

Transit Improvement Program

Technical Memorandum

December 12, 2017

Executive Summary

This report estimates the short-term economic impacts associated with the proposed development and construction of the Nashville Transit Improvement Program, including Light Rail Transit (LRT) projects and expansion and improvements to the Nashville Metropolitan Transit Authority (MTA) existing local bus network. The impact estimates are supplied at the county level.

The Study Team used IMPLAN® economic modeling software, which applies multipliers specific to the local economy, to generate estimates of economic impact. The economic impacts estimated in the findings below are based on the current cost estimates for the proposed individual transit projects and are subject to alteration upon changes to their scope and cost.

Summary of Findings

The total capital investment for the Transit Improvement Program is estimated to be over 5.354 billion in 2017 dollars, spent over 14 years of the project's development and construction. During this time, the transit system development and expansion will support an estimated 44,753 local jobs, represented in job-years,<sup>1</sup> associated with more than \$3.112 billion in labor income for Davidson County. This spending will contribute an estimated \$4.016 billion to the gross regional product (GRP) for Davidson County over the life of the project.

Economic Impact of Nashville Transit Improvement Program Capital Costs 2018 to 2032 (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	27,864	\$2,060	\$2,390	\$4,383
Indirect Effect	7,549	\$484	\$736	\$1,187
Induced Effect	9,341	\$568	\$890	\$1,424
<b>Total Effect*</b>	<b>44,753</b>	<b>\$3,112</b>	<b>\$4,016</b>	<b>\$6,994</b>

Source: Wilmot Inc. and IMPLAN online (2015)

During the development and construction period, operations and maintenance spending will total approximately \$679 million. Bus system improvements will be \$541 million and LRT will account for the remaining \$138 million in operations and maintenance spending from 2018-2032. This spending will support an estimated 9,136 local jobs, represented in job-years, associated with more than \$548 million in labor income for Davidson County.

<sup>1</sup> Job years: one person employed for one year, whether part-time or full-time.

\*Throughout document, numbers in tables do not always sum due to rounding.

Economic Impacts of Operations and Maintenance Spending 2018-2032 (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	6,319	\$370	\$475	\$658
Indirect Effect	1,105	\$75	\$108	\$186
Induced Effect	1,712	\$104	\$163	\$261
<b>Total Effect</b>	<b>9,136</b>	<b>\$548</b>	<b>\$746</b>	<b>\$1,105</b>

Source: Wilmot Inc. and IMPLAN online (2015)

## Introduction

Investment in transit infrastructure can impact economic activity and support or create jobs in an economy. Transit infrastructure capital investments support short-term construction jobs during the development and construction of an infrastructure project, providing a short-term stimulus to a local economy. While important, this short-term impact is only one of many ways that transit spending can impact the local economy. Sustained economic growth from operations and maintenance spending and productivity impacts are also major contributors to transit-related jobs and growth, but are not evaluated in this study.

This report evaluates the short-term economic impact to Davidson County of the capital investment of the new transit infrastructure. The Study Team estimates that the \$5.354 billion in capital spending for the Nashville Transit Improvement Program will result in a total of \$4.016 billion in value added to Davidson County's economy and support an estimated 44,753 local jobs, in job-years, over the 14 years of the project's development and construction.

## Background

Metro is currently in the planning and development stages for several proposed multimodal transit and transportation infrastructure improvements, as first proposed in the 25-year nMotion Strategic Transit Plan (September 2016) and the nMotion High Capacity Briefing Book (August 2017) and now more fully articulated by the Let's Move Nashville Plan. The proposed Nashville Transit Improvement Program includes a combination of Light Rail Transit (LRT) and Rapid Bus infrastructure, as well as local bus improvements to provide a robust, countywide, multimodal transportation network for residents and visitors. While funding and planning for these two transit improvements will occur in tandem, this report will treat them as two separate components: (1) LRT transit project composed of 5 LRT corridor projects including the downtown tunnel and commuter rail improvements along with (2) the Bus Improvements project which includes development of the 4 Rapid Bus corridors, and the expansion and improvements to MTA's existing local bus network.

## General Methodology

This report evaluates the short-term impacts to the economy of Davidson County, Tennessee from the development and construction of the transit projects that make up the proposed system. Short-term economic impacts from infrastructure investments may include jobs, wages, output, value-added, and increased tax revenues. These metrics are more fully defined in the sections below. The main objective of an economic impact analysis is to determine the effect of a change in the demand for goods and services on the level of economic activity in a given area. This demand change can be the result of decisions made by the government (e.g., investing in transit infrastructure), firms (e.g., investing in a new building) or households (e.g., increased spending due to a tax abatement).

