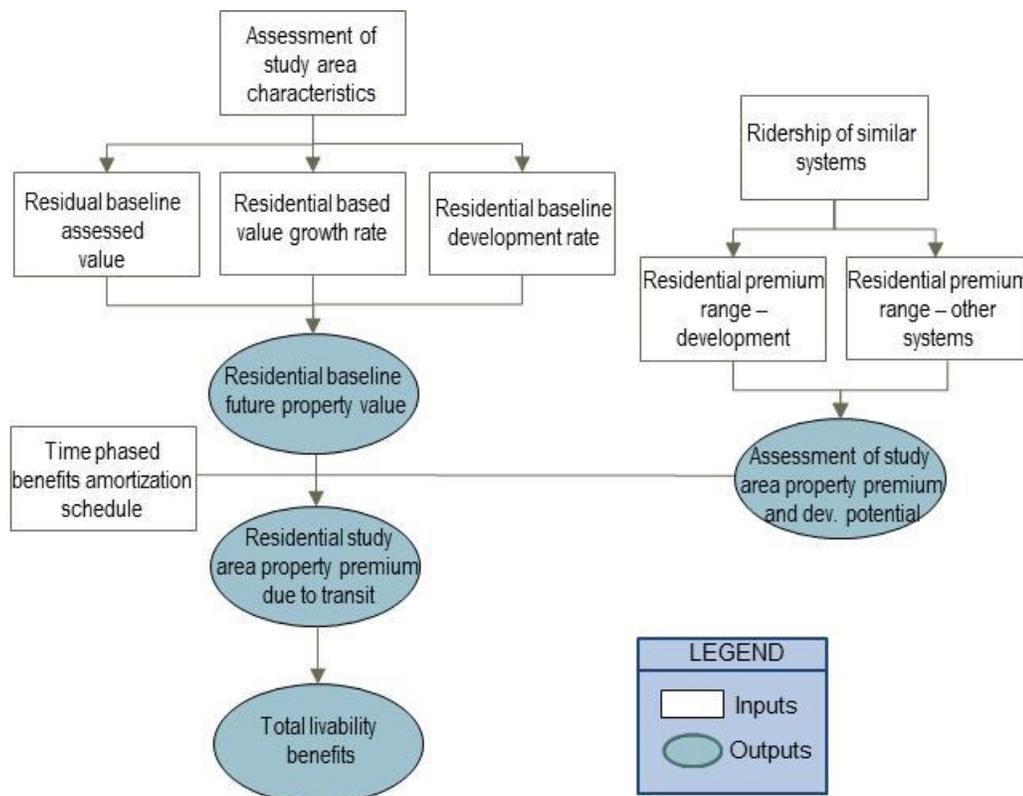
This analysis only applies the BRT premium rates to new properties after transit opening and not during construction. In this setting, a new property is one that is newly impacted by transit. All existing properties are considered "new" in the first year of the analysis, while only those that are newly constructed in subsequent years will be considered for the remaining lifecycle of the BRT operations. For a new property near the transit alignment, its market price at the time of purchase is assumed to capture the expected lifecycle stream of benefits. The amount of benefits is then realized by the property owner annually at an increasing rate to reflect ramp-up/ growing certainty over time. As a result of these two assumptions, the estimated BRT premium rate (as a percentage of property value) was applied only once to the price of new property and the dollar amount of benefits were spread over the analysis horizon.

The process of estimating benefits can be summarized by the following six steps:

1. Review existing property values, historical rates of change in values, and historical rates of growth in the number of parcels;
2. Identify proposed alignments and potential station areas and collect data, by property type, on those properties within station areas;
3. Estimate the average property value growth rate (in the “No-Build” scenario) based on historical transaction prices;
4. Estimate the number of additional properties based on historical land use;
5. Identify appropriate value premiums based on multiple criteria: ridership level, underlying demand, income group of forecast residents, income group of forecast riders, similarity to benchmark systems, development trends and urban development planning;
6. Quantify the incremental benefit of station area proximity as follows:
 - a. Based on a literature review and stakeholder interviews, select the most comparable transit systems (i.e., focusing on studies that used a 0.25/0.5 mile radius around BRT station areas);
 - b. Compute average transit premiums ranges by property type based on selected systems (residential property types include single-family homes, multifamily homes, and condominiums);
 - c. Compute the adjustment factor by property type for average transit premiums using the ratio of associated system ridership and city population to those of the cities in the selected studies;
 - d. Apply the modified adjustment factor estimated above by property type to average transit premiums; this yields the expected premiums in the two scenarios by property type.

Figure 8 illustrates the flow of the computations.

Figure 8: Structure and Logic for Estimating Economic Development Impacts



5.1.1 Station Area Impact Scenarios

As documented in our literature review, to date there is limited evidence of BRT contributing to significant station area development benefits within the US. Light rail transit (LRT), on the other hand, has been shown to offer accessibility and amenity benefits when there is sufficient demand to support the investment. Therefore, the following three station area development scenarios are used in this property value analysis:

- Low Premium Scenario:** Using empirical evidence from Pittsburgh, Boston, and Eugene, Oregon, this scenario is based on an average BRT premium of 0.5 percent on property values (USDOT (2009, 2012) and Hodel and Ickler (2012)).^{13,14} Even though there is no strong evidence of property value premium associated with BRT, there is no evidence of value discount that suggests BRT brings about negative impact on station area properties. This scenario suggests the minimum amount of property value benefits associated with the BRT investment.

¹³ USDOT. (2009). *Land Use Impacts of Bus Rapid Transit: Effects of BRT Station Proximity on Property Values along the Pittsburgh Martin Luther King, Jr. East Busway*. USDOT. (2012). *Land Use Impacts of Bus Rapid Transit: Effects of BRT Station Proximity on Property Values along the Boston Silver Line Washington Street Corridor*.

¹⁴ Hodel, Peter and Megan Ickler (2012). *The Value of Bus Rapid Transit: Hedonic Price Analysis of the EmX in Eugene, Oregon*. Working paper.

- **Medium Premium Scenario:** This scenario assumes a number of transit oriented design (TOD) elements that support BRT. The supportive infrastructure and initiatives include:
 - Amenities (street trees, public plazas, parks);
 - Sidewalks;
 - Bikeways;
 - Infrastructure enhancements (bike signals, diagonal crosswalks and signals, connected street network);
 - Preservation of mixed and low income housing (property acquisition and land banking or programs such as rent control and condominium conversion ordinances);
 - Development subsidies (tax creates, loans); and Support for job training, etc.

The premium values used in this scenario are based on the average of what are used in the Low Premium and High Premium scenarios- 2.3 percent for single-family properties and 8.3 percent for multifamily and condominium properties.

- **High Premium Scenario:** The scenario assumes all the TOD planning elements noted in the Medium Premium Scenario, as well as enhanced local bus services. Additionally, the scenario assumes BRT elements such as:
 - Information technology systems at stations, along with off-board fare payment for multiple-door boarding;
 - Level boarding;
 - High capacity vehicles;
 - Curb separations; and
 - Signal priority for optimized flow, etc.

The assumptions suggest the possibility of return on investment of fixed guideway system such as LRT, as its impacts on property values are well-documented. This scenario assumes an average LRT premium of 4.1 percent on single-family properties as well as 16.0 percent on multifamily and condominium properties.^{15, 16}

¹⁵ Atkinson-Palombo, Carol. *Comparing the capitalisation benefits of light-rail transit and overlay zoning for single-family houses and condos by neighbourhood type in metropolitan Phoenix, Arizona*. *Urban Studies* (2010); Chen, Hong, Anthony Rufolo, and Kenneth Dueker. *Measuring the impact of light rail systems on single-family home values: a hedonic approach with geographic information system application*. *Transportation Research Record: Journal of the Transportation Research Board* 1617 (1998): 38-43; Landis, John, Subhrajit Guhathakurta, and Ming Zhang. *Capitalization of transit investments into single-family home prices: A comparative analysis of five California rail transit systems*. University of California Transportation Center (1994). Goetz, Edward G., Kate Ko, Aaron Hagar, Hoang Ton, and Jeff Matson. (2010). *The Hiawatha Line: impacts on land use and residential housing value*.

¹⁶ Mathur, Shishir, and Christopher Ferrell. (2009). *Effect of suburban transit oriented developments on residential property values*; Cervero, Robert, and Michael Duncan. (2002). *Land value impacts of rail transit services in San Diego County*. Report prepared for National Association of Realtors Urban Land Institute; Billings, Stephen B. (2011). *Estimating the value of a new transit option*. *Regional Science and Urban Economics* 41, no. 6: 525-536; Petheram, Susan, Arthur Nelson, Matt Miller, and Reid Ewing. (2013). *Use of the Real Estate Market to Establish Light Rail Station Catchment Areas: Case Study of Attached Residential Property Values in Salt Lake County, Utah, by Light Rail Station Distance*. *Transportation Research Record: Journal of the Transportation Research Board* 2357: 95-99.

Essentially this scenario answers the question: what if BRT's impacts on property values can be as high as LRT's?

The premiums in the three scenarios remain unchanged with the opening of the Blue and Purple lines in 2021 (Full-Build network expansion). While a wider network may bring about additional station area development benefits, there is no evidence in the literature (to date) that premiums are proportional to network size.

5.1.2 Data Analysis

To estimate the residential property value impacts of the Indy Connect Plan, property parcel data for the study area was analyzed. The data helped us understand the current residential real estate market and land use patterns. We defined the study area as a “buffer” around the BRT corridor(s) that reflects a walkable distance to the BRT stations. Properties were analyzed by use, size, and value, and potentially developable or re-developable properties were identified. More technical details regarding the data analysis are found in

In this section, we discuss the data and processes applied to compute the parcel inputs for the analysis. In terms of data, the following data were used in the analysis:

- BRT stops GIS shapefiles (IndyGo);
- BRT stops maps;¹⁷
- ESRI ArcGIS street maps;
- Home price index (2014-2040) for the Indianapolis metropolitan area (Moody's analytics);
- Marion County 2014 tax assessment parcel data (IndyGo); and
- Land use code from Indiana's Department of Local Government Finance.

A number of criteria were applied to the parcel data. The data filters include:

- Station area buffer of 0.5-mile for each station (resulted in 67,318 parcels);
- Section of vacant residential, single-family, multifamily, and condominium parcels (resulted in 52,711 parcels);¹⁸
- Removing parcels that did not have improvement values (114 parcels removed); and
- Removing parcels that did not have building square footage (1,102 removed).

¹⁷ <http://indyconnect.s3.amazonaws.com/wp-content/uploads/2016/02/03232503/Red-Line-Map.pdf>

¹⁸ The vacant parcels are used to determine the parcel absorption rate. The rate is a proxy for the growth rate of the number of new parcels. The assumption is conservative as it does not account for new construction or changes in housing demand.

The summary statistics of the processed parcel data based on the data filter applied is provided in Table 4.

