

**Consideration of
Economic Development Potential:
Light Rail Transit in
Durham and Orange Counties, North Carolina**

July 20, 2015

Prepared For:



**William L. Bishop
Lucy L. Gallo**



EXECUTIVE SUMMARY

Construction of the proposed 17.1 mile Durham-Orange Light Rail Transit Project (DOLRT) will benefit the economies of the 16-county Research Triangle Region and the entire state. The DOLRT will connect major regional activity centers such as the UNC Hospitals, Duke University, Duke and Durham VA Medical Centers, and downtown Durham.

The 17-station DOLRT line has the potential to spur the type of new development sought after by a highly educated and economically important workforce and attract the businesses that rely on them. These are the very workers and employers that will help the region and the State of North Carolina remain competitive for decades to come.

Light Rail will create jobs and spur long-term economic development

The economic impact of the project will be substantial. Prospective new development within DOLRT station areas will:

- Support almost **20,000 new jobs** in Durham and Orange Counties
- Generate **10,000 additional jobs outside the rail station areas** within the two counties
- **Add several thousand additional jobs** in the 14 counties that comprise the balance of the Triangle Region, plus **1,300 more jobs** in the State's other 84 counties
- **Add \$4.7 billion of economic output each year in Durham and Orange Counties**, with **more than \$600 million** of additional economic output **statewide**
- Provide **more than \$175 million in annual tax revenues** to the towns, cities, counties, and State.

Building Light Rail will create jobs

Predevelopment DOLRT related economic benefits have already begun. As construction of the LRT system begins and private development gets underway in the rail station areas, additional jobs will be created:

- DOLRT construction will generate **1,000 jobs per year** on average.
- Construction of office and retail buildings near transit stations is projected to result in more than **530 jobs per year** on average.
- Construction of residential buildings in rail station areas is projected to result in approximately **740 jobs per year** on average.

Compact, transit-oriented neighborhoods resulting from DOLRT development can result in significant cost savings for local government. All new development requires investment in, operation, and maintenance of infrastructure and services related to roadways, fire and police protection, public utility, wastewater and solid waste. Increasingly dispersed infrastructure and services following conventional, often highway dependent, development patterns can significantly increase the cost of municipal services. Geographically compact development patterns centered around transit stations can reduce such costs while providing new opportunities, alternatives, and amenities (Litman 2015).

Astute investment in strategic transportation infrastructure can have significant impacts on economic development by leveraging large amounts of private investment. Not all types of transportation investments have the same scale or type of economic impact. In regions with mature and extensive roadway networks, like those in the Triangle, the most productive transportation investments are those that create new transportation alternatives and networks. These enable transformative economic development opportunities that cannot now be accommodated elsewhere in the Triangle region.

Much like the regional partnership that brought the decisively successful and transformative Research Triangle Park (RTP) into existence 57 years ago, DOLRT can catalyze the region's economic growth by enabling economic development that meets the growing national demand for compact, pedestrian-friendly, and amenity-filled neighborhoods and help the region continue to attract the highly skilled workforce on which it depends. With the implementation of DOLRT, the region will be well equipped to meet the needs of those businesses and people searching for the lifestyle and economic benefits of living in higher-density neighborhoods. The lifestyle and employment opportunities that can result from transit oriented development will augment rather than displace the high-quality, low-density suburban development that has occurred in the Triangle from since the 1950's.

Go Triangle's proposed investment in light-rail can be leveraged to unlock the full development potential of the rail station areas in Chapel Hill and Durham Counties, providing a substantial boost to economic development and helping to keep the region competitive for high-wage, high-skilled jobs in the coming decades. Construction of the light-rail system alone will generate more than a thousand jobs annually for a decade. When completed, the light-rail system will help support tens of thousands of jobs within the region and produce many millions of dollars of new tax revenue.

OVERVIEW

This paper considers prospective impacts of an economic development strategy focused on delivery of high quality transit-oriented development (TOD) along a state of the art light rail transit (LRT) line connecting the University of North Carolina at Chapel Hill, Duke University, the two respective medical centers, and the City of Durham. Such development could act as an “incendiary event”¹ ushering a period of renewed vigor in the Triangle’s development of knowledge-based industries. This strategy would capitalize on and reinforce the success of similarly transformative infrastructure investment decisions made 60-years ago related to development of the Research Triangle Park (RTP). Such a strategy would reinforce the value of the Triangle Region’s existing attributes and amenities and reinvigorate ongoing strategies and initiatives that continue to produce great success.

The dramatic rate of population growth anticipated for the Raleigh-Durham-Chapel Hill Triangle Region (Triangle or Region) will create significant challenges and even greater opportunities. The infrastructure investment decisions undertaken to accommodate the Region’s growth will frame the nature and extent of many economic opportunities, and guide future economic development. Foremost among economic development objectives must be attracting and retaining future generations of highest quality (“best and the brightest”) knowledge workers so as to maintain the productive and competitive advantages currently enjoyed within the Region. As competition for talent intensifies among vibrant centers of innovation and intellectual capital, it is increasingly clear that the rank and file of young highly-educated “Creative Class”² are attracted to a specific array of lifestyle opportunities and urban amenities; and that these are neither common nor widely available within the Triangle today. Millennials (and many others) increasingly seek compact, high quality, pedestrian oriented, mixed-use urban or semi-urban landscapes in which to live, work, and play.

Employers of knowledge workers likewise seek to locate in locations with relatively high population densities, subject to significant industry or sector-specific agglomeration, and where the requisite urban amenities are in place to attract those best and brightest workers on whom they depend. A fixed guideway transit system can be used to induce transit-oriented development (TOD) much as fixed transportation infrastructure has always defined nodes of economic

¹ See Smilor, O'Donnell, Stein, & Welborn, 2007

² (Florida, 2002)

development and activity³. TOD can provide the very opportunities, amenities, and development patterns in demand both by knowledge workers and their employers in addition to expanding multimodal transportation and transit alternatives.

Given the Region's highly dispersed low-density development patterns, the Light Rail Transit (LRT) systems proposed by Go Triangle (GT) can be particularly potent in defining new opportunities for economic, community, and real estate development within the Triangle. The proposed transit/TOD strategy would open new windows of opportunity, investment, and productivity; proactively anticipate challenges to regional vitality and competitiveness posed by rapid anticipated growth; and avoid the steeply diminishing marginal economic returns to investment in (conventional) transportation infrastructure that must be expected in the absence of more innovative alternatives.

Few now living within the Triangle may recognize the implications of a 50 percent or 100 percent increase in the Region's population over the next several decades. Many metropolitan areas across the U.S. now suffer the unpleasantness and inconvenience, as well as the economic costs, of traffic congestion approaching gridlock; specifically because adequate preparations for rapidly expanding populations were not undertaken. Similarly, few may be acutely concerned with the strategic choices required to maintain the Triangle's robust economic vigor in the face of intensifying national and international competition. It falls to a relatively few visionary stewards of future interest to guide the community toward future competitive advantage. In the process of considering alternative courses, one must consider what the Region will look like in 15, 20, or 25-years in the absence of thoughtful strategic commitment today. [What would the region's economic circumstances be today were it not for the foresight and willingness to act boldly of those who envisioned and delivered the RTP?]

³ During the 18th century, economic development in the U.S. occurred along harbors and navigable waterways, particularly at the mouths and confluences of significant rivers. During the 19th century, nodes of new economic development were created through development of improved roadways, man-made canals, and railroads. The 20th century saw U.S. economic development and commercial location defined by Interstate Highway interchanges.