## Background on IMPLAN® Model

To measure the economic impacts associated with transit and other transportation investments in the City of Nashville and Davidson County, the Study Team used IMPLAN®, an input-output based regional economic assessment modeling system developed and maintained by the IMPLAN® Group LLC. IMPLAN® consists of a software package and data files that are updated annually. The IMPLAN® data files include transaction information (intra-regional and import/export) on 536 distinct industrial sectors (corresponding to four- and five-digit North American Industry Classification System [NAICS] codes) and data on more than 20 different economic variables, including employment, output, and value added. For this study, the IMPLAN® system is populated with the most recent data available and used by the Study Team to estimate the direct, indirect, and induced impacts, explained below, associated with active transportation. The total economic impact is the sum of these direct, indirect and induced effects for the project being evaluated.

- **Direct effect:** Refers to the economic activity occurring as a result of direct spending by businesses or agencies located in the study area (e.g. project owner purchasing materials and services from suppliers for construction activities);
- **Indirect effect:** Refers to the economic activity resulting from purchases by local suppliers to the directly affected businesses or agencies (e.g., spending by suppliers on office rent, equipment, etc.); and
- **Induced effect:** Represents the increase in economic activity, over and above the direct and indirect effects, associated with increased 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 (e.g., employees of construction contractors and their suppliers spend money to buy groceries or take their families to dinner).

## Description of Economic Impact Output

Typically, economic impacts are measured in terms of industry output, “value added,” employment, and tax revenue, as is the case when using IMPLAN®. While output is the broadest measure of economic activity and refers to the total volume of sales, “value added” is the value a company adds to a product or service. It is measured as the difference between the amount a company spends to acquire that product and its value at the time that product 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., sales tax).

With respect to employment, two impact metrics are calculated: (1) labor income and (2) jobs. Labor income includes employee compensation and proprietary income. Employee compensation, in turn, consists of wage and salary payments as well as benefits (health, retirement, etc.) and employer paid payroll taxes (employer side of social security, unemployment taxes, etc.). Proprietary income consists of payments received by self-employed individuals (such as doctors and lawyers) and unincorporated business owners. The job impact measures 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 industry. Strictly speaking, they should not be interpreted as permanent jobs either, but rather as job-years. A job-year can be defined as one person employed for one year, whether part-time or full-time.

### Economic Impacts of the Light Rail Transit Capital Expenditures

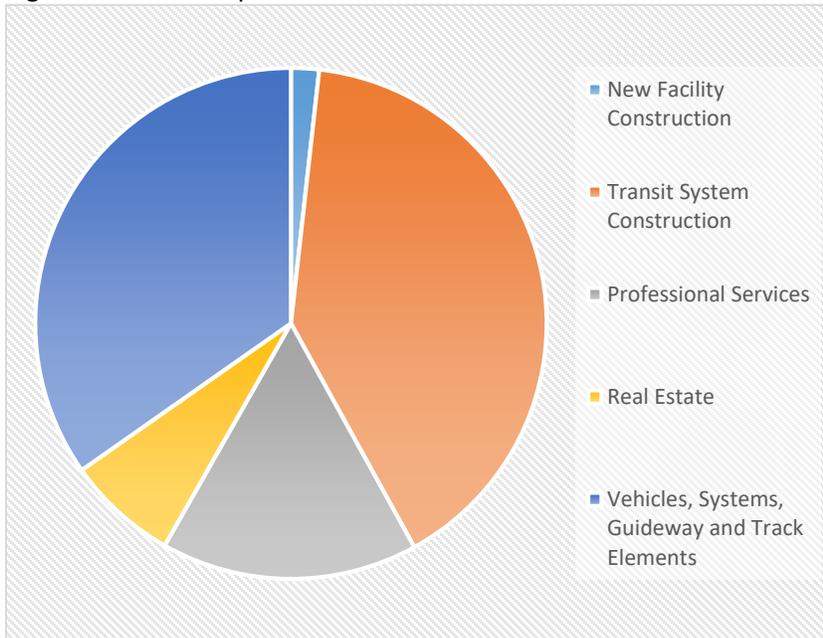
The total capital cost to develop the LRT Corridor Transit System, is estimated to be \$4.362 billion in 2017 dollars (Table 1). The total capital cost is broken down by LRT corridor and includes cost allocated into different categories, such as vehicle purchases, systems, guideway and track elements, stations, site work and construction of stops and terminals, construction of new support facilities, land acquisition and improvements, and professional services (Figure 1). Construction of the proposed LRT corridors is expected to begin in 2018 and continue in phases through the middle of 2032. The corridors will begin service in series upon completion, with the first corridors projected to begin in 2023 and the final corridor projected to begin in late 2032.