Table 4: Summary of Parcels

Property Type	Number of Parcels	Average Assessment Value	Average Value per Square Foot
Vacant	5,545	NA	NA
Single-Family	39,138	\$100,400	\$47.1
Multifamily	5,162	\$100,942	\$33.1
Condominium	2,866	\$179,158	\$112.3

5.2 Results

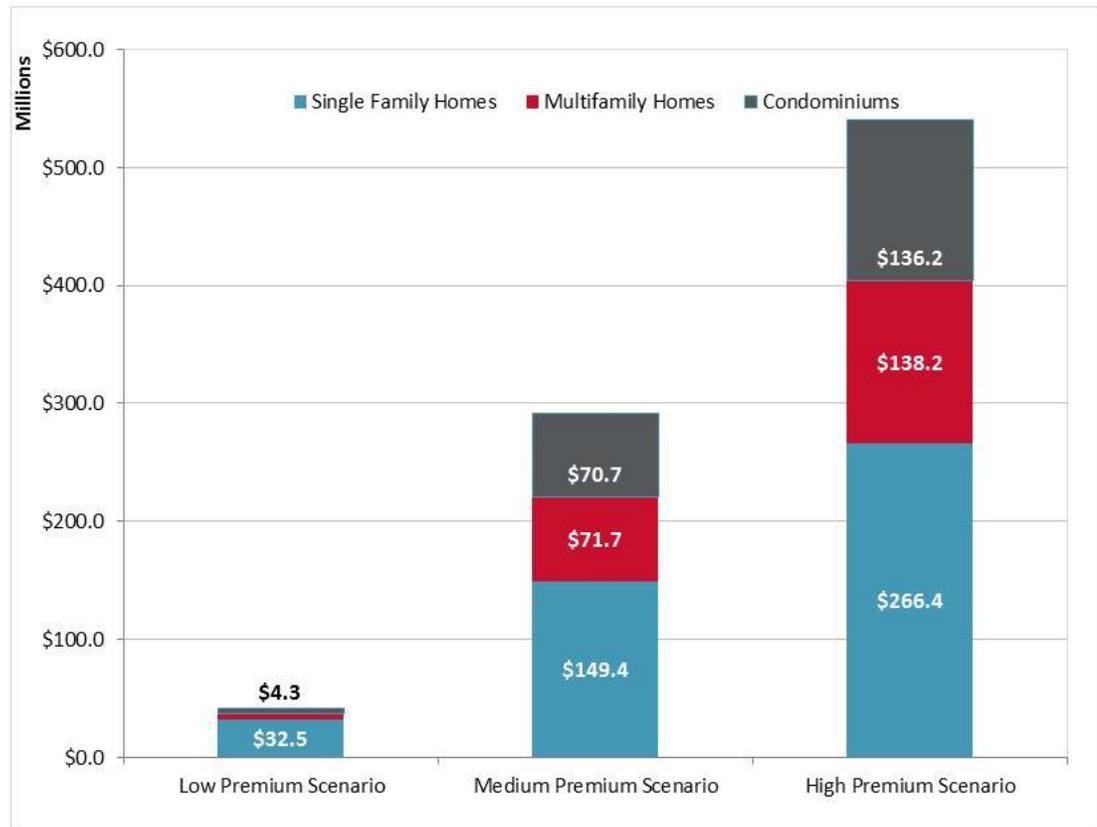
The estimated property value impacts of the Indy Connect Plan are presented in Table 5. They range from \$41.1 million under the Low Premium Scenario to \$540.8 million under the High Premium Scenario.

Table 5: Full-Build Scenario Property Value Impacts

Property Type	Low Premium Scenario	Medium Premium Scenario	High Premium Scenario
Single-Family	\$32,482,983	\$149,421,723	\$266,360,463
Multifamily	\$4,319,784	\$71,708,420	\$138,233,099
Condominium	\$4,256,790	\$70,662,715	\$136,217,281
Total	\$41,059,558	\$291,792,858	\$540,810,844

The impacts are presented by property type in Figure 9.

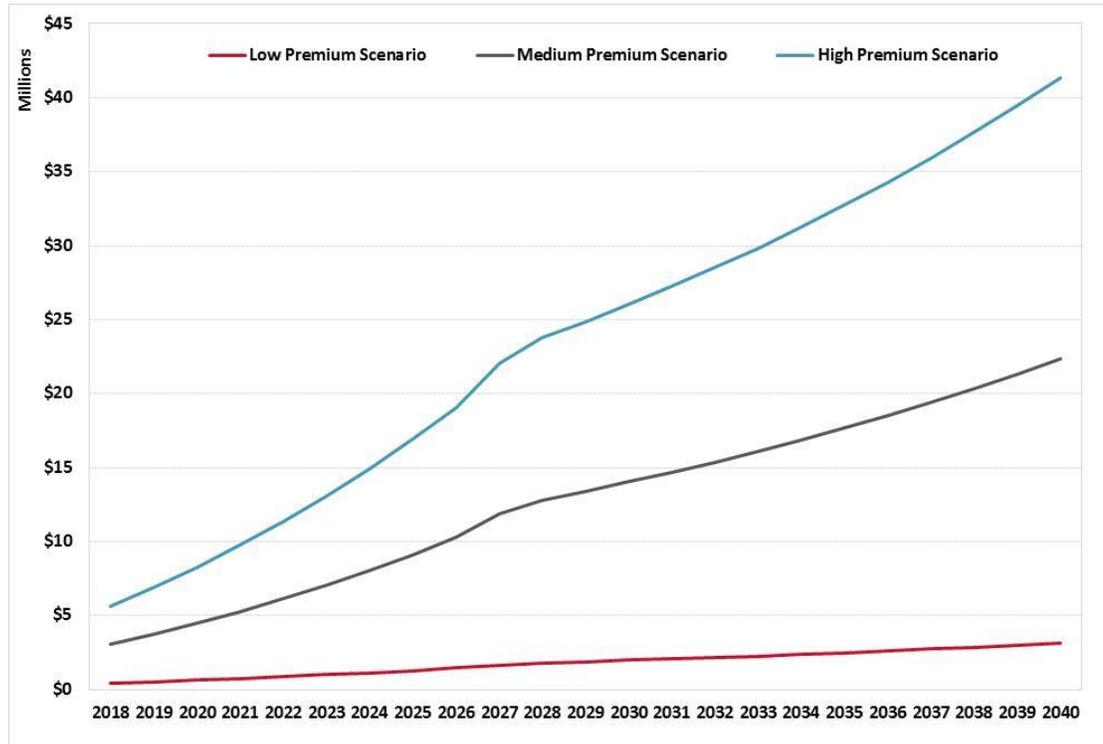
Figure 9: Property Value Impacts



Single Family Homes are expected to contribute the most to the total impacts. Under the Low Premium Scenario, they represent 79.1 percent of total benefits, and represent 49.3 percent of total benefits under the High Premium Scenario.

The annual property value impacts are presented in Figure 10. On average, total annual impacts are expected to generate \$1.6 million per year in the Low Premium Scenario. Average annual impacts could potentially reach \$21.1 million per year under the High Premium Scenario, assuming TOD planning and full BRT service.

Figure 10: Annual Property Value Impacts



The property value analysis results point to the benefit of aligning BRT investment with supportive infrastructure and planning. As demand for attached housing in mixed-use districts is underserved, there is potential for residential properties to capture significant benefit that BRT can generate to enhance community vitality and connectedness.

6 Economic Impacts

Economic impacts related to a corridor level investment include estimates of worker payroll, economic output and value added. The analysis presented below is based on the benefits and costs associated with the Indy Connect improvements. The economic impacts resulting primarily from these benefits are not strictly included in the analysis. But it is important to recognize the overall potential for the investment to generate new economic activity.

Traditionally, economic impact analysis involves the estimation of three types of effects, commonly referred to as direct effect, indirect effect and induced effect:

- **Direct effect:** Refers to the economic activity occurring as a result of direct spending by agencies or business located in the study area (e.g., expenses related to construction activities for Indy Connect are \$438.5 million);

- **Indirect effect:** Refers to the economic activity resulting from purchases by local firms who are the suppliers to the directly affected agencies or businesses (e.g., spending by suppliers of the contractors responsible for construction activities); and
- **Induced effect:** Represents the increase/decrease in economic activity, over and above the direct and indirect effects, associated with increased/decreased labor income that accrue to workers (of the contractor and all suppliers, in our example) and is spent on household goods and services purchased from businesses within the study area.

The indirect and induced effects are referred to as multiplier effects because they can make the total economic impact substantially larger than the direct effect alone. In theory, the larger the multiplier, the larger the overall response (total economic impact) to the initial expenditure (direct effect). The total economic impact is the sum of these direct, indirect and induced effects for the project being evaluated.

6.1 Methodology

Typically, economic impacts are measured in terms of employment, industry output, and value added. The employment impact measures the number of jobs created for a full year. A job-year is defined as one person employed for one year, whether part-time or full time. Output refers to the total volume of sales. In comparison, value added refers to the value a company adds to a product or service. It is measured as the difference between the amount a company (or governmental agency) spends to acquire it and its value at the time it is sold to other users. Thus, value added can be thought of as a measure of the contribution to the gross domestic product (GDP) made by an establishment or an industry. The total value added within a region is equivalent to the gross regional product and includes employee compensation, proprietary income, other property type income (e.g., rents) and indirect business taxes (e.g., excise taxes).

Employment impacts measure the number of jobs created for a full year. These impacts should not be interpreted as full-time equivalent (FTE) as they reflect the mix of full- and part-time jobs that is typical for each sector. And, strictly speaking, they should not be interpreted as permanent jobs either, but rather as job-years.

Tax impacts are divided into State/Local governments and Federal government. Note that state and local tax impacts are combined and cannot be separated into state vs. local in IMPLAN – the economic impact modeling system used in the analysis. However, a breakdown of tax impacts by institution (households, corporations, etc.) and by type of tax (sales tax, income tax, etc.) can be provided.

6.1.1 The IMPLAN System

To estimate the economic impacts of the Indy Connect Plan, we used IMPLAN Version 3.0. IMPLAN is an economic impact assessment modeling system structured as an input-output model¹⁹ originally developed by the U.S. Forest Service and now maintained by the IMPLAN Group, LLC.²⁰ The IMPLAN data files include transaction information

¹⁹ An input/output model uses a matrix representation of inter-industry transactions to calculate the effects of a change in one industry on other industries.

²⁰ For more information on the IMPLAN® system, visit <http://www.implan.com/>.

(intra-regional and import/export) on 536 industrial sectors (corresponding to four and five digit North American Industry Classification System (NAICS) codes) and data on over 20 economic variables, including business output, value added and employment. We use the most recent available data files (2014) for Marion County.

In the course of our analysis, we made the following adjustments:

- We adjusted model inputs for inflation to express the impact analysis results in 2016 (or year of analysis) dollars.²¹
- We modified the type Social Accounting Matrix (SAM) multipliers,²² which are used for estimating indirect and induced effects, with regional purchase coefficients (RPCs)²³ derived from the trade flow model. This modification is necessary to ensure that we do not count any spending “leaking” out of the study area (for example, if buses purchased by IndyGo are manufactured outside of the region).
- Households are the only institution considered when constructing SAM multipliers. Government and capital institutions are typically not internalized. As a result, we estimated induced effects based on the income of households living in the study area only.