CONTENTS

Executive Summary	2
Overview	4
Table of Contents	6
Introduction	7
Background	8
Economic Development	9
Transportation Infrastructure and Infrastructure Investment	11
Strategic Opportunity	15
Lessons and Inspiration from the Research Triangle Park	17
The Transit Oriented Development Opportunity, and Market Demand	18
Transit Oriented Development Value Premiums	23
Beneficial Fiscal Impacts	24
Lifestyle and Other Economic Benefits	24
Considerations for Successful Implementation	25
Economic Impacts of a DOLRT Project	27
Comments and Observations Regarding Estimation of Economic Impact	42
References	44
Appendix I: Paragraph 7a Article 26 of North Carolina GS 160A FTA Circular 7050.1, excerpt	47
Appendix II: North Carolina General Statute §160A-536	48
GENERAL AND LIMITING CONDITIONS	49

INTRODUCTION

The Durham-Orange Light Rail Transit (DOLRT) line proposed by Go Triangle (GT) can induce transit-oriented development (TOD) creating significant economic opportunity and development both locally and regionally. TOD, possible only as a result of investment in fixed-guideway transit infrastructure, can create significant new investment and real estate development opportunities, of regional-brand and community enhancing quality, at each new transit station. Transit and multi-modal stations represent opportunities for the development of new asset classes and realization of significant real estate price premiums relative to other residential and non-residential properties. Land-rent premiums resulting from TOD can defray part of the LRT infrastructure cost by capturing some portion of the value premium.

Such development can be a central component of a Regional strategy to attract and retain future generations of “best and brightest” knowledge workers on whom the Region’s future prosperity depends. Vibrant, compact, pedestrian-oriented, amenity rich, mixed-use residential and employment centers are increasingly in demand nationwide by employers as well as by the Creative Class.⁴ In addition to fulfillment of currently unsatisfied market demand, TOD can provide interconnected nodes of highly productive dense spatial agglomeration of strategically important industries and sectors. TOD can also accommodate those existing workers within the Triangle who desire to retire-in-place in compact pedestrian-oriented communities.

LRT can help to mitigate growing burdens on existing transportation infrastructure, offset alternative transportation infrastructure costs, and create economic benefits through enhanced mobility and accessibility.⁵ TOD resulting from LRT can provide environments to support the dense spatial agglomeration that can be so highly productive.⁶ TOD can help to accommodate the Region’s

⁴ A recent Brookings Institute report on “The Rise of Innovation Districts: A New Geography of Innovation in America” observes that “The trend is to nurture living, breathing communities rather than sterile compounds of research silos.” (Katz & Wagner, 2014)

⁵ Transportation infrastructure investment decisions can extend and reinforce existing patterns, or they can be transformational through creation of new opportunities and markets. “Transport improvements [can] open up markets and create conditions, in the context of spatial agglomerations and technical change and diffusion, which influence [future] economic structure and performance.” (Lakshmanan, 2011)

⁶ We have come to understand that population density, and increased frequency of human interaction can increase the effectiveness and productivity of agglomeration. This may be particularly true amongst knowledge workers and intellectual capital. One study found that “all else

burgeoning population while providing significant fiscal benefits to local governments through efficiencies in providing municipal services.

BACKGROUND

Go Triangle was established in 1989 by the North Carolina General Assembly to provide public transportation services to the Research Triangle Region of North Carolina encompassing Raleigh, Durham, and Chapel Hill. GT operates bus and shuttle services, paratransit and ride-matching services, vanpools, and emergency ride home programs. Article 26 of North Carolina General Statute 160A that enabled the creation of the Go Triangle agency in 1989 specified that: “General powers of the Authority shall include [the enhancement of] mobility within the region and [promotion of] *sound growth patterns*...”⁷ Much of the prospective benefit associated with GT’s DOLRT project results from realization of “sound growth patterns” along a corridor of TOD.

GT has been planning light rail transit (LRT) services between Wake and Durham Counties, and between Durham and Orange Counties since 1995 as part of a strategy to anticipate and accommodate the explosive population growth anticipated for the Region.^{8, 9} This paper considers prospective economic development benefits associated with a proposed Durham-Orange Light Rail Transit (DOLRT) line, and with the “sound growth patterns” it could enable. The Federal Highway Administration has identified five distinct steps in the process of describing and measuring such economic impacts associated with a transportation infrastructure project.¹⁰ We attempt to address each of these over the course of this paper:

equal, doubling employment density (jobs per square mile) increases patent intensity (patents per capita) about 20 percent, up to about 2,200 jobs per square mile. (Carlino, Chatterjee, & Hunt, 2007)

⁷ See Appendix I

⁸ A Forbes January 27, 2015 article “America’s Fastest-Growing Cities 2015” identifies the Raleigh MSA as America’s 4th fastest growing metropolitan are (the top three are all in Texas).

⁹ The North Carolina Office of State Budget and Management projects that population within the 16-counties that comprise the Research Triangle Economic Region will grow from more than 2-million in 2014 to more than 3-million in 2034. The Capital Area and Durham-Chapel Hill-Carrboro Metropolitan Planning Organizations predict that the Region will “add 1.3 million people over the next generation.” (MPO, 2014)

¹⁰ “Transportation as Catalyst for Community Economic Development,” Adams, John S.; Vandrasek, Barbara J. (University of Minnesota Center for Transportation Studies, 2007)

1. Definition of what is meant by economic development in the context of transportation infrastructure projects;
2. Definition of the full range of costs and benefits associated with transportation projects;
3. Evaluation of net benefits of transportation projects (benefits less costs);
4. Definition of appropriate geographical frameworks for analysis of transportation projects; and
5. Identification of appropriate temporal frameworks for analysis of transportation projects.

ECONOMIC DEVELOPMENT

An economic development objective of paramount importance to the Triangle is that of attracting and retaining future generations of high quality (“best and the brightest”) knowledge workers so as to maintain the productive and competitive advantages the Region currently enjoys. The Region’s many successes have been achieved not only as a result of its fine universities, high quality of life, and modest cost structure, but also as a result of visionary investments in transformative assets and infrastructure over many decades. Evaluation of alternative transportation infrastructure investment strategies should consider a broad array of economic and public policy objectives.

Common economic development objectives include high and rising standards of living, and increased levels of employment, income, education, or productivity. Business and financial communities may perceive economic development as opportunities for wealth creation, and the development of new asset classes and investment opportunities. Tod Litman enumerates the following list of economic development objectives and indicators as suitable for evaluation of transportation of transportation related impacts:

- income (wage rates or household income),
- employment (or unemployment),
- productivity (GDP),
- competitiveness (efficiency/productivity),
- business activity (sales volumes),
- profitability (ROI or other measures),
- real property values,
- investment levels,
- tax revenues,

- affordability (transit/transportation),
- social equity, and
- lifestyle outcomes (health, longevity, education, crime, etc.). (Litman, 2010)

Transportation infrastructure, capacity, and cost are inexorably intertwined with economic activity. Choices regarding the nature, extent, quality, and cost of transportation systems impact costs of goods and services, business and social interaction, productivity, the nature and extent of consumer expenditures (and potential savings and investment), access to economic activities such as education, employment, and shopping, and impacts on land use and real estate development patterns. Economic growth at both national and region levels depend on the interactions between many individuals, firms, and households as well as their independent decisions. Infrastructure investment that expands or enhances a region's amenities can "attract households and firms, which further contributes to an area's growth." (Adler, 1966) These considerations "underline the importance of maintaining, improving, and expanding public capital stock in order to support future economic growth." (Eberts, 1990)

High quality transportation infrastructure supports economic activity by facilitating interactions between individuals, enterprises, and institutions. Transportation accommodates the exchange and delivery of goods, services, and resources of every kind. Investment in transportation infrastructure is perceived by many as a means to induce or encourage economic activity and development. There may be significant debate, however, regarding what type of infrastructure investments (or capacities) are most productive, and what specific economic development objectives are most desirable.