Table 1. Uninflated LRT Project Capital Costs 2018 to 2032 (\$ in millions)

Corridor or Project	Mode	Total Capital Cost
Gallatin Pike	Light Rail	\$789
Murfreesboro	Light Rail	\$828
Nolensville	Light Rail	\$666
Charlotte	Light Rail	\$697
Northwest Corridor	Light Rail	\$252
Downtown Connector	Light Rail and Rapid Bus	\$936
O&M Facility - Primary	Light Rail	\$100
O&M Facility - Secondary	Light Rail	\$64
Music City Star	Commuter Rail	\$30
<b>Subtotal</b>		<b>\$4,362</b>

Source: HDR Inc., Summary of Program Costs (12/7/17)

Figure 1. LRT Concept Estimate



Source: HDR Inc., SCC Summary

Because the spending categories in Figure 1 have different types of services and products, each category was modeled separately before being aggregated into an overall economic impact for Davidson County. The Study Team used IMPLAN's analysis-by-parts (ABP) methodology to prevent double-counting.

Local companies and the local labor force will contribute significantly to supplying goods and services during the construction and operation of these new transportation facilities. However, the Study Team presumes that the vehicles (buses and trains) will

be manufactured elsewhere since the IMPLAN® model does not include bus or train car manufacturing capacity local to Nashville. In order to generate conservative estimates of impacts, some potentially local capital expenditures were excluded from the economic model. For example, while it is possible that local companies have the capability to supply other key technologies, including fare collection, signaling and communications technology, the Study Team presumed that these more specialized technology-driven services will be largely sourced outside of the study area. To the extent that these excluded services are ultimately sourced from businesses within the Nashville region, the estimates of economic impact presented in this study are understated.

Table 2. Economic Impact of LRT Project Capital Costs Estimate 2018 to 2032 (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	23,310	\$1,747	\$2,052	\$3,716
Indirect Effect	6,387	\$404	\$617	\$992
Induced Effect	7,832	\$476	\$746	\$1,194
<b>Total Effect</b>	<b>37,530</b>	<b>\$2,627</b>	<b>\$3,415</b>	<b>\$5,902</b>

Source: Wilmot Inc. and IMPLAN online (2015)

In total, the development and construction of the LRT projects will support approximately 37,530 full and part-time jobs in Davidson County. The Study Team estimates that approximately 23,310 jobs will be directly associated with project development while the remaining jobs will take the form of indirect (business-to-business transactions) and induced (household spending) impacts (Table 3).

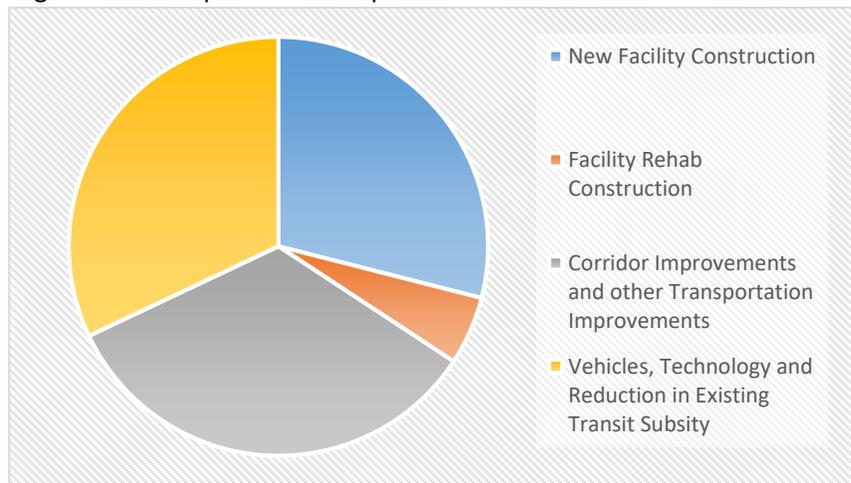
The LRT projects will also support \$5.902 billion in sales of goods and services by county businesses during the development period, leading to a gross regional product of \$3.415 billion. Note that these

impacts are expected to transpire over the course of the projects' development and construction phases, and should not be considered annual, but rather the total impacts over 14 years of construction and development for the LRT transit system.