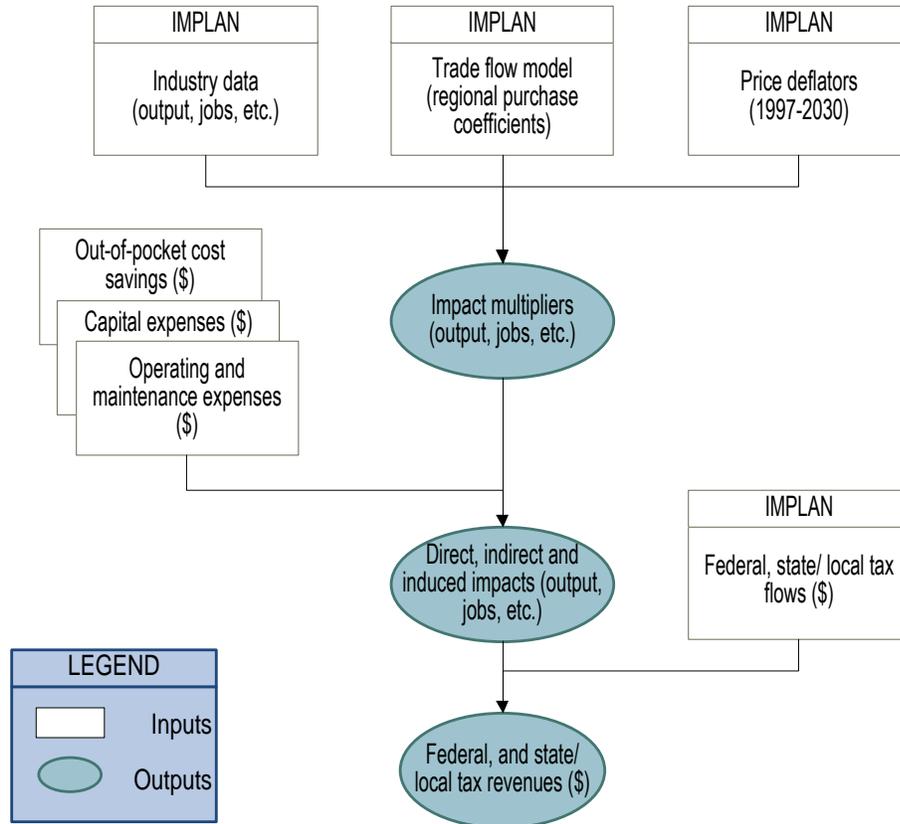
²¹ IMPLAN uses deflators derived from the most current Bureau of Labor Statistics (BLS) growth model to account for relative price changes over time. These deflators are available at the commodity level through 2020.

²² Type SAM (Social Accounting Matrix) multipliers are the direct, indirect and induced effects where the induced effect is based on information in the social accounting matrix. Type SAM multipliers capture inter-institutional transfers (such as transfers between households and the Federal government) in addition to all commodity flows (purchases of goods). It is commonly accepted that only households should be internalized when building type SAM multipliers. Internalizing households relies on the assumption that local workers will re-spend their labor income.

²³ RPCs represent the portion of the total regional demand that is met by regional production and attempt to account for cross-hauling, which is the regional importation and exportation of commodities from the same sector. All remaining demand is satisfied by imports, which provide no economic benefit to the region. In other words, RPCs filter out economic leakages from the region.

Figure 11 shows a graphical representation of the general process we used to estimate economic impacts with IMPLAN.

Figure 11: Structure and Logic for Estimating Economic Impacts



6.2 Results

Economic impacts are estimated based on short-term capital spending and long-term on-going operation and maintenance (O&M) spending as well as savings from vehicle operating costs.

6.2.1 Short-term Impacts

Table 6 represents employment impacts associated with the Plan’s initial capital spending. Capital spending includes the cost of construction, vehicles, stations, and systems, but excludes those of right-of-way acquisition and financing.²⁴

Construction spending associated with the Indy Connect Regional Transportation Plan is estimated to generate 430 temporary jobs.

Table 6: Short-Term Employment Impacts

Types of Effects	Indy Connect
Capital Expenditures (millions)	\$236.1
Temporary Jobs	430

Notes: The cost excludes costs of right-of-way acquisition, financing, and vehicles. Vehicles are excluded because they are purchased outside of the Indianapolis region. Capital expenditures are based on annual estimates provided by the Indianapolis Metropolitan Planning Organization.

Table 7 presents the short-term economic impacts of the Plan. These impacts are estimated at \$438.5 million.

Table 7: Short-Term Economic Impacts (Millions)

Impact	Indy Connect
Labor Income	\$182.9
Value Added	\$244.0
Output	\$438.5

Notes: The cost excludes costs of right-of-way acquisition, financing, and vehicles. Vehicles are excluded because they are purchased outside of the Indianapolis region. Total output is a combined effect of direct, indirect and induced.

6.2.2 Long-term Impacts

Long-term economic impacts of a project consist of two categories. The first category is the operations and maintenance (O&M activities) throughout the operational life of the asset. The second category arises due to savings from vehicle operation costs for IndyGo customers. By providing more affordable transportation options, the transit services can enable travelers to spend less on vehicle operating expenses (fuel expenses in particular). The cost savings can be spent in the local area and generate additional economic activity locally.

²⁴ Economic impacts associated with right-of-way acquisition and financing are negligible and are normally not estimated.

Table 8 and Table 9 summarize the economic impacts from O&M activities. Table 8 shows that the additional annual O&M costs are expected to generate 990 permanent jobs.

Table 8: Long-Term Employment Impacts from O&M Expenses

Types of Effects	Indy Connect
O&M Expenditure (millions)	\$61.7
Permanent Jobs	990

Table 9 presents the economic output in which the annual expenditure is expected to create a total annual output of \$103.5 million.

Table 9: Long-Term Annual Economic Impacts from O&M Expenses (millions)

Impacts	Indy Connect
Labor Income	\$41.2
Value Added	\$63.3
Output	\$103.5

Note: Total Output is a combined effect of direct, indirect, and induced.

Table 10 presents the economic impacts from the savings in vehicle operating costs. For example, IndyGO riders are expected to save approximately \$24.4 million in vehicle operating costs on average per year due to improved transportation conditions.

Table 10: Long-Term Annual Economic Impacts from Vehicle Operation Cost Savings

Impact	Indy Connect
Permanent Jobs	163
Labor Income (millions)	\$8.5
Value Added (millions)	\$15.2
Output (millions)	\$24.4

Note: All impacts from VOC Savings are induced; there are no direct or indirect impacts.

6.2.3 Impact on Gross Regional Product

Economic value added within a region is equivalent to the gross regional product. Therefore, we calculated the total impact on the Gross Regional Product of the Indy Connect Plan by combining the short term value added from Table 7 with the long term annual value added from Tables 9 and 10. Assuming that 2022 is the first year of full service, the Indy Connect Plan is expected to add \$1,736,000,000 to the Gross Regional Project through 2040.

7 Economic Development Impacts

Along with improved mobility and better connectivity, another primary benefit of quality transit service is the potential for economic development generated by the improved transit system. The study team estimated the economic development impacts based on the following:

- Interviews with economic development experts in the Indianapolis region;
- An analysis of tax assessor data for properties within ½ mile of the corridor; and
- Modeling to estimate the potential square footage of development by use (residential, office, etc.) supported by the transit system enhancements.

The following provides greater detail related to the analytical methodology, key assumptions, and economic development estimates for both phases of this project.

7.1 Methodology

In 2012, the Government Accountability Office (GAO) completed a report²⁵ that analyzed economic development generation and BRT systems. Their findings suggest that economic development can be supported by quality BRT, but the perception of BRT permanence plays a role in the types and magnitude of development spurred. Developers need to be assured that if they invest along a transit corridor, the system will continue to be available over the long term.

To best leverage BRT to support economic development, systems should incorporate features that relay system “permanence”, such as dedicated running ways, substantial stations with enhanced amenities, and other fixed assets. These features represent a larger investment in a corridor by the public sector, and they assure developers that the transit service and infrastructure will be maintained over the long term.²⁶ Other factors should also be considered when determining how best to capitalize on a BRT investment to generate economic development. They include:

- Service linking residential areas to employment centers or attractions;
- Involvement of institutional and employment centers; and
- Existence of transit-supportive policies and development incentives.

For this analysis, we assumed that some of these factors are in place in Indianapolis and along the proposed corridors to best support economic development around this transit investment. Whether the actual development falls short or exceeds the estimates will depend on the success of initiatives to support permanence, connectivity, stakeholder engagement, and implementation of transit-supportive policies.

²⁵ *Projects Improve Transit Service and Can Contribute to Economic Development*, Prepared by the General Accounting Office, July 2012.

²⁶ *Projects Improve Transit Service and Can Contribute to Economic Development*, Prepared by the General Accounting Office, July 2012.

7.1.1 Economic Development Interviews

The study team conducted four interviews with local economic development experts. The purpose of these interviews was to understand the overall Indianapolis real estate market, identify nodes of potential economic development activity, and inform key assumptions of the analysis.

Among these experts, there was general consensus that the expanded transit service would support new development, though the magnitude was less certain. One individual suggested that new transit could support between five and 10 percent more development than the market would likely generate organically.

Other issues were also discussed during these interviews, including affordable housing, neighborhoods within the study area that were already experiencing development, and neighborhoods where future development might be likely to occur, particularly with good transit service. The study team used these discussions to develop assumptions for our analysis.

7.1.2 Data Analysis

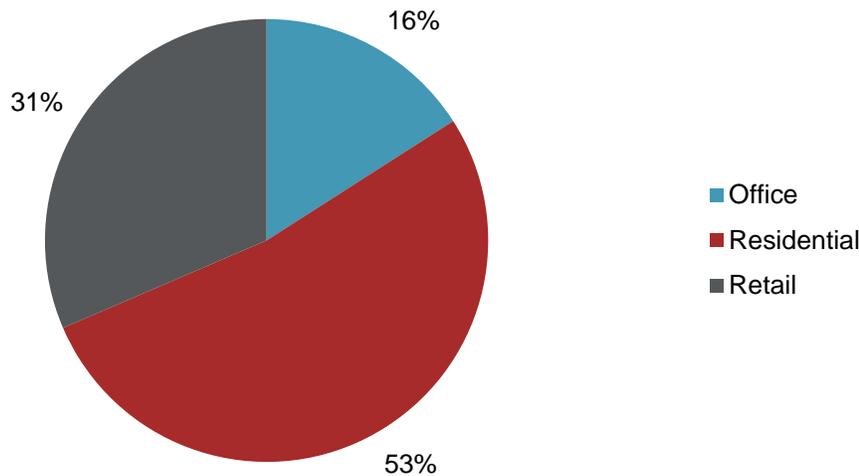
Tax assessor data for the study area, with valuations as of 2014, was assembled and ½-mile “buffers” were created around each station. Square footage by use was then determined. As necessary, decisions were made to aggregate the various uses. For example, multifamily, condominiums, and single family homes were all classified as “Residential” for the analysis.

The aggregated uses included in the analysis are:

- Industrial;
- Office;
- Other;
- Residential;
- Retail; and
- Vacant.

Parcels with missing information were excluded from the analysis. To develop the estimates of potential economic development supported by the BRT systems, we focused on existing office, residential, retail and vacant properties. Figure 12 presents the share of 2014 building square footage by the three uses of focus. When office, residential, and retail building square footage are combined, residential accounts for more than half of all use along the entire corridor.

Figure 12: Building Square Footage in Study Area by Focused Uses - 2014



Mixed use development is desired in the corridors, and the relative shares of office, residential and retail uses above were used as an input to the modeling effort described below.