In addition to strategic economic development and competitive advantages that can result from the lifestyle and employment opportunities afforded by transit induced TOD, we estimate the direct, indirect, and induced impacts of construction and operation of the DOLRT line, and development of resulting TOD as summarized in the following table.

Table 1: DOLRT Summary of Economic Impacts

Summary of Economic Impacts	DOLRT/TOD	State	Triangle Region	Durham-Orange Counties
DOLRT Construction				
Total Project Cost	\$1.58 Billion			
Direct Construction Cost	\$1.04 Billion			
Cumulative (Total) Economic Output		\$1.78 Billion	\$1.63 Billion	\$1.43 Billion
Peak Construction Employment (Jobs) 2023		2,781.2	2,555.2	2,278.4
Cumulative (Total) Labor Income		\$695.3 Million	\$653.1 Million	\$583.8 Million
Ongoing Rail Operations (Annual)	\$16.9 Million	\$22.3 Million	\$22.3 Million	\$21.7 Million
Non-Residential TOD Construction				
Average Annual Economic Output		\$96.2 Million	\$86.3 Million	\$74.9 Million
Average Annual Labor Income		\$34.3 Million	\$31.7 Million	\$27.9 Million
Residential TOD Construction				
Average Annual Economic Output		\$134.9 Million	\$122.8 Million	\$107.5 Million
Average Annual Labor Income		\$42.7 Million	\$39.0 Million	\$34.2 Million
Annual Ongoing TOD Commercial Impacts (at buildout)				
Retail Employment (Jobs) Cumulative Total	1,901.0			
Office Employment (Jobs) Cumulative Total	18,029.0			
Total New Employment (Jobs)	19,930.0	35,084.8	33,761.3	30,485.1
Annual Economic Output		\$5.36 Billion	\$5.19 Billion	\$4.73 Billion
Annual Labor Income		\$2.14 Billion	\$2.09 Billion	\$1.89 Billion
Annual State and Local Tax Revenue		\$175.6 Million		

Source: Go Triangle, IMPLAN, DFIG, 2015

Assumptions underlying, and details regarding, estimated economic impacts to the State of North Carolina, the Triangle Region, and Durham and Orange Counties are identified below.

TRANSPORTATION INFRASTRUCTURE AND INFRASTRUCTURE INVESTMENT

Every level of government within the United States is now under pressure to replace and upgrade existing infrastructure. The future vitality of regional, national, and global economies will be determined to a significant extent by the success and effectiveness of the coming wave of infrastructure investment. Infrastructure investment that expands or enhances a region's amenities can attract targeted and/or strategically beneficial workers and firms, which further contributes to an area's economic growth and vitality. Transportation infrastructure investment can leverage large amounts of private investment in real estate and economic development toward these ends.

Not all transportation infrastructure investment is equally productive however. Once networks of excellent transportation infrastructure are in place, as within the Triangle, investment toward expansion of capacity in existing modes of

transportation can be subject to steeply declining marginal economic benefit. The strategic challenge, therefore, is to identify potentially transformative investment opportunities that create new avenues of economic development while alleviating rather than compounding existing transportation and infrastructure challenges. LRT, and the TOD that could follow, should be considered as essential components of a transportation infrastructure strategy designed both to reinforce existing strategic competitive advantages within the Region, and to maximize future economic development potential.

Both the complexity and inadequacy of U.S. infrastructure investment have been subjects of significant ongoing media attention. A recent Brookings Institute blog from its series on Metropolitan Infrastructure points out: “America’s infrastructure woes are no joke:”

...the diverse and highly fragmented ways that America selects, builds, maintains, operates, and pays for assets as different as public transit, telecommunications, and water... How choices are made about American infrastructure is exceedingly complex and depends on funding sources, jurisdictional concerns, and political negotiations. (Puentes, 2015)

In 2010 the Congressional Budget Office reported that “the percentage of Federal spending for infrastructure in proportion to all Federal spending [had] steadily declined over the [previous] 30 years. Our current infrastructure increasingly fails to meet demands. Facilities are aging; their level of service, reliability, and performance are declining; and increasingly they are extended into natural environments and fragile ecosystems. The dangers that the Nation’s crumbling infrastructure poses to our economic health are as great as those posed by [recent] financial [crises].” (DOHS, 2010) Every 4 years, the American Society of Civil Engineers releases a Report Card for America’s Infrastructure that depicts the condition and performance of the nation’s infrastructure in the familiar form of a report card assigning letter grades to each class of infrastructure.¹¹ In 2013 ASCE assigned American infrastructure an overall grade of D+ and estimated that \$3.6 trillion of infrastructure investment is required by 2020. Individual grades included: bridges (C+), rail (C+), roads (D), and transit (D). (ASCE, 2013)

¹¹ Each category is evaluated “on the basis of capacity, condition, funding, future need, operation and maintenance, public safety, and resilience. A=exceptional, fit for future; B=good, adequate for now; C=mediocre, requires attention; D=poor, at risk; F=failing/critical, unfit for purpose.

Subject to suitable economic and market conditions, transportation infrastructure investment can leverage large amounts of private investment in real estate and economic development. “A billion dollars invested in a new rail line [for example] can stimulate ten billion dollars in nearby property development. In competitive markets, small differences in accessibility and traffic impacts can make a large difference in property values and development potential.” (Adams, 2007) The infrastructure does not itself create economic potential (demand) however. Infrastructure investment contributes to economic development only where appropriate economic and market conditions exist. (Kessides, 1993)

Even where economic and market opportunity exists, as within the Triangle, economic return is neither uniform nor consistent across transportation infrastructure investment alternatives. Investing in the “wrong” transportation infrastructure can be counterproductive or only marginally beneficial. In highly developed economies with excellent well-established transportation systems further investment in, or expansion of, existing infrastructure (such as additional highway capacity) may produce little or no economic benefit. (Banister & Berechman, 2001) Once excellent transportation networks have been established, “the relationship between vehicle travel and economic development is actually weak” (Baird, 2005; De la Fuente, 2010; Litman, 2010) Significant economic development in such circumstances may require that infrastructure investment create new or different types of transportation capacity, linkages, or economic development opportunities.

Comprehensive analysis of both direct and immediately realizable transportation benefits of specific transportation infrastructure investments, and the long-term strategic impacts of such investments suggests investment in TOD and the transit infrastructure on which it depends. It is increasingly well understood and widely accepted that “built environments that encourage walking and cycling have a wide range of benefits, including the potential for substantial economic impact. The synergies between policies that promote health, support environmental sustainability, and reduce congestion would seem too clear to ignore, given the fact that they are economically attractive and have a wide range of other benefits... the “best buy” is investing in infrastructure that makes walking and cycling a convenient and safe option for the majority of the population. [This requires] integrated policy and planning at a system level.” (Bidwell, 2012) “As part of a city’s economic development strategy, finding the right balance of mobility and livability can be expected to gain importance in the competition for high-skilled, knowledge-based industries and services in the global marketplace. Cities that advance

sustainable transport modes will be best positioned to attract high-value-added growth in years to come.” (R. Cervero, 2009)

Although planners, analysts, and policy makers recognize all such impacts, some are frequently overlooked or undervalued in the process of evaluating transportation infrastructure alternatives. (Litman, 2010) Institutional requirements shaping the evaluation of competitive infrastructure investments may focus relatively more attention on direct and immediately realizable impacts such as transportation costs and mobility, and less on longer term and more complex impacts such as land use, urban planning, social, lifestyle, environmental, and economic development impacts. Long term and short term, tactical and strategic objectives may even be in direct conflict with each other. Comprehensive consideration of all such objectives will be particularly important at a time when we should expect increasingly urgent demands for infrastructure investment and reinvestment, and increasing competition for the scarce capital needed to fund that investment.