### Economic Impacts of the Bus Improvement Capital Expenditures

The total capital cost for the development and construction portions of the the Bus Improvement is estimated to be nearly \$992 million (Table 3). The total capital costs are allocated into different improvement categories assigned by MTA, each of which include construction of a number of new facilities, to include 12 neighborhood transit centers, 7 mini-transit hubs, a secondary transit hub, a new bus maintenance facility and additional passenger waiting shelters. This estimate also includes rehabbing of the existing facilities, improvements to existing roadways and corridors, and a reduction to the existing transit subsidy (Figure 2). The anticipated system improvements and expansions of the local bus network will begin in 2018 and continue through 2023.

Figure 2. Bus Improvement Capital Cost Estimate 2018 - 2032



Source: HDR Inc., Summary of Program Costs 2018 to 2032

Table 3. Uninflated Bus Improvement Project Costs: 2018 to 2032 (\$ in millions)

Bus System Improvement Cost Categories	Mode	Total Capital Cost
Make Service Easier To Use	Bus	\$29
Improve Existing System	Bus	\$288
Improve Access to Transit	Bus	\$9
Make Service More Comfortable	Bus	\$83
Develop a Network of Regional Transit Centers	Bus	\$145
Bordeaux	Rapid Bus	\$45
Dickerson	Rapid Bus	\$42
Hillsboro	Rapid Bus	\$42
West End	Rapid Bus	\$104
Reduction in Existing Transit Subsidy (6 years)	Other	\$90
Other Transportation Improvements	Other	\$114
<b>Total</b>		<b>\$992</b>

Source: HDR Inc., Summary of Program Costs 2018 to 2032

Similar to the LRT analysis, each Bus Improvement spending category was modeled separately before being aggregated into overall economic impact for Davidson County. As was the case with the LRT analysis, the Study Team was careful to avoid double counting.

As mentioned previously, not all goods and services required to make the transportation improvements envisioned for Metro are available in the region. The Study Team presumes that these costs, including the purchase of busses or other specialized technology, cannot be sourced within the study area and excluded them from the economic impact analysis. To the extent that these services are ultimately sourced from businesses within Davidson County, the estimates of economic impact presented in this study are not comprehensive and likely conservative.

Table 4. Economic Impact of Bus Improvements Capital Cost Estimate (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	4,554	\$313	\$338	\$668
Indirect Effect	1,161	\$81	\$120	\$195
Induced Effect	1,509	\$92	\$144	\$230
<b>Total Effect</b>	<b>7,224</b>	<b>\$485</b>	<b>\$601</b>	<b>\$1,092</b>

Source: Wilmot Inc. and IMPLAN online (2015)

In total, the Bus Improvement development and construction will support approximately 7,224 full and part-time jobs in Davidson County. The Study Team estimates that approximately 4,554 jobs will be directly associated with the project while the remaining jobs will take the form of indirect (business-to-business transactions) and induced (household spending) impacts (Table 4).

The Bus Improvement development and construction will also support approximately \$1.092 billion in augmented sales of goods and services by county businesses during the project period leading to a gross regional product of \$601 million (Table 4). Note that these impacts are expected to transpire over the course of the project's development and construction phases, and should not be considered annual, but rather the total impacts over 14 years of construction and development for the Bus Improvements.

### Economic Impacts of the Nashville Transit Improvement Program Capital Costs 2018-2032

The total capital investment for the Transit Improvement Program is estimated to be over 5.354 billion in 2017 dollars, spent over 14 years of the project's development and construction. This total includes the \$992 million (Table 3) in Bus Improvements and the \$4.362 billion (Table1) for the Light Rail Transit project. Over the life of the project, the transit system development and expansion will support an estimated 44,753 local jobs, represented in job-years<sup>2</sup>, associated with more than \$3.112 billion in labor income for Davidson County. This spending will contribute an estimated \$4.016 billion to the gross regional product (GRP) for Davidson County over the life of the project (Table 5).

<sup>2</sup> Job years: one person employed for one year, whether part-time or full-time.

Table 5. Economic Impact of Nashville Transit Improvement Program Capital Costs 2018 to 2032 (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	27,864	\$2,060	\$2,390	\$4,383
Indirect Effect	7,549	\$484	\$736	\$1,187
Induced Effect	9,341	\$568	\$890	\$1,424
<b>Total Effect</b>	<b>44,753</b>	<b>\$3,112</b>	<b>\$4,016</b>	<b>\$6,994</b>

Source: Wilmot Inc. and IMPLAN online (2015)

Over 14 years of the project's construction and development, there will be an estimated \$750 million in value added for Davidson County and 8,359 local jobs supported, measured in job-years, per billion dollars in spending (Table 6).