7.1.3 Economic Development Projections

Using the existing square footage by use developed in the tax assessor data analysis described above, baseline forecasts of development were made. Forecasts were developed separately for the two scenarios, using real estate market data related to vacancy rates and historical growth in real estate development (square footage) by use in these areas.

The model also estimates the BRT-related development that may occur above and beyond the baseline forecasts. Several assumptions were made to generate these estimates, based on the Indy Connect “Transit Oriented Development Strategic Plan” completed in 2015, interviews with economic development professionals, real estate market reports, previous similar analyses, and the literature review conducted for this study. The following are the primary assumptions related to the estimation of development generated by the BRT service:

- Some parcel square footage will remain vacant.
- Two percent of existing, vacant, parcel square footage will be redeveloped as a result of the improved transit system.
 - Building development (i.e., building square footage developed as a result of the BRT improvements) on this vacant land is based on a floor-to-area ratio (FAR) assumption of 2.5.
 - Development square footage is distributed between residential, retail and office, based on existing building square footage by use (see Figure 12).

- BRT-related development will begin to occur one year after construction is complete and it will be phased in over a five-year period. The timing of development varies for each of the Phases.
- After the five-year period, development will continue to grow based on recent real estate trends in Indianapolis.

7.2 Results

Table 11 shows the expected new real estate development along the proposed routes. By 2040, nearly 4 million square feet of new development is expected in the study area.

Table 11: New Real Estate Development in 2040 (square feet)

Use	Indy Connect
Office	564,000
Residential	2,324,000
Retail	1,110,000
Total	3,998,000

The results of this analysis are intended to provide a sense of the magnitude and timing of development that may be generated by the proposed transit improvements. The projections are based on today's best available data. Conditions that could influence the underlying analytical assumptions may change over time and alter the projected results. For example, the real estate market in Indianapolis is not something that the Indy MPO or transit authority can control, but it could impact future development. In contrast, there are some factors that affect successful transit oriented development that are within the power of the public sector and transit authority. These include:

- Outreach and marketing that emphasizes the “newness” of the service. This is not an old service repackaged and has the potential to provide new opportunity.
- Making design decisions that relay permanence. As noted above, developers are typically more comfortable investing dollars in projects that are located near fixed transit and, while BRT is not a fixed rail system, elements of the system can be designed to relay a more permanent feel.
- Auxiliary investments in pedestrian improvements and other transit supportive infrastructure. Making sure that the transit stops are accessible is an important element of a successful, well-utilized system.
- Implementation of policies that support transit and transit oriented development.

8 References from the Literature Review

- American Public Transportation Association, *News Releases*, “Transportation Secretary Mineta Proposes Increased Funding for Public Transit Infrastructure,” October 2, 2002.
- American Public Transportation Association and Public Transportation Partnership for Tomorrow, *The Benefits of Public Transportation: Mobility for the Aging Population*, 2002.
- American Public Transportation Association, *News Releases*, “We Make Communities Go» Campaign to Highlight Transit’s Benefits to National and Local Economies,” February 17, 2005.
- American Public Transportation Association, *Public Transportation: Benefits for the 21st Century*, 2007.
- Blumenberg, Evelyn, and D. Baldwin Hess, *Measuring the Role of Transportation in Facilitating the Welfare-to-Work Transition: Evidence from Three California Counties*, University of California Transportation Center, November 2002.
- Cambridge Systematics, Inc., *Public Transportation and the Nation’s Economy*, prepared for the American Public Transit Association, 1999.
- Cervero, R., M. Duncan. Rail Transit’s Value Added: Effect of Proximity to Light and Commuter Rail Transit on Commercial Land Values in Santa Clara County California. Paper prepared for National Association of Realtors Urban Land Institute. 2001.
- Debrezion, G., E. Pels, and P. Rietveld.. The Impact of Railway Stations on Residential and Commercial Property Value: A Meta-analysis. *The Journal of Real Estate Finance and Economics* 35 (2):161-180. 2007.
- Deng, T. & Nelson, J. *Recent Developments in Bus Rapid Transit: A Review of the Literature*. Centre for Transport Research, University of Aberdeen, May 2010.
- Duncan, M. Comparing Rail Transit Capitalization Benefits for Single-Family and Condominium Units in San Diego, California. *Transportation Research Record: Journal of the Transportation Research Board* 2067: 120-130. 2008
- Economic Development Research Group. 2014. *Economic Impact of Transportation Investment 2014 Update*. American Public Transportation Association.
- ECONorthwest and Parsons Brinckerhoff Quade & Douglas, Inc., *Estimating the Benefits and costs of Public Transit Projects: A Guidebook for Practitioners*, Transit Cooperative Research Program, Transportation Research Board, 2002.
- Goetz, E. G., K. Ko, A. Hagar, H. Ton, and J. Matson. *The Hiawatha Line: Impacts on Land Use and Residential Housing Value*: Center for Transportation Studies, University of Minnesota. 2010.
- Faulk, D. & Hicks, M. 2009. *The Economic Effects of Bus Transit in Small Cities*, Center for Business and Economic Research. Miller College of Business, Ball State University.
- Federal Transit Administration (Perk, V. & Catalá, M.). 2009. *Land Use Impacts of Bus Rapid Transit: Effect of BRT Station Proximity on Property Values along the Pittsburgh Martin Luther King, Jr. East Busway*. Federal Transit Administration.

- Government Accountability Office. 2012. *Bus Rapid Transit: Projects Improve Transit Service and Can Contribute to Economic Development*. Government Accountability Office. Gwilliam, Kenneth M., *Cities on the Move: a World Bank Urban Transport Strategy Review*, The World Bank, 2002.
- Hess, Daniel B., and T.M. Almeida, "Impact of Proximity to Light Rail Rapid Transit on Station- Area Property Values in Buffalo, New York," *Urban Studies*, Vol. 44, Nos. 5/6, May 2007, pp. 1041-1068.
- Hicks, M., Faulk, D., & Kroll, K. 2013. *Fixed-Route and Demand-Response Bus Systems: Financing Methods, Benefits and Costs in Indiana*. Indiana Transportation Association; Center for Business and Economic Research, Ball State University.
- HNTB. Economic Benefits of Investing in Transit. December 2015.
- Irwin, Elena, and Nancy Bockstael. 2007. The Evolution of Urban Sprawl: Evidence of Spatial Heterogeneity and Increasing Land Fragmentation. Proceedings of the National Academy of Sciences of the United States.
- Kleffman, Sandy. 2002. "Transit Gaps Hinder Health Care Access". Contra Costa Times, 2002.
- Litman, Todd, *Guide to Calculating Mobility Management Benefits*, Victoria Transport Policy Institute, November 2011.
- Litman, Todd, *Evaluating Public Transit Benefits and Costs: Best Practices Guidebook*, Victoria Transport Policy Institute, December 2015.
- Mohammad, S., Graham, D. J., Melo, P., Anderson, R. A Meta-analysis of the Impact of Rail Projects on Land and Property Values. Transportation Research Part A 50. 2013 158-170.
- Morris, Lloyd & Associates. Indy Connect: Analysis of Economic Impacts. December 2012.
- Minnesota IMPLAN Group, Inc., <http://www.implan.com/>
- National Center for Transit Research. 2013. *A Tool for Assessing the Economic Impacts of Spending on Public Transit*.
- Nelson, A., Appleyard, B., Kannan, S., Ewing, R., Miller, M., & Eskic, D. 2013. *Bus Rapid Transit and Economic Development: Case Study of the Eugene-Springfield BRT System*. Journal of Public Transportation.
- Nelson, A. & Ganning, J. 2015. *National Study of BRT Development Outcomes*. National Institute for Transportation and Communities.
- Shapiro, Robert J., Kevin A. Hassett, and Frank S. Arnold, *Conserving Energy and Preserving the Environment: The Role of Public Transportation*, prepared for the American Public Transportation Association, July 2002.
- Sierra Club, *Clearing the Air with Transit Spending*, November 2001. Surface Transportation Policy Partnership, *Transportation and Jobs*, [http://www.transact.org/library/factsheets/transportation and jobs.doc](http://www.transact.org/library/factsheets/transportation%20and%20jobs.doc)
- Smith, Jeffery J., and Thomas A. Gihring. Financing transit systems through value capture: An annotated bibliography. 2004.
- The Texas A&M University System, Texas Transportation Institute, *The 2007 Urban Mobility Report*, September 2007.
- Transit Cooperation Research Program. Methodology for Determining the Economic Development Impacts of Transit Projects. Transportation Research Board, April 2012.

Transportation and Land Use Coalition, *Roadblocks to Health: Transportation Barriers to Healthy Communities*, 2002.

United Nations, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects: The 2005 Revision*, Working Paper No. ESA/P/WP/200, 2006.

9 Appendix A: OMB Guidelines on Benefit Transfer

Benefit transfer is a general approach to estimating the value of a proposed project by applying results from an *ex post* evaluation of a completed project. The approach is commonly used to estimate the value of non-market goods, and has been accepted by federal agencies, especially when direct measures of value are not feasible or practical.²⁷

In estimating station area benefits, proximity premiums are the values that are transferred from one study to another. To implement this approach in a reasonable manner, BCA practitioners face two key challenges:

- Selecting studies, or conducting new ones, where project site characteristics are reasonably similar;²⁸ and
- Adjusting values from existing studies to match conditions at the policy site.²⁹

In addition, standards in analytical due-diligence also necessitate a third step, which entails using sensitivity tests or simulation methods (including risk-analysis) to evaluate the robustness of the results.

OMB establishes guidelines for conducting benefit transfer in Circular A-4 (OMB 2003).³⁰ OMB defines the approach as a process for “transferring existing estimates obtained from indirect market and stated preference studies to new contexts.” These guidelines outline several considerations to ensure that the correct measure is estimated, and that the estimation draws from relevant, reliable, and defensible sources. It cautions also that due to “uncertainties and potential biases of unknown magnitude, [benefit transfer] should [...] be treated as a last-resort option and not used without explicit justification.” Even so, there are many contexts when it is used and accepted by federal agencies if reasonable steps are taken to accurately estimate benefits and document analytical decisions and assumptions.

A first step in meeting OMB’s benefit transfer guidelines is to describe the explicit specification of the value to be estimated, i.e., what is the relevant measure of the investment? In this case, the key benefit measure is the property price premium that can be transferred as a “point” or “function” value. A “point” transfer is a single estimated coefficient, whereas a “function” transfer is an estimated value derived from an equation, such as a statistical model. OMB prefers function transfers when possible because this approach can convey more information about the estimate and its determinants. A

²⁷ Survey methods to elicit non-market valuation responses for livability enhancements are not well-developed either.

²⁸ Office of Management and Budget (2003) Circular A-4.
http://www.whitehouse.gov/sites/default/files/omb/assets/regulatory_matters_pdf/a-4.pdf

²⁹ Guidelines for Preparing Economic Analyses. Chapter 7.5.