In 2005 the U.S. Congress passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act — A Legacy for Users. (Congress, 2005) The act required, for the first time, “that economic development criteria be incorporated into the process for evaluating proposed transit systems under consideration for FTA New Starts Funding.” This change reflected an understanding that “economic development, including economic growth and sustainability at the regional level, is of great concern to the U.S. and should be a goal that is fostered by all major federal investments, including those in transit.”¹²

“The efficiency of infrastructure delivery is particularly important at present. If done right the investment boom could become a boon, because infrastructure investment ... creates and sustains employment; [is comprised of] a large element of domestic inputs relative to imports; [and] improves productivity and competitiveness.” (Flyvbjerg, 2009) The challenge to, and opportunity for, the Triangle Region is to choose transportation infrastructure investments that maximize the Region’s competitive advantages and yield the greatest possible opportunities for economic development in the face of significant economic and technological innovation and restructuring. We suggest that LRT, and the TOD that could follow, should be considered as keystone components of a transportation

¹² (“FTA NEW STARTS ECONOMIC DEVELOPMENT CRITERIA”, 2006)

infrastructure plan designed both to reinforce strategic competitive advantages within the Region, and to maximize economic development potential.

STRATEGIC OPPORTUNITY

Those individuals, enterprises, and industries most drawn to the array of live-work-play lifestyle opportunities typically available within TOD happen to be those on which the Triangle's economic vigor (and future prosperity) is most dependent. Attracting and retaining highly skilled knowledge workers and their employers is acutely important given increasingly vigorous competition in those economic areas in which the Region excels. LRT can provide for TOD crafted to attract future generations of knowledge workers and their employers, accommodate active adult communities, and spawn a wide variety of economic development while providing significantly beneficial fiscal impacts. The great opportunity and challenge for the Triangle is to identify and adopt transportation infrastructure investment policy that maximizes benefits from future land use and development patterns, promote productivity and economic development, while alleviating pressure on existing infrastructure. (Burchell, 2002)

The tendency for knowledge-based industries to locate in higher-density (TOD-like) locations is rational and based on experience regarding the relationship between population density and intellectual productivity.

Although employment has been sprawling away from central business districts for the past century, jobs have not dispersed evenly, either in terms of geography or industry. Certain high-skill "knowledge-based" industries, which include Professional, Scientific and Technical services, Information, Finance, and Insurance sectors, are more likely to locate in central business districts and higher density regional employment areas. (CTOD, 2011)

Thanks in large part to visionary planning, strategic investment, and public-private partnerships set in motion with the establishment of the Research Triangle Park on December 29, 1958; the Region has become an exceptional place to live, learn, work, and play. Raleigh, Durham, and Chapel Hill routinely rank very highly in surveys of desirability, growth, and productivity, but the Region is subject to increasingly vigorous economic competition, as is the United States as a whole. A 2015 report by the Brookings Institution, "America's Advanced industries: What they are, Where they are, and Why they Matter," concludes that "The United States

is losing ground to other countries on advanced industry competitiveness.” Although currently home to the most productive advanced industries in the world U.S. competitiveness appears to be eroding. (Muro, Rothell, Andes, Flkri, & Kulkarni, 2015)

The United States is losing ground relative to other countries on measures of innovation performance and capacity. For example, the U.S. share of global R&D and patenting is falling much faster than its share of global GDP and population, meaning that U.S. slippage cannot simply be attributed to demography or macroeconomic convergence. Likewise, America’s research dominance looks less impressive after adjusting for the size of its working age population. Turning to the nation’s critical regional innovation ecosystems, surprisingly few U.S. metropolitan areas rank among the world’s most innovative... Among the nation’s most patent-intensive regions, just two—San Diego and the San Jose-San Francisco combined area—rank in the global top 20 and just two more (Boston and Rochester) score in the top 50.

“firms, governments, and other relevant actors must work to strengthen the nation’s local advanced industry ecosystems—the regional industrial communities within which firms operate. Innovation and skills development do not happen just anywhere. They happen in places, most notably within metropolitan regions, where firms tend to cluster in close geographic proximity, whether to profit from local knowledge flows, access skilled workers, or tap regional supplier networks. ... It is critical, therefore, that private and public-sector leaders work together to renew the vitality of the nation’s regional advanced industries ecosystems—the most durable foundations of U.S. competitiveness in the sector. Firms should seek to quantify the value they derive from vibrant local ecosystems even as localities and states work to enhance the local environment for advanced industry activity through investments in anchor institutions and support for cluster infrastructure. (Muro et al., 2015)

In his 2001 evaluation “*Research Triangle: clusters of innovation initiative: Council on Competitiveness*,” Michael Porter observed that “While fundamentally strong, the Research Triangle ...faces several challenges that, if unchecked, could undermine the region’s historical bases of strength and ... diversified growth.” The report goes on to recommend several strategies to secure future competitiveness:

The success of [the Triangle's historic RTP-centric] strategy has created problems that cannot be solved by the current course. Growth is leading to more traffic, stressing the local school systems, increasing the cost of living; amenities that enabled the old strategy to succeed. Communities within the Research Triangle Area, no longer galvanized by a common economic challenge, do not collaborate as well as they have in the past. ... A new economic strategy is needed to reenergize the community, increase collaboration, and solve ongoing challenges. (Porter, 2001)

LESSONS AND INSPIRATION FROM THE RESEARCH TRIANGLE PARK

The Triangle Region's many successes, economic vitality, and enviable standards of living owe a great deal to visionary and passionate leaders who conceived and proselytized for specific, transformative, somewhat abstract, strategic infrastructure investment sixty years ago. The vision for and commitment to the Research Triangle Park on the part of UNC professor Howard Odum and North Carolina Governors Hodge and Hunt ultimately defined and reshaped the entire Triangle Region. The Raleigh-Durham-Chapel Hill area of the 1950s enjoyed neither the reputation nor the prosperity it does today. North Carolina was suffering through a very difficult period. The area's primary industries, tobacco, textiles, and furniture manufacturing, had failed or were failing. There was a flight of investment and business activity. Only 3.3 percent of the region's workforce was employed in high-technology companies as compared to 10.3 percent throughout the U.S. overall. (Luger & Goldstein, 1991) The transformative impact of the Research Triangle Park, and supportive infrastructure investment, has been profound and definitive.

Although looking forward from a much better state of economic circumstances today, the Region once again faces potentially daunting challenges. And once again, those challenges can be met to a significant degree through strategic infrastructure investment focused squarely on economic development in the context of the Region's competitive advantages. The authors of the 2007 study "The Research University and the Development of High-Technology Centers in the United States" identify the need for an "incendiary event" to attract resources, firms, and the "investment and talent needed to attract high-technology [enterprises]. In the case of the Triangle Region, that event was the development of the Research Triangle Park. "The creation of RTP was the flame that spread like wildfire to redefine the environment for technology and commercialization in North Carolina." (Smilor, O'donnell, Stein, & Welborn, 2007) Writing about the development and success of

several high-tech research centers in the U.S., the authors observe: “In the case of each region, an incendiary event served as the spark to ignite a coordinated strategy and to instigate a coalescing strategy that brought disparate groups and interests together in a common cause.”