Table 6. Economic Impact of Nashville Transit Program Capital Investment Per \$ Billion of Spending (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	5,204	\$385	\$446	\$819
Indirect Effect	1,410	\$90	\$138	\$222
Induced Effect	1,745	\$106	\$166	\$266
<b>Total Effect</b>	<b>8,359</b>	<b>\$581</b>	<b>\$750</b>	<b>\$1,306</b>

Source: Wilmot Inc. and IMPLAN online (2015)

### Economic Impact of All Operations and Maintenance 2018 -2032

During the development and construction of the Nashville Transit Improvement Program, spending in operations and maintenance will begin as service begins. Durin this period, operations and maintenance spending (Table 7 and 8) will include operations of expanded local bus network, development and operations of rapid bus corridors and the beginning of operations and maintenance of LRT when the corridors begin to run.

Table 7. Uninflated LRT Project Operations and Maintenance Costs: 2018 to 2032 (\$ in millions)

Corridor or Project	Mode	Total Capital Cost
Gallatin Pike	Light Rail	\$44
Murfreesboro	Light Rail	\$23
Nolensville	Light Rail	\$19
Charlotte	Light Rail	\$0
Northwest Corridor	Light Rail	\$28
Downtown Connector	Light Rail and Rapid Bus	\$20
O&M Facility - Primary	Light Rail	\$0
O&M Facility - Secondary	Light Rail	\$0
Music City Star	Commuter Rail	\$4
<b>Subtotal</b>		<b>\$138</b>

Source: HDR Inc., Summary of Program Costs (12/7/17)

Table 8. Uninflated Bus Improvement Operations and Maintenance Costs: 2018 to 2032 (\$ in millions)

Bus System Improvement Cost Categories	Mode	Total Capital Cost
Make Service Easier To Use	Bus	\$11
Improve Existing System	Bus	\$403
Improve Access to Transit	Bus	\$116
Make Service More Comfortable	Bus	\$1
Develop a Network of Regional Transit Centers	Bus	\$10
Bordeaux	Rapid Bus	\$0
Dickerson	Rapid Bus	\$0
Hillsboro	Rapid Bus	\$0
West End	Rapid Bus	\$0
Reduction in Existing Transit Subsidy (6 years)	Other	\$0
Other Transportation Improvements	Other	\$0
<b>Total</b>		<b>\$541</b>

Source: HDR Inc., Summary of Program Costs 2018 to 2032

During the development and construction period, operations and maintenance spending will support an estimated 9,136 local jobs, represented in job-years, associated with more than \$548 million in labor income for Davidson County (Table 9). This includes longer-term jobs associated directly with the operations and maintenance of the transit system, as well as indirect (business-to-business transactions) and induced (household spending) impacts.

Table 9. Economic Impacts of Operations and Maintenance Spending 2018-2032 (\$ in millions)

Impact Type	Employment	Labor Income (\$)	Value Added (\$)	Output (\$)
Direct Effect	6,319	\$370	\$475	\$658
Indirect Effect	1,105	\$75	\$108	\$186
Induced Effect	1,712	\$104	\$163	\$261
<b>Total Effect</b>	<b>9,136</b>	<b>\$548</b>	<b>\$746</b>	<b>\$1,105</b>

Source: Wilmot Inc. and IMPLAN online (2015)

## Conclusion

This memo has included estimates of the short-term economic impacts of transit investment in development and construction of the Nashville Transit Improvement Program, as well as the longer-term economic impacts estimated to result from sustained increases in operations and maintenance funding to operate the transit system developed in the Nashville Transit Improvement Program.

Investment in transit infrastructure can also spur a third type of economic impact, described as a productivity impact. These productivity impacts occur as a result of reductions in costs to businesses and households associated with improved access to transit. Transit systems can improve the productivity of businesses by increasing businesses access to and the reliability of labor markets and skills. Transit systems can improve the productivity of a household by reducing transit costs, saving time, and improving access to jobs and other necessities.

While the economic impacts of these types of benefits will not be discussed in this report, future memos will quantify the value of some of these types of transit benefits including, travel time savings, reduced travel costs, and mobility benefits to businesses and households.