³⁰ This document replaces both “Best Practices” (OMB 1996) and “OMB Guidelines” (OMB 2000). In addition, EPA has developed extensive guidance on benefit transfer because of the frequency of use in environmental analyses (EPA, 2000, 2010).

function transfer, however, is not always the best option because not all of the information about a site can be reasonably transferred.³¹

Given that a number of studies may be potentially relevant for a benefit transfer analysis, OMB has established guidelines for selecting the most appropriate ones. These guidelines establish a series of criteria that can be applied to determine if an existing study, its context and results are similar enough to a new site to be determined suitable for benefit transfer. Quoting again from OMB (2003), OMB states that in selecting transfer studies for either point transfers or function transfers, choices should be based on the following criteria:

- The selected studies should be based on adequate data, sound and defensible empirical methods and techniques.
- The selected studies should document parameter estimates of the valuation function.
- The study context and policy context should have similar populations (e.g., demographic characteristics). The market size (e.g., target population) between the study site and the policy site should be similar. For example, a study valuing water quality improvement in Rhode Island should not be used to value policy that will affect water quality throughout the United States.
- The good, and the magnitude of change in that good, should be similar in the study and policy contexts.
- The relevant characteristics of the study and the policy contexts should be similar. For example, the effects examined in the original study should be "reversible" or "irreversible" to a degree that is similar to the regulatory actions [or, "*project*"] under consideration.
- The distribution of property rights should be similar so that the analysis uses the same welfare measure.³² [For example,] If the property rights in the study context support the use of willingness to accept (WTA) measures while the rights in the rulemaking context support the use of WTP measures, benefit transfer is not appropriate.
- The availability of substitutes across study and policy contexts should be similar.

OMB (2003) cautions further that benefit transfer in estimating benefits should not be used:

- If resources are unique or have unique attributes.

³¹ The imposition of a functional operation may introduce other forms of uncertainty. Some methodological uncertainties are addressed in the research conducted by Boyle et al (2010). In this case, property premiums can be estimated from a partial functional benefit transfer if location coefficients are used.

³² The distinction between willingness to accept (WTA) and willingness to pay can be important in some non-market valuation analyses. WTA is the minimum amount that a person is willing to accept to sell a good or accept a negative condition (e.g. nuisance effects). Implicit in a WTA measure is that property rights reside with the seller. In contrast, willingness to pay (WTP) is the maximum amount of money a person is willing to offer to obtain a good or avoid negative conditions. In most cases WTA does not equal WTP.

- If the study examines a resource that is unique or has unique attributes, [... that is] a different resource and vice versa.
- If a policy yields a significant change in the attributes of the good, [...].
- [... If the] value developed from a study involving, small marginal changes in a policy context involving large changes in the quantity of the good.

10 Appendix B: Indy Connect Economic Impact Analysis - Red Line Phase I

October 5, 2016

The Indy Connect Central Indiana Transit Plan includes three bus rapid transit (BRT) routes and enhanced local bus service in Marion County. These enhancements will support economic growth while meeting the expected demand for frequent, reliable, and safe transit service in the region.

This document summarizes the economic impacts of the Red Line Phase I through 2040. This scenario includes the Red Line from 66th Street to Hanna Avenue. It is assumed that this scenario will be completed in 2018 and cost \$91.8 million.

The methodologies used to assess the Red Line are exactly consistent with those used to analyze the full Indy Connect Plan. These methodologies are described in the *Indy Connect Economic Impact Analysis Final Report*, dated October 2016. All figures provided in this document are presented as 2016 dollars.

10.1 Transportation Benefits

Table 1 summarizes the projected transportation benefits of the Red Line Phase I.

Table 12: Transportation Benefits, 2018-2040 (Millions of 2016 Dollars)

Category	Red Line Phase I
Travel Time Savings	\$267.89
Vehicle Operating Cost Savings	\$100.79
Cross-Sector Benefits	\$75.94
Safety Benefits	\$51.71
Affordable Mobility Benefits	\$3.63
Environmental Benefits	\$2.94
Pavement Maintenance Savings	\$0.26
Total	\$503.17

10.2 Benefit Cost Ratio

Based on an annualized view of the benefits presented above and a standard discount rate of 7 percent, the Red Line Phase I has an estimated benefit/cost ratio of 2.01. Any project with a benefit cost ratio over 1.0 is considered to be a good investment.

10.3 Residential Property Value Impacts

Table 2 summarizes the parcel data used in the analysis of residential property values.

Table 13: Summary of Red Line Phase I Parcels

Property Type	Number of Parcels	Average Assessment Value	Average Value per Square Foot
Vacant	1,963	NA	NA
Single-Family	13,443	\$138,546	\$55.0
Multifamily	2,598	\$152,948	\$36.7
Condominium	1,880	\$230,989	\$138.8

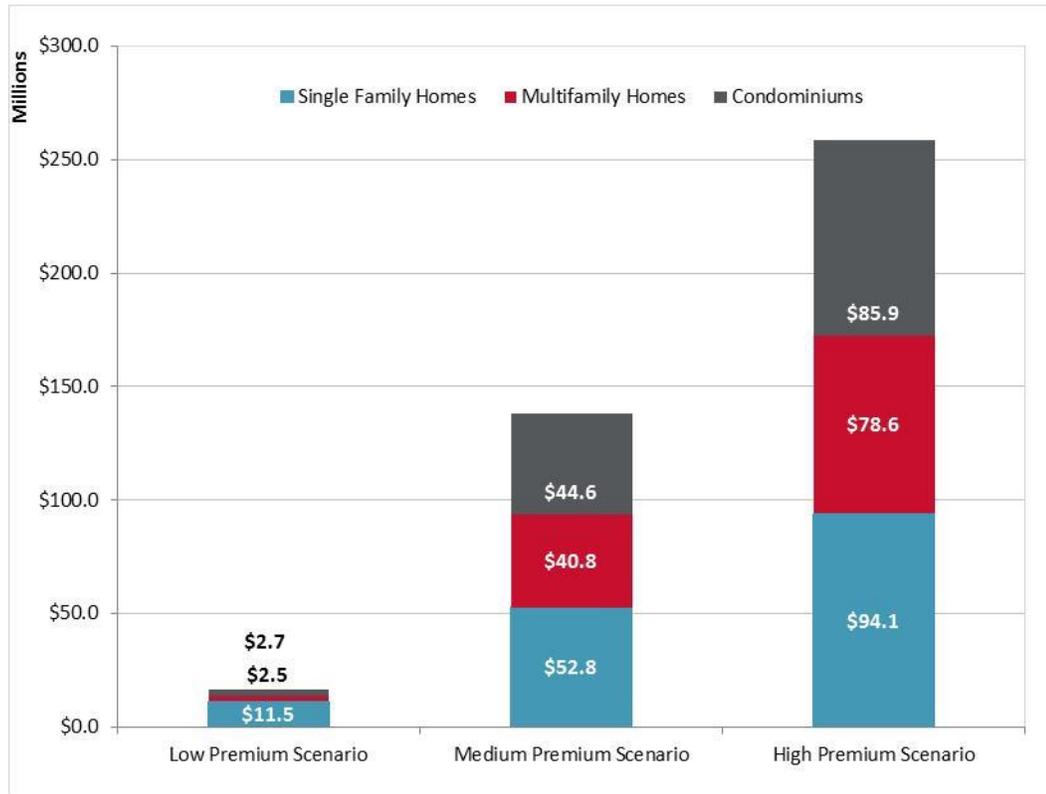
The estimated property value impacts for the Red Line Phase I through 2040 are presented in Table 14.

Table 14: Red Line Phase I Property Value Impacts (Millions of 2016 Dollars)

Property Type	Low Premium Scenario	Medium Premium Scenario	High Premium Scenario
Single-Family	\$11,476,726	\$52,792,941	\$94,109,156
Multifamily	\$2,457,207	\$40,789,633	\$78,630,619
Condominium	\$2,685,395	\$44,577,563	\$85,932,651
Total	\$16,619,329	\$138,160,138	\$258,672,426

The property value impacts are also depicted in Figure 13. These estimates are based on the assumed one-time value increase of 0.5 percent in the Low Premium Scenario, 2.3 percent to 8.3 percent in the Medium Premium Scenario, and 4.1 percent to 16 percent in the High Premium Scenario.

Figure 13: Red Line Phase I Property Value Impacts

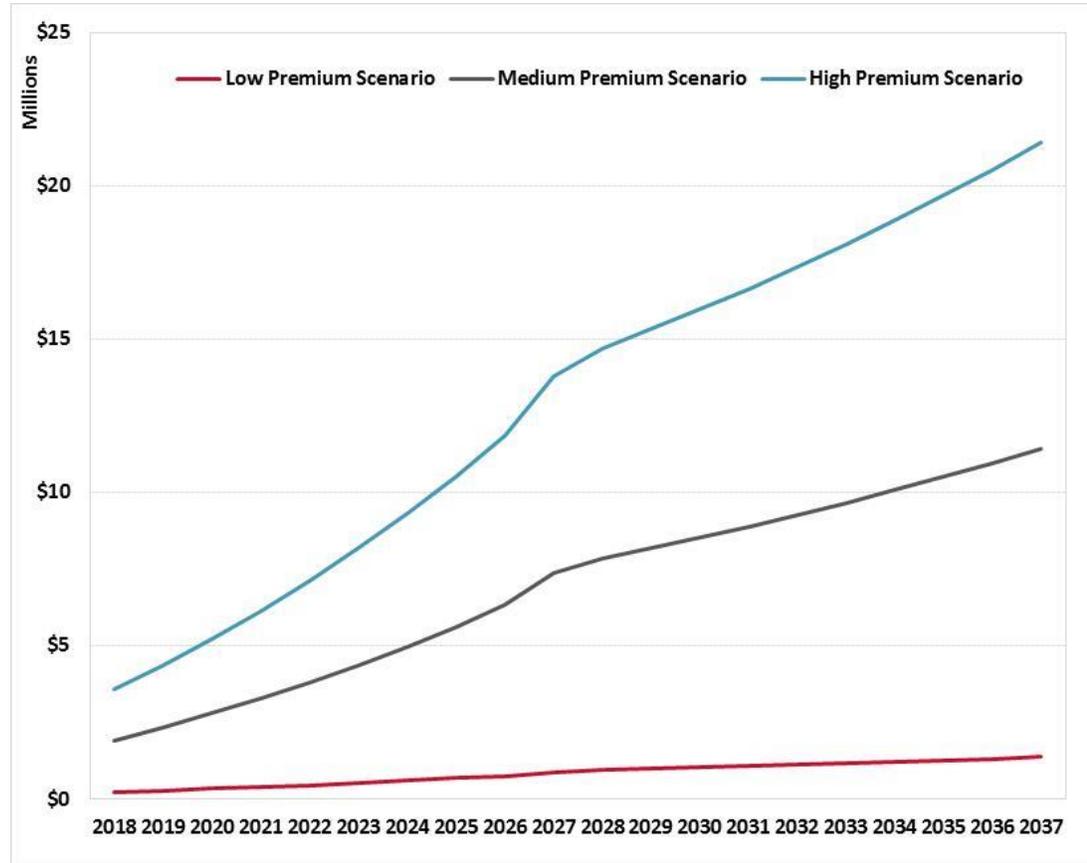


Single Family Homes are expected to contribute the most to the total impacts. This is because current demand for attached housing in mixed-use districts is underserved in Central Indiana.³³

³³ Indy Connect. Transit Oriented Development Strategic Plan. April 2015.

The annual total impacts for all properties in the Phase I study area are presented in Figure 14.

Figure 14: Red Line Phase I Annual Property Value Impacts



10.4 Economic Impacts

The projected economic impacts of the Red Line Phase I are summarized in Tables 4 through 7.