A strategy for development of high quality TOD along state of the art LRT connecting important centers of research and urban amenities can act as an “incendiary event” ushering a period of renewed vigor in the Triangles development of knowledge-based industry.

THE TRANSIT ORIENTED DEVELOPMENT OPPORTUNITY, AND MARKET DEMAND

Demand both for high quality public transit, and for the TOD it can induce, is increasing significantly in the U.S.¹³ Younger Americans, in particular, are choosing to travel less by private automobile and are increasingly using alternative and emerging transportation modes. Youthful early adopters and innovators are also the rank and file of the knowledge workers whom we must attract to, and retain within, the Triangle in order to insure the Region’s robust economic future. Young families and highly educated knowledge workers are centrally important to TOD demand, but they do not represent the entire market. Many factors contribute to increasing numbers of empty nesters and other small households preferring compact, pedestrian-friendly, mixed-use environments.

The DOLRT project can induce significant economic development through TOD that would not be possible but for the transit investment. “Transit-oriented development is regional planning, city revitalization, suburban renewal, and walkable neighborhoods combined. It is a cross-cutting approach to development that can do more than help diversify our transportation systems; it can offer a new range of development patterns for households, businesses, towns and cities.”¹⁴

Although TOD may refer to different concepts in different settings, the most economically potent of these emphasize “place making”:

creating attractive, memorable, human-scale environs with an accent on quality-of-life and civic spaces. Increasingly, projects built around up-and-coming transit nodes, like Dallas’s Mockingbird Station, Portland’s Pearl

¹³ In 2013, public transit saw almost 10.7 billion trips, more than any year since 1957. (APTA, 2015)

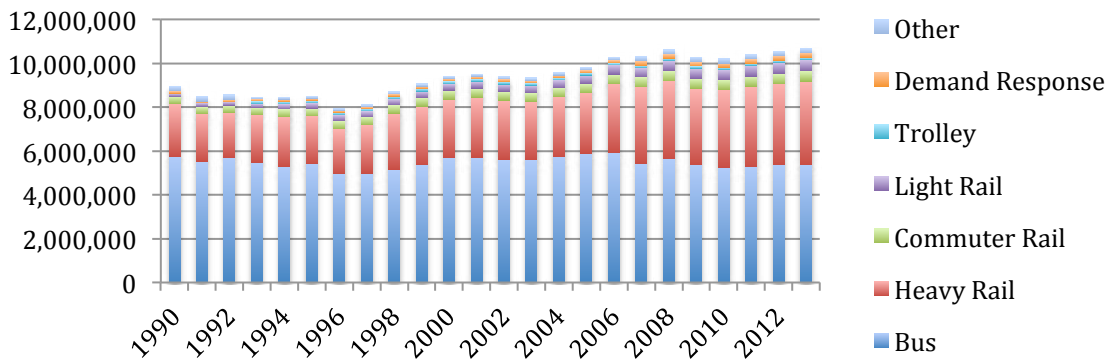
¹⁴ Peter Calthorpe; (Dittmar & Ohland, 2004)

District, and Metropolitan Chicago's Arlington Heights, are targeted at individuals, households, and businesses seeking locations that are vibrant and interesting; these places usually have an assortment of restaurants, entertainment venues, art shops, cultural offerings, public plazas, and civic spaces. (R. Cervero, 2004)

Demand for high quality low-density suburban lifestyles will remain intact and evident throughout the Triangle. Absent development of a new range of highly amenitized, compact, pedestrian friendly, vibrant lifestyle opportunities, however, an increasingly large segment of market demand may go unsatisfied. LRT can provide the impetus to drive such development. Fortunately, demand for transit ridership is increasing, as is demand for the TOD it can induce.

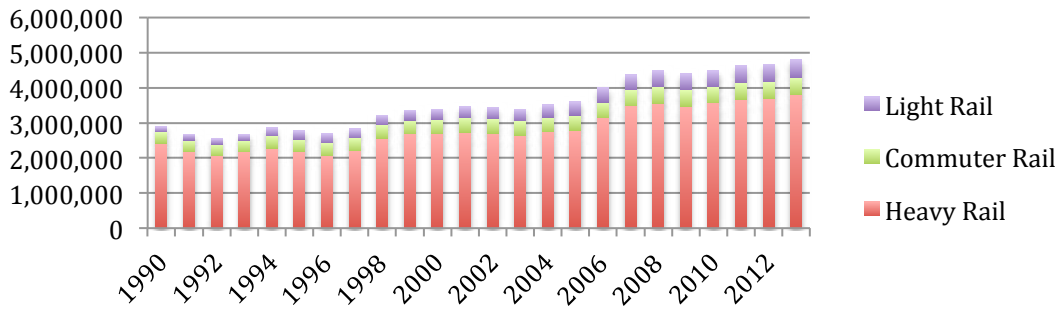
The following graph illustrates the steady increase in total U.S. transit ridership since 1990. As of 2013, transit ridership was at a higher level than anytime since 1957. Total transit ridership continues to increase even though bus transit, the single largest component of U.S. transit ridership, has been declining slightly.

TOTAL U.S. Transit Ridership
American Public Transportation Association Data

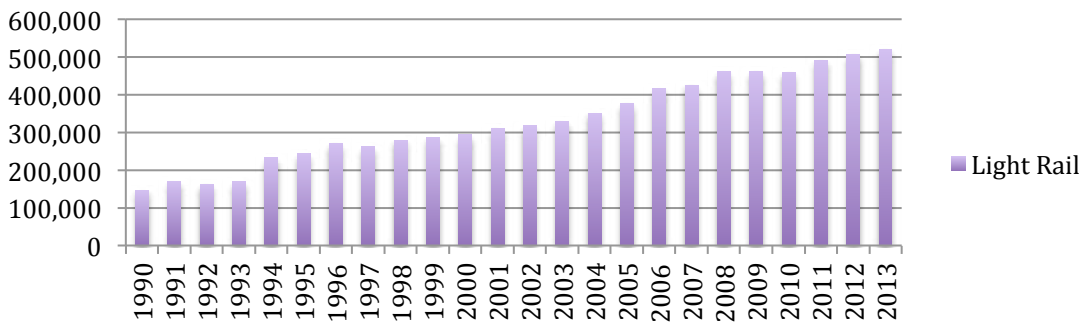


The following graph illustrates the steeper rate of increase of transit ridership for all U.S. rail services, exclusive of bus and other transit modes.

Total U.S. RAIL Transit Ridership American Public Transportation Association Data



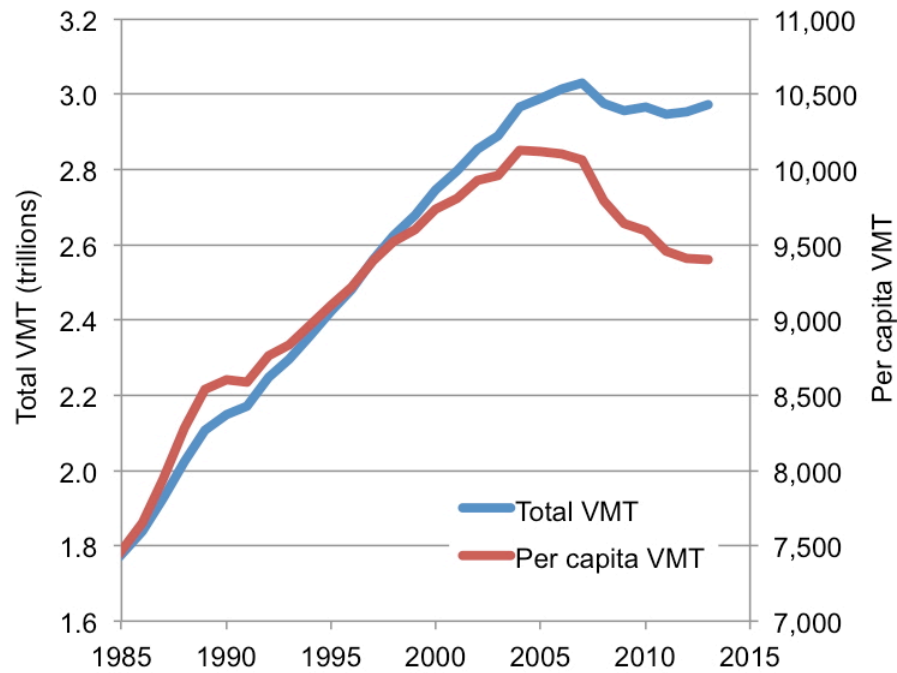
Total U.S. LIGHT RAIL Transit Ridership American Public Transportation Association Data



Finally, the rate of increase of transit ridership is steepest for light rail transit (LRT) alone. Although the absolute numbers are not yet huge, LRT ridership increased by 350 percent between 1990 and 2013.

As U.S. transit ridership continues to increase, particularly for LRT, vehicle miles traveled (VMT) has dropped for the ninth consecutive year.

Estimates released by the Federal Highway Administration in February 2015 suggest that per capita vehicle miles of travel dropped once again in 2013, and total VMT in the United States increased only slightly.



(SSTI, 2015)

These trends appear to reflect structural changes of behavior. A 2012 report concluded that the average number of vehicle miles traveled (VMT) “had dropped 23 percent since 2001 for people age 16 to 34.9. In the same time period, that age group—primarily approximately 50 million Millennials—increased their transit miles by 40 percent and took 24 percent more trips by bicycle and 16 percent more trips on foot.” (Shinkle, 2012) Studies of the behavioral characteristics and preferences of the Millennials reveal what appear to be durable generational cohort effects. In the aggregate, Millennials are less enthusiastic about driving and automobile ownership and drawn to less driving-intensive lifestyles. They seek urban lifestyle amenities and conveniences, and prefer to reside in “walkable” communities. It is the Millennials who are driving “ride-sourcing” (Uber), bike and car sharing, and other rapidly evolving technology driven transportation solutions. These youthful early adopters and innovators are also the rank and file of the knowledge workers whom the Triangle must attract and retain.

Young families and highly educated knowledge workers are centrally important to TOD demand, but they do not represent the entire market. There are several demographic drivers underpinning increasing demand for TOD and compact, pedestrian-friendly, amenity rich lifestyles. The U.S. population is aging, and significantly so within the Triangle. As of 2000, 10 percent of the Triangle’s population was more than 65 years of age. By 2030 that number will have doubled

to 20 percent. (MPO, 2014) These trends have implications both in terms of accommodating increasing numbers of active adult retirees and in terms of replacing them in the workforce. Many factors contribute to increasing numbers of empty nesters and other small households preferring compact, pedestrian-friendly, mixed-use environments. Many of America's new immigrants, comprising as much as 35 percent of net population growth, also prefer more "urban" areas. These trends reinforce consumer preferences for TOD-like communities, particularly on the part of those engaged in the knowledge-based economy. (Greene, 2009)

The 2011 Community Preference Survey: "What Americans are looking for when deciding where to live" commissioned by the National Association of Realtors (NAR) confirms a shift toward lifestyle preferences consistent with TOD.

Overall, Americans' ideal communities have a mix of houses, places to walk, and amenities within an easy walk or close drive:

When selecting a community, nearly half of the public (47 percent) would prefer to live in a city (19 percent) or a suburban neighborhood with a mix of houses, shops, and businesses (28 percent). Another four in ten (40 percent) would prefer a rural area (22 percent) or a small town (18 percent). Only one in ten (12 percent) say they would prefer a suburban neighborhood with houses only.

After hearing detailed descriptions of two different types of communities, 56 percent of Americans select the smart growth community and 43 percent select the sprawl community. Smart growth choosers do so largely because of the convenience of being within walking distance to shops and restaurants (60 percent). Those who prefer the sprawl community are motivated mostly by desire to live in single-family homes on larger lots (70 percent).

In a forced choice question, being within walking distance of amenities is preferred by a majority of Americans. Nearly six in ten adults (58 percent) would prefer to live in a neighborhood with a mix of houses and stores and other businesses within an easy walk. Four in ten (40 percent) select a community with housing only, where residents need to drive to get to businesses.

(Beldon, Russonello, & Stewart, 2011)

TOD VALUE PREMIUMS

High and increasing demand for vibrant, compact, pedestrian-friendly mixed-use development, as well as demand for proximity to transit, reveal themselves in the form of significant real estate price premiums within many TOD settings. A great deal of research confirms that the enhanced value of attractive, high quality, TOD is capitalized into real property values. Land rent premiums result from the character and quality of a specific TOD project as well as from the value of the transit amenity itself. There are significant capitalization benefits (price premiums) associated with being within walking distance of many walk-and-ride LRT stations. Such real estate premiums are more than 20 percent in many cases, and more than 100 percent in some.¹⁵ (R. Cervero & Duncan, 2001) Land rent premiums provide not only the incentive to invest in TOD projects, but also the opportunity to “capture” some of that value premium to help pay for the infrastructure cost that makes TOD possible.¹⁶ With sufficient value capture mechanisms in place, value premiums may also allow municipalities to undertake workforce housing or similar public policy initiatives with greater resources than would otherwise be available.

The economic vitality created within TOD can be reflected not only through real estate price premiums, but also through accelerated growth and absorption rates, and perhaps through economic resiliency. From 2000 through 2010, a period spanning the Great Recession, four of the five U.S. cities with extensive rail transit systems (New York, Philadelphia, Boston, and San Francisco) experienced higher economic and development growth within (1/2 mile) transit zones than elsewhere in the cities. Chicago was the only exception, where regional growth exceeded transit related growth. (Prall, 2013)

Real property value premiums associated with TOD begin to materialize even before transit and station development takes place. Land value capitalization begins as investors and speculators respond to announcement of plans and continue as progress toward project implementation continues. (Knaap, Ding, & Hopkins, 2001) Land value benefits from proximity to transit are neither universal nor consistent, however, and depend a great deal on location and TOD-specific

¹⁵ Excerpts from a number of representative TOD land rent value capitalization studies are included in Appendix IV.

¹⁶ Land rent premiums are associated with other (non-LRT) forms of TOD as well. A 2008 study found significant value premiums associated with pedestrian proximity to bus rapid transit (BRT) stations in Bogota Columbia. (Rodriguez & Mojica, 2008)

design and function.¹⁷ Park and ride (PAR) stations, for example, designed to expand the transit commuter-shed, may have adverse impacts on immediately surrounding property values; whereas high quality walk and ride (WAR) stations can induce significant value premiums. Dittmar and Poticha have defined six common classes of TOD based on the location and function of each. These include:

- urban downtown,
- urban neighborhood,
- suburban town center,
- suburban neighborhood,
- neighborhood transit zone, and
- commuter town. (Atkinson-Palombo, 2010)

Different types of stations will produce different types of TOD potential in each location, and each of these will perform differently.

BENEFICIAL FISCAL IMPACTS

In addition to productivity and lifestyle benefits, compact land use can produce beneficial fiscal impacts. The highly efficient development patterns that can be achieved within TOD tend to reduce the cost of providing many municipal services. These include road maintenance, provision of utility and emergency services, education, and, of course, transit services. Some studies have identified savings of 20-40 percent per capita compared with the cost of providing services to low-density development. (Burchell, et al. 2002).