Table 15: Short-Term Employment Impacts

Types of Effects	Red Line Phase I
Capital Expenditures (millions)	\$57.0
Temporary Jobs	94

Notes: The cost excludes costs of right-of-way acquisition, financing, and vehicles. Vehicles are excluded because they are purchased outside of the Indianapolis region. Capital expenditures are based on annual estimates provided by the Indianapolis Metropolitan Planning Organization.

Table 16: Short-Term Economic Impacts (Millions)

Impact	Red Line Phase I
Labor Income	\$36.5
Value Added	\$50.0
Output	\$91.8

Notes: The cost excludes costs of right-of-way acquisition, financing, and vehicles. Vehicles are excluded because they are purchased outside of the Indianapolis region. Total output is a combined effect of direct, indirect and induced.

Table 17: Long-Term Employment Impacts from O&M Expenses

Types of Effects	Red Line Phase I
O&M Expenditure (millions)	\$5.8
Permanent Jobs	93

Table 18: Long-Term Annual Economic Impacts from O&M Expenses (millions)

Impacts	Red Line Phase I
Labor Income	\$3.9
Value Added	\$6.0
Output	\$9.8

Note: Total Output is a combined effect of direct, indirect, and induced.

Table 19: Long-Term Annual Economic Impacts from Vehicle Operation Cost Savings

Impact	Red Line Phase I	Full Build
Permanent Jobs	30	163
Labor Income (millions)	\$1.5	\$8.5
Value Added (millions)	\$2.8	\$15.2
Output (millions)	\$4.5	\$24.4

Note: All impacts from VOC Savings are induced; there are no direct or indirect impacts.

10.5 Impact on Gross Regional Product

Economic value added within a region is equivalent to an increase in the gross regional product. When combining the short term short term value added from Table 5 with the long term annual value added from Tables 7 and 8, the Red Line Phase I is expected to add \$244 million to the Gross Regional Project through 2040.

10.6 Economic Development Impacts

Figure 3 summarizes the breakdown of existing building square footage in the Red Line Phase I study areas.

Figure 15: Red Line Phase 1 Study Area, Building Square Footage - 2014

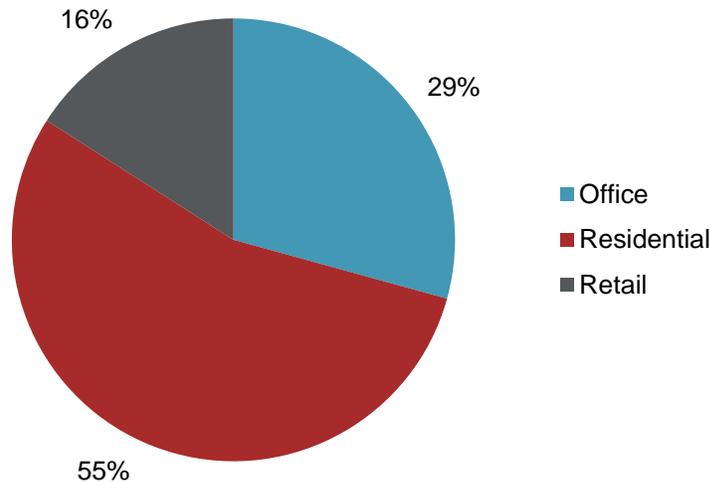


Table 9 shows the expected new real estate development along the proposed route.

Table 20: New Real Estate Development in 2040 (square feet)

Use	Red Line Phase I
Office	230,000
Residential	560,000
Retail	125,000
Total	915,000

The results of this analysis are intended to provide a sense of the magnitude and timing of development that may be generated by the proposed transit improvements. The projections are based on today's best available data. Conditions that could influence the underlying analytical assumptions may change over time and alter the projected results. For example, the real estate market in Indianapolis is not something that the Indy MPO or transit authority can control, but it could impact future development. In contrast, there are some factors that affect successful transit oriented development that are within the power of the public sector and transit authority. These include:

- Outreach and marketing that emphasizes the “newness” of the service. This is not an old service repackaged and has the potential to provide new opportunity.
- Making design decisions that relay permanence. As noted above, developers are typically more comfortable investing dollars in projects that are located near fixed

transit and, while BRT is not a fixed rail system, elements of the system can be designed to relay a more permanent feel.

- Auxiliary investments in pedestrian improvements and other transit supportive infrastructure. Making sure that the transit stops are accessible is an important element of a successful, well-utilized system.
- Implementation of policies that support transit and transit oriented development.

11 Appendix C: Indy Connect Economic Impact Analysis - Impacts on Affordable Housing

October 5, 2016

The Indy Connect Central Indiana Transit Plan includes three bus rapid transit (BRT) routes and enhanced local bus service in Marion County. These enhancements will support economic growth while meeting the expected demand for frequent, reliable, and safe transit service in the region.

This document presents an assessment of existing housing affordability conditions along the proposed BRT corridors, and identifies locations within the study area that may be susceptible to changes in overall affordability in the scenarios.

The project team assessed the benefits separately for two scenarios:

- Red Line Phase I – this scenario includes the Red Line from 66th Street to Hanna Avenue. It is assumed that this scenario will be complete in 2018.
- Full Build – this scenario includes the entire Red Line in Marion County (from county line to county line), the Blue Line, the Purple Line, and the increase in local bus service. It is assumed that this scenario will be completed in 2021.

11.1 Methodology

Following is a summary of the process used to assess affordable housing.

1. Evaluate existing conditions in the study area. The study team looked at several categories of Census Block Group level data from the 2014 5-year American Community Survey for all blocks within ½-mile of the proposed BRT lines. The ½-mile radius buffer is consistent with the focus areas of the residential property value and transit-oriented development impact analyses. In total, there are 231 Census Block Groups along the corridor – 89 along the Red Line Phase 1 and an additional 142 along the full-build that includes the Red Line Phase 2, the Purple Line, and the Blue Line. Though the proposed Red Line extends into Hamilton and Johnson Counties, the scope of this study is restricted to Marion County. Additionally, while the proposed full-build scenario includes enhanced bus service along non-BRT routes, there is no empirical evidence that bus service impacts property value or transit-oriented development. Because these factors directly affect housing costs, and no bus-related impacts are expected, no housing affordability impacts along these corridors were considered.
2. Identify all census blocks and tracts within that study area buffer and for each block or tract, and collect data from the US Census Bureau and other sources regarding existing:
 - a. Transit dependence;
 - b. Income distribution;
 - c. Household demographic characteristics;
 - d. Number of housing units; and

- e. Rental lease rates and residential property values.
3. Gather additional information on residential lease rates through interviews conducted as part of the economic development assessment.
4. Use the results of economic development analysis and demographic/economic data analysis to identify tracts and blocks that are likely to be most impacted by the planned improvements.

11.2 Results

The following sections present the qualitative and quantitative findings of the affordable housing analysis.

11.2.1 Low Income Households

Of particular interest when considering the overall affordability of an area is the share of low income households. According to the United States Department of Housing and Urban Development, households earning less than 80 percent of the area median income are considered to be low income. There are several categories of low income, including “very low income” (households earning 30 to 50 percent of the area median income) and “extremely low income” (households earning less than 30 percent of area median income). For this analysis, the study team looked at all “low income” households, encompassing each of the three categories.

While the “area median income” often reflects the metropolitan area median, this study utilizes the median in Marion County. This is done for the following reasons:

- The scope of the study is limited to Marion County;
- A large majority of the BRT investment would occur in Marion County;
- This analysis was done in conjunction with the economic development and property value impact analyses and thus reflects the same study area; and
- The median income in Marion County does not differ greatly from Indianapolis as a whole, \$42,378 and \$40,076, respectively.³⁴

³⁴ While the study team recognizes that comparison to the metropolitan statistical area is ideal, skewing the median income by including a large number of households that are not directly adjacent to the proposed BRT alignment within Marion County is not appropriate. The inclusion of the larger MSA would show a higher concentration of poverty in Marion County than is reflected in this analysis.

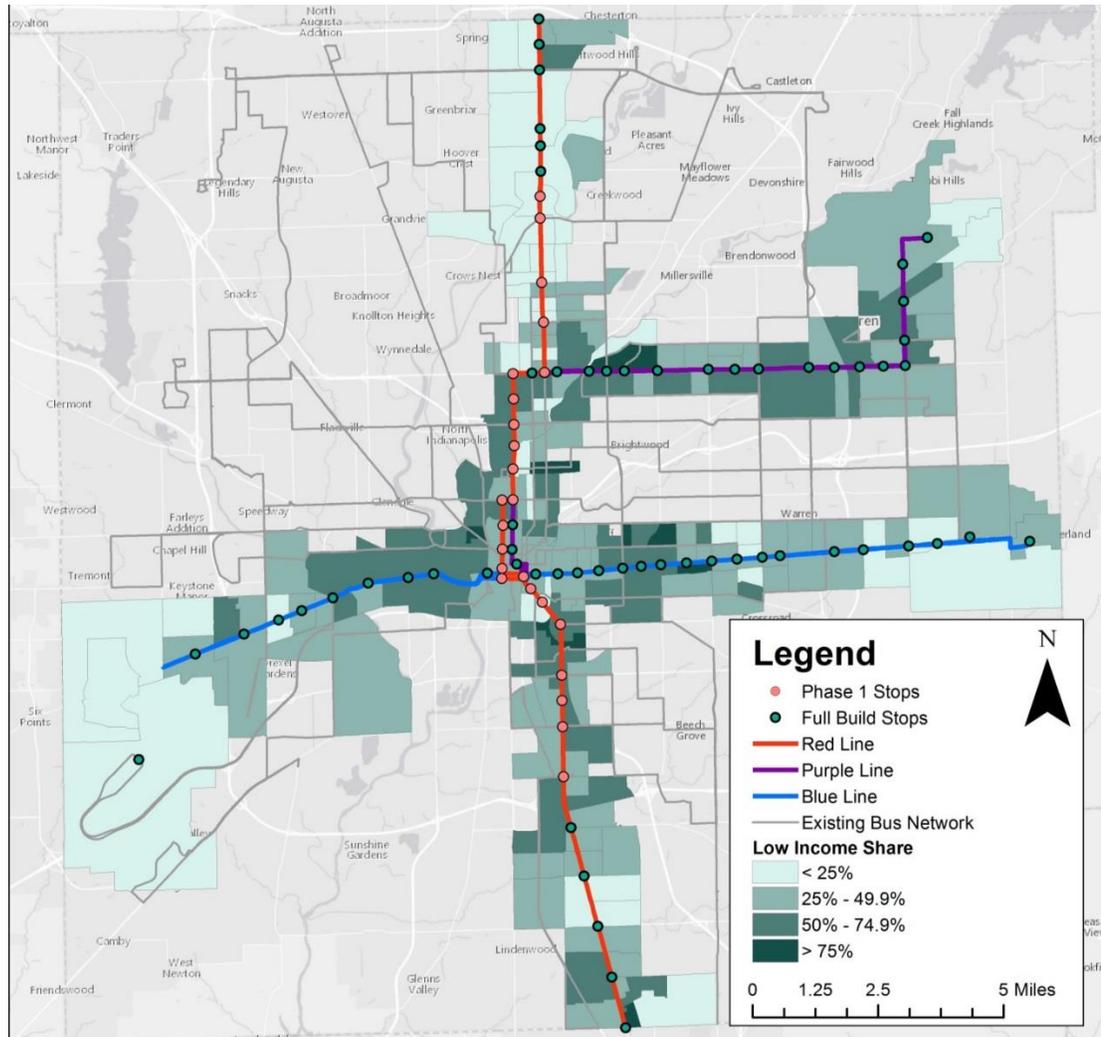
As presented in Table 21, the Census Data shows that more than three-quarters of the Census Blocks in the study area contain at least 25 percent of households that are low income and 40 percent have at least half of households earning less than 80 percent of the area median. These low income residents are more likely than other households to struggle with affordability issues. This information is also displayed in

Figure 16.