More compact, mixed, connected land use patterns tend to increase employment, economic productivity, land values and tax revenues due to the combined effects of reduced land consumption, improved accessibility, reduced transportation costs, agglomeration efficiencies, and more efficient provision of public services (IEDC 2006).

LIFESTYLE AND OTHER ECONOMIC BENEFITS

In addition to enhanced mobility choices and economic activity and productivity, TOD can have beneficial impacts on personal disposable income and savings,

¹⁷ See “Considerations for Implementation” below.

leisure time, and health. Public health benefits and other lifestyle affects should be considered along with broader environmental and economic benefits.

Those who choose to live or work in TOD or similarly designed communities benefit from a wide variety of lifestyle opportunities and amenities. In addition to the beneficial fiscal impacts previously addressed, TOD can have positive social benefits such as reduced air and water pollution, increased energy efficiency, and reduced rural land consumption. (R. F. Cervero, Christopher; Murphy, Steven, 2002)

...traffic congestion is not the only significant urban transportation problem. A comprehensive analysis must take into account additional benefits such as parking cost savings, consumer savings, crash reductions, improved mobility for nondrivers, energy conservation, pollution emission reductions, and improved public fitness and health As more of these planning objectives are considered, transit in general, and rail transit in particular, tends to become more cost effective. (Litman, 2007)

Although of somewhat modest economic impact relative to the capital and operating costs associated with LRT, research suggests “that there is a sizable public health benefit associated with the adoption of light rail. (Stokes, MacDonald, & Ridgeway, 2008)

Public policy investments in transit should consider potential increases in physical activity as part of the broader set of cost-benefit calculations of transit systems...Land-use planning and travel choice have a clear impact on health outcomes. Public transit systems can generate positive health benefits by encouraging greater numbers of users to walk to transit stops and maintain more physically active lives. An additional benefit ... of LRT ... the potential reduction in obesity in the population. (MacDonald, Stokes, Cohen, Kofner, & Ridgeway, 2010)

CONSIDERATIONS FOR SUCCESSFUL IMPLEMENTATION

TOD benefits are not automatic and will not manifest themselves spontaneously. A number of considerations must be addressed in order to realize and maximize the potential of TOD:

- Highly productive TOD often requires successful resolution of complex political and institutional factors, optimization of planning and land-use strategies, pursuit of specific benefits and impacts, navigating fiscal considerations and partnerships, and resolving numerous design challenges. (R. Cervero, 2004) These considerations may be pronounced when multiple regulatory (and tax) jurisdictions are involved along a single transit corridor, as is the case with the DOLRT line.

- Consistent community or organizational leadership is required to crystalize, articulate, and communicate TOD-specific vision and to sustain the realization of that vision over many years. An effective TOD vision must include definition of realistic goals and communication of them clearly and compellingly to others. (Adams, 2007)

- TOD requires time to materialize following station development. Thereafter, direct and indirect economic benefits accruing directly from TOD require additional time to develop, and those time frames vary significantly. The strategic economic benefits described above will take more time yet, and manifest over many years (as have those we enjoy today).

- Fulfillment of TOD potential requires that strategies for land assembly and redevelopment be in place. (Fogarty et al., 2013) Execution of a coordinated mixed-use TOD plan is impossible without assemblage of parcels of significant size. In the absence of large parcels it may also be difficult to set aside and dedicate acreage for necessary public realm components of the TOD community, or to achieve other public policy objectives.

- Necessary public-sector commitments extend beyond significant investment in the transit infrastructure itself, to an array of associated public policy initiatives and interventions. Realization of high-quality and economically productive TOD requires specific zoning and development regulations governing the type, densities, character, and relationships between components of anticipated development. Such rules will often need to accommodate and/or require a rich variety of land uses within a small geographic area, and development at higher densities than typical prior to TOD. Rules must regulate both proximity of specific land uses to the transit station and define innovative urban design guidelines to insure compatibility both between land uses and between specific land uses and transit facilities. (Freilich, 1998)

- Real estate price premiums associated with TOD do not develop uniformly or spontaneously. (Vickerman, 2008) Value maximizing form, function, and aesthetic design considerations must be evaluated for each station area. “Station-area plans and planning matter. Given the risks and uncertainties associated with TOD, developers, residents, and merchants expect, and indeed deserve, carefully crafted, forward-looking plans that orchestrate how, when, and where a TOD will evolve.” (R. Cervero, 2004) The character, quality, function, and specific design and aesthetics have a material impact on TOD real estate values and premiums. (*Bartholomew & Ewing, 2011*) It is clear that “the design of the transit system plays an important role in determining whether it will have a positive or negative effect on nearby property values.” (Mathur & Ferrell, 2009) “Station proximity has a significantly stronger impact [on value] when coupled with a pedestrian-oriented environment. Conversely, station area condominiums in more auto-oriented environments may sell at a discount. This indicates that TOD has a synergistic value greater than the sum of its parts.” (Duncan, 2010)

- Development of relatively high-density mixed-use products involves greater complexity and risk than other types of real estate development. This has implications for capital availability and financing. TODs take time to evolve, and land-value benefits from TODs take more time to accrue. “Market fundamentals, not a TOD label, govern whether private capital gets invested around transit stations. The availability of equity and loans to fund projects near transit is primarily driven by capital market conditions and perceived market demand, not a project’s status as a TOD. (R. Cervero, 2004)

ECONOMIC IMPACTS OF DOLRT PROJECT

Economic Impact Analysis Overview

The impact of an economic stimulus can be broken into three components: direct effects, indirect effects, and induced effects. The investment in constructing the DOLRT is used to illustrate each of these concepts.

- ***Direct effects*** represent the immediate impact of an economic change on the industry directly involved. In the DOLRT construction example, direct effects would include gross revenues earned by the construction contractors working on the project.
- ***Indirect effects*** represent the changes in inter-industry purchases as the economy responds to the new demands of the directly affected industries. Following the same example, local suppliers of construction materials would

increase their economic activities in order to meet new demand by the contractors.

- **Induced effects** represent the changes in spending from households as income increases due to the changes in production. In this example, construction workers would receive additional wages by working on the DOLRT project. These workers would then spend a portion of those wages on consumer goods and services, such as food, clothing, and personal items from businesses within the study area.

The sum of the direct, indirect, and induced effects is the total economic effect.

This report analyzes the direct effects of the following:

- Construction of the DOLRT
- Ongoing operations of the DOLRT Rail Operations and Maintenance Facility (ROMF)
- Construction of new TOD commercial buildings
- Ongoing activities of new TOD commercial establishments
- Construction of new TOD residences¹⁸

Each set of direct effects is modeled on the State of North Carolina (State or Statewide), the Triangle Region¹⁹, and Durham and Orange Counties²⁰. Generally, the larger the study area the larger the impact; thus, the impact will generally be larger for the State and the Triangle Region than for Durham and Orange Counties.

The *construction phase* is a one-time, temporary impact that creates economic activity during the building process but then goes away once construction is complete. The construction of the DOLRT, including engineering and permitting, will take approximately 12 years so the construction period benefits will be experienced over a sustained period of time compared to other construction projects that may take only one or two years to complete. Because construction is a vital component of many local economies (as validated in the recent recession), the construction of the DOLRT, the new TOD commercial facilities, and the new TOD residences will provide an important economic contribution to the three study areas.

¹⁸ The effect of the new household spending is excluded to avoid any double-counting of the induced effects of the new TOD ongoing commercial activities.