Table 21: Share of Low Income Households by Block Group

	Total Block Groups			Share of Block Groups		
	Red Line Phase I	Full Build	Total	Red Line Phase 1	Full Build	Total
>25% Low Income Households	67	117	184	75%	82%	80%
>50% Low Income Households	36	57	93	40%	40%	40%
>75% Low Income Households	4	6	10	4%	4%	4%

Figure 16: Share of Low Income Households by Census Block



The darker shaded areas in

Figure 16 represent higher concentrations of low income households within each Block Group. The majority of Block Groups along the Phase 1 core contain at least 25 percent

low income households. Concentrations of poverty increase along the western portion of the proposed Blue Line and along the Purple Line.

11.2.2 Transit Dependence

Consistent with the Indianapolis Metropolitan Planning Organization’s Transit Oriented Development Strategic Plan (April 2015), households with an income under \$25,000 per year are considered to be transit dependent, having been statistically shown to have limited access to personal vehicles. For context, \$25,000 is 58 percent of the Marion County study area median income.³⁵ The Census data shows a high incidence of transit dependence within the region.

The most recent Census data shows that within more than two-thirds of the Block Groups, more than 25 percent of households are transit dependent. More than one-quarter of the block groups contain more than 50 percent transit dependent households, noted in Table 22 and depicted geographically in Figure 17.

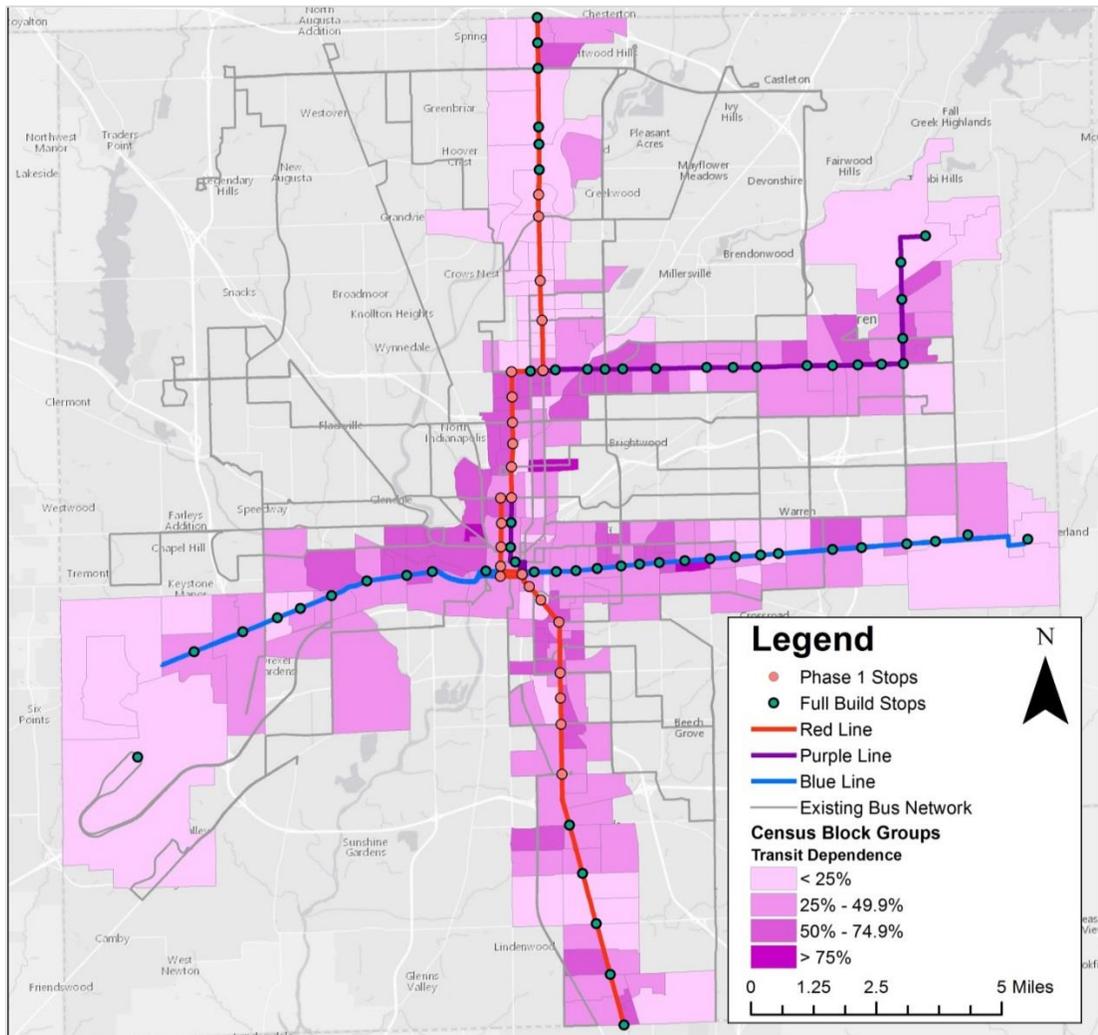
Table 22: Share of Transit Dependent Households by Block Group

	Total Block Groups			Share of Block Groups		
	Red Line Phase I	Full Build	Total	Red Line Phase 1	Full Build	Total
>25% Transit Dependent Households	59	107	166	66%	75%	72%
>50% Transit Dependent Households	24	35	59	27%	25%	26%
>75% Transit Dependent Households	2	1	3	2%	1%	1%

Similar to the low income conditions, Figure 17 shows some transit dependence along the Red Line Phase 1 core and higher transit dependence along the Blue and Purple Lines in the Full Build scenario. The north side of the Red Line Phase 1 has much lower concentrations of transit dependent households than any other corridor.

³⁵ This share decreases to 35.9 percent when considering the FY2015 HUD Median Family Income for Indianapolis of \$69,700. This encompasses a larger area, much of which will not be directly served or impacted by the new BRT system.

Figure 17: Share of Transit Dependent Households by Census Block Group



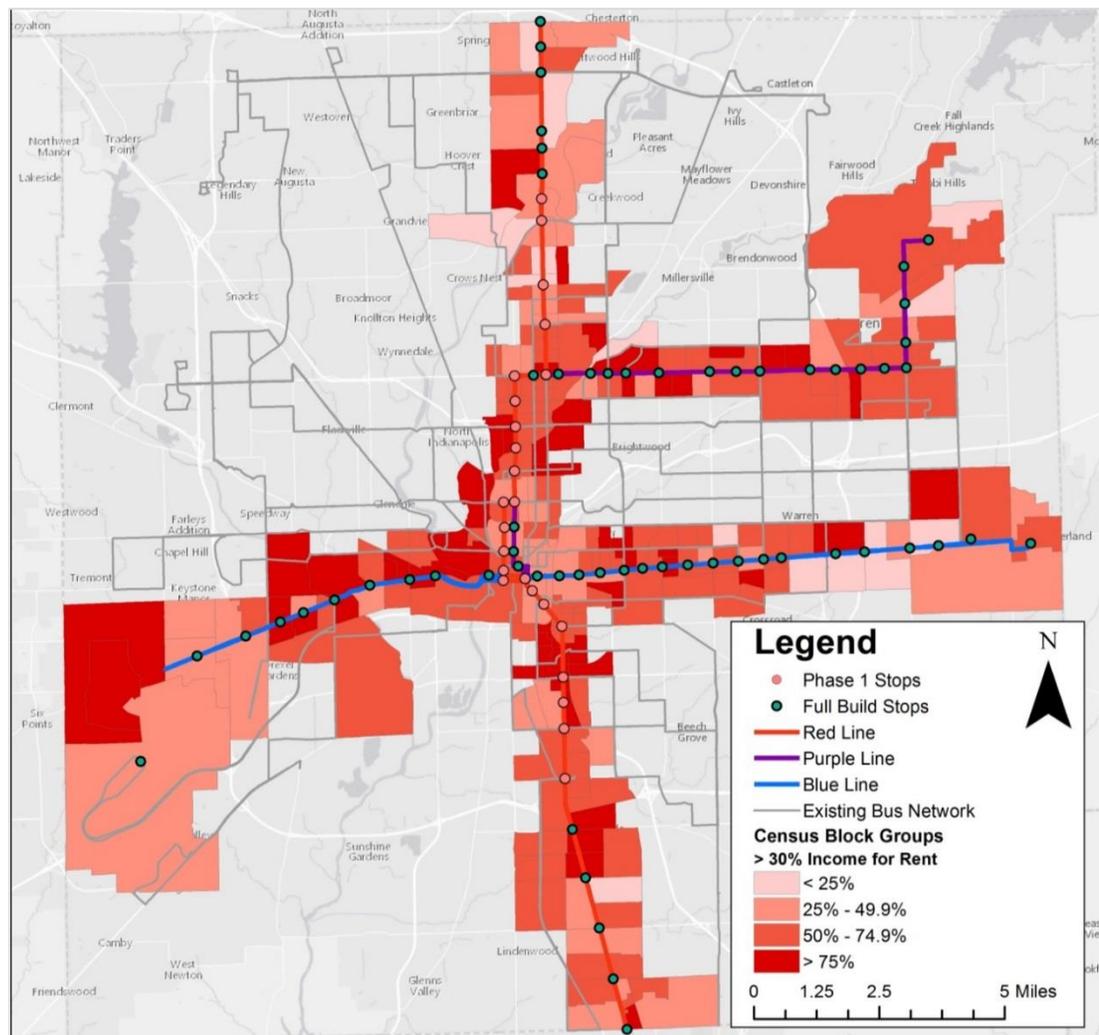
11.2.3 Rent-Burdened Households

Another metric to assess the overall affordability conditions in the community is the share of households that are rent-burdened. The standard industry rule-of-thumb is that households paying more than 30 percent of their income for rent (including utilities) are considered rent-burdened. Paying such a large share of income toward housing reduces the amount of available income for other expense, such as food, clothing, and transportation. The Census data indicate that housing costs account for a large portion of monthly expenses for much of the study area population. Approximately 70 percent of the Block Groups within the study area have more than 50 percent of rent-burdened households, and nearly one-quarter of block groups have more than 75 percent of households that are rent-burdened.

Table 23: Share of Rent-Burdened Households by Block Group

	Total Block Groups			Share of Block Groups		
	Red Line Phase I	Full Build	Total	Red Line Phase 1	Full Build	Total
>25% Rent Burdened Households	85	131	216	96%	92%	94%
>50% Rent Burdened Households	61	100	161	69%	70%	70%
>75% Rent Burdened Households	20	35	55	22%	25%	24%

Figure 18: Share of Households Paying More than 30% of Income for Gross Rent by Census Block Group



As shown in Figure 3, a large portion of households in the study area are rent-burdened. Nearly all of the Census Blocks in the study area have at least one-quarter of households paying more than 30 percent of their income for housing. The area between Fountain Square and Garfield Park has a high concentration of rent burdened households, with more than 75 percent rent-burdened. In the Full Build scenario, the Blue Line West and the western end of the Purple Line also have higher concentrations of rent-burden.

The general measure of rent burden is more than 30-percent of household income spent on gross rent. As an indication of the general affordability, the study team also looked at heavily rent-burdened households, those spending more than 40 percent of their income on housing expenses. This analysis found 33 Block Groups for the Red Line Phase I that pay more than 40 percent of their income for housing expenses, and an additional 63 Block Groups, or 42 percent, within ½ mile of the Full Build routes.

Table 24: Share of Heavily Rent-Burdened (More than 40% of Income) Households by Block Group

	Total Block Groups			Share of Block Groups		
	Red Line Phase I	Full Build	Total	Red Line Phase 1	Full Build	Total
>25% Heavily Rent Burdened Households	74	122	196	83%	86%	85%
>50% Heavily Rent Burdened Households	33	63	96	37%	44%	42%
>75% Heavily Rent Burdened Households	4	9	13	4%	6%	6%

Figure 19: Share of Households Paying More than 40% of Income for Gross Rent by Block Group

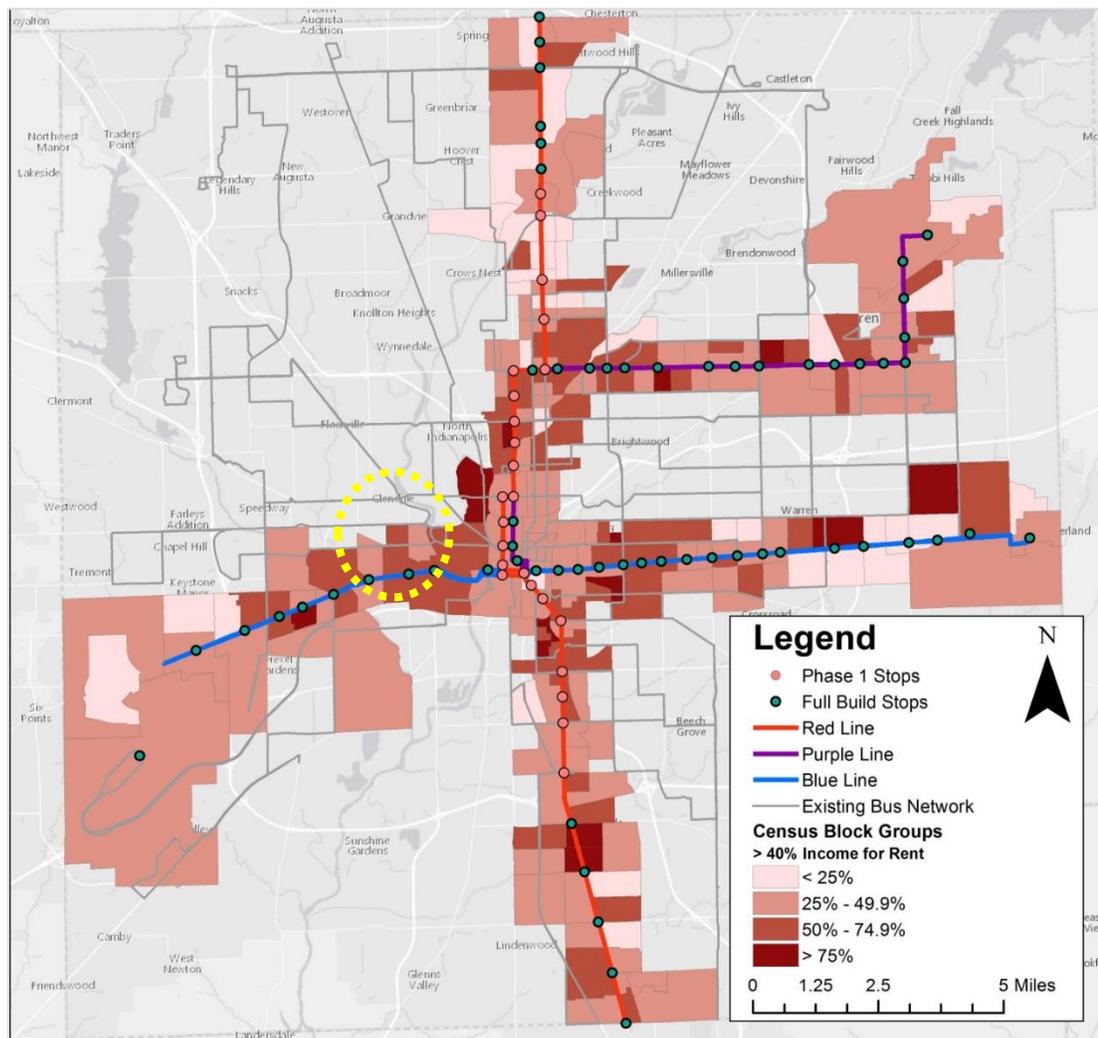


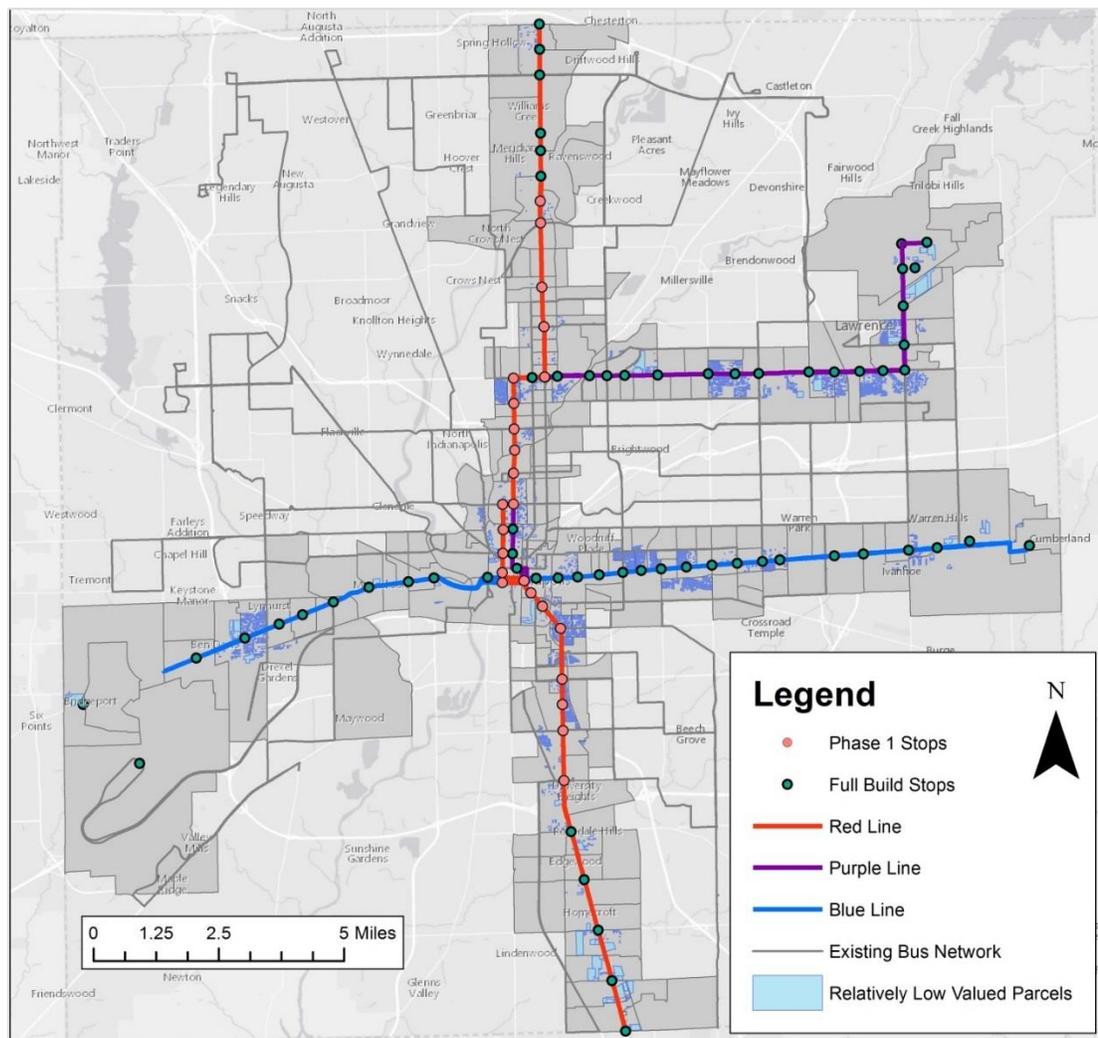
Figure 19 shows that, with the exception of the northern end of the Red Line Phase 1 and a few areas on the eastern end of the Blue Line, most of the Census Block Groups have at least one-quarter of households that pay more than 40 percent of their income for housing. The Block Group circled yellow in Figure 19 has a high concentration of transit-dependent, rent-burdened households. While this area is within ½-mile of the proposed Red Line improvements, the elevated I-65 overpass may present a psychological barrier to walkability and future development.

When considering all of these affordability factors, there are 88 Census Blocks with more than 50 percent of households defined as low income and more than 50 percent of households considered rent burdened – 35 Block Groups in the Red Line Phase 1 Study Area and 53 Block Groups in the Full Build Study Area. These Block Groups are considered “at-risk” for displacement and turnover if the property values along the alignment increase.

11.2.4 Current Property Values and Costs

Based on the assessment described above, a significant number of households within the study area likely already struggle with housing affordability issues. The other side of the housing affordability issue, however, is related to the availability of properties that could be redeveloped at a relatively low cost and resold or leased at a higher price. Building upon the assessment of residential property rates conducted for the economic development assessment, the study team identified parcels with relatively low assessed values, including both land and improvements, compared to the study area as a whole. Figure 5 highlights the residential parcels that have combined land and building values less than \$52,000 as of 2014. This value represents less than one-half of the weighted average of residential property values by type for the full build study area (\$105,245).³⁶ For purposes of this analysis, these properties are considered susceptible to redevelopment due to their relative cost.

Figure 20: Relatively Low Valued Parcels



³⁶ A detailed table of the number of properties and property values by type can be found in the property value analysis section of the IndyConnect Economic Impact Analysis Final Report.

11.2.5 Areas Susceptible to Increased Housing Affordability Issues

Combining the demographic data with the results of the property value and economic development assessments, the study team identified areas susceptible to increased affordability concerns. These areas reflect the interaction of many factors. On the demographic side, they are Block Groups where at least half of households are rent burdened and at least half of households are considered low income. These areas also see concentrations of relatively low residential property values and are in areas that have been identified or discussed as areas with high potential for transit-oriented development.

As shown by the dashed circles in Figure 21, four key areas have been identified. Two of the areas are along the Red Line Phase 1, one is on the Blue Line, and one is on the Purple Line. While there are no definitive plans for these areas that would reduce overall affordability, should the circumstances outlined in this document materialize, these areas are likely to see affordability issues based on current demographics.

Figure 21: Areas Susceptible to Increased Housing Affordability Issues