¹⁹ The Triangle Region comprises the counties of Chatham, Durham, Edgecombe, Franklin, Granville, Harnett, Johnston, Lee, Moore, Nash, Orange, Person, Vance, Wake, Warren, and Wilson. www.researchtriangle.org

²⁰ DPGF constructed Multi-Regional Input-Output (MRIO) models using the IMPLAN 3.0 software to estimate the economic effects of the various DOLRT-related activities on the Triangle Region and the State.

The *ongoing activities phase* generates economic activity during each year the DOLRT and the TOD business establishments are in operation. If businesses maintain the level of activity as projected, the ongoing activities phase has a recurring impact. Both phases are modeled as direct positive stimulants that help grow and develop the economies of the study areas.

Sources for the direct effects are described in subsequent sections of this report. The IMPLAN economic modeling system was used to estimate the corresponding indirect and induced effects. The IMPLAN model is a system for estimating local economic multipliers, including those pertaining to production, value-added, employment, wage, and supplier data. IMPLAN differentiates its software and datasets between 536 sectors that are recognized by the United States Department of Commerce. Multipliers are available for all states, counties, and zip codes and are derived from production, employment, and trade data from a variety of national, regional, state and local resources such as the United States Census Bureau, County Business Patterns, Annual Survey of Government Employment, Annual Survey of Retail Trade, United States Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Consumer Expenditure Survey; United States Department of Labor, Office of Management and Budget, United States Department of Commerce, and the Internal Revenue Service. IMPLAN is widely accepted as the industry standard when estimating impacts from a one-time or a sustained increase in economic activity in a particular region.

All amounts in this report are presented in constant 2015 dollars.

Construction Impacts of the DOLRT

The cost to construct the DOLRT is estimated to exceed \$1.58 billion as shown in Table 2. For purposes of this analysis, the direct effects were limited to \$1.04 billion as the remaining cost elements would likely be imported into each of the three study areas based on federal procurement requirements. In addition, property acquisitions were excluded as they are transfers of funds that do not affect the economies of the study areas.²¹

²¹ Property acquisitions do not create any specific construction impacts but only transfer dollars to the property owners for the value of the existing assets.

Table 2: DOLRT Project Cost

Cost Element	Amount
Guideways and Track Elements	\$385.6 Million
Stations, Stops, Terminals, Intermodal	\$120.5 Million
Support Facilities, Yards, Shops, Administrative Buildings	\$56.8 Million
Sitework and Special Conditions	\$232.0 Million
Professional Services	\$240.5 Million
Assumed Direct Effects	\$1.04 Billion
Systems	\$194.1 Million
Row, Land, Existing Improvements	\$173.3 Million
Vehicles	\$87.0 Million
Unallocated Contingency	\$89.4 Million
Total DOLRT Project Cost	\$1.58 Billion

Source: Go Triangle, 2015

Construction Impacts of the DOLRT - Statewide

Output, as defined by IMPLAN, represents the value of industry production. For manufacturers, output includes sales plus or minus changes in inventory. For service sectors, output equals sales; and for retail and whole trade, output equals gross margin and not gross sales.

The economic effects on the State's output, from the \$1.04 billion assumed direct construction spending, is presented in Table 3. Spending levels vary on an annual basis with peak direct construction spending of \$241.7 million in 2023. Over the entire DOLRT construction period, the State's output will increase by \$1.78 billion.

Table 3: DOLRT Construction – Statewide Impact - Output

OUTPUT	2015	2016	2017	2018	2019	2020	2021
Direct	\$16.1 Million	\$16.5 Million	\$19.1 Million	\$24.3 Million	\$27.7 Million	\$27.7 Million	\$109.0 Million
Indirect	\$7.6 Million	\$7.8 Million	\$9.0 Million	\$11.5 Million	\$13.1 Million	\$13.1 Million	\$50.5 Million
Induced	\$5.1 Million	\$5.3 Million	\$6.1 Million	\$7.8 Million	\$8.8 Million	\$8.8 Million	\$26.2 Million
Total	\$28.9 Million	\$29.7 Million	\$34.2 Million	\$43.6 Million	\$49.6 Million	\$49.6 Million	\$185.7 Million

OUTPUT	2022	2023	2024	2025	2026	Total
Direct	\$209.5 Million	\$241.7 Million	\$159.7 Million	\$165.3 Million	\$18.8 Million	\$1.04 Billion
Indirect	\$98.5 Million	\$114.1 Million	\$75.8 Million	\$79.1 Million	\$8.9 Million	\$489.0 Million
Induced	\$49.0 Million	\$56.3 Million	\$37.9 Million	\$39.3 Million	\$6.0 Million	\$256.6 Million
Total	\$356.9 Million	\$412.1 Million	\$273.4 Million	\$283.6 Million	\$33.7 Million	\$1.78 Billion

Source: Go Triangle, IMPLAN, DPGF, 2015

Jobs, as defined by IMPLAN, include full-time and part-time positions. As reflected in Table 4, the number of Statewide construction period jobs will vary in relation to construction activity over the construction period with jobs peaking to 2,781 in 2023.

Table 4: DOLRT Construction – Statewide Impact - Jobs

JOB	2015	2016	2017	2018	2019	2020
Direct	121.2	124.6	143.6	183.4	208.6	208.6
Indirect	61.3	63.1	72.6	92.7	105.4	105.4
Induced	39.6	40.7	46.9	60.0	68.2	68.2
Total	222.1	228.4	263.1	336.1	382.2	382.2

JOB	2021	2022	2023	2024	2025	2026
Direct	735.9	1,383.8	1,584.0	1,045.6	1,069.4	141.4
Indirect	336.2	655.2	761.5	515.0	543.3	71.4
Induced	202.6	379.1	435.7	293.2	303.9	46.2
Total	1,274.7	2,418.1	2,781.2	1,853.8	1,916.6	259.0

Source: Go Triangle, IMPLAN, DPF, 2015

Labor income, as defined by IMPLAN, comprises all forms of employment income, including wages and benefits and proprietor income. In total, the construction of the DOLRT is projected to increase cumulative labor income in the State by \$695.3 million.

Table 5: DOLRT Construction – Statewide Impact - Labor Income

LABOR INCOME	2015	2016	2017	2018	2019	2020	2021
Direct	\$9.5 Million	\$9.7 Million	\$11.2 Million	\$14.3 Million	\$16.3 Million	\$16.3 Million	\$43.9 Million
Indirect	\$3.3 Million	\$3.4 Million	\$4.0 Million	\$5.0 Million	\$5.7 Million	\$5.7 Million	\$18.1 Million
Induced	\$1.8 Million	\$1.9 Million	\$2.2 Million	\$2.8 Million	\$3.1 Million	\$3.1 Million	\$9.2 Million
Total	\$14.6 Million	\$15.0 Million	\$17.3 Million	\$22.1 Million	\$25.2 Million	\$25.2 Million	\$71.2 Million

LABOR INCOME	2022	2023	2024	2025	2026	Total
Direct	\$79.6 Million	\$90.7 Million	\$61.2 Million	\$62.8 Million	\$11.0 Million	\$426.5 Million
Indirect	\$34.5 Million	\$39.8 Million	\$26.8 Million	\$27.9 Million	\$3.9 Million	\$178.3 Million
Induced	\$17.2 Million	\$19.8 Million	\$13.3 Million	\$13.8 Million	\$2.1 Million	\$90.5 Million
Total	\$131.3 Million	\$150.4 Million	\$101.4 Million	\$104.6 Million	\$17.1 Million	\$695.3 Million

Source: Go Triangle, IMPLAN, DPF, 2015

Construction Impacts of the DOLRT on the Triangle Region

The economic effects, from the \$1.04 billion assumed direct construction spending, on the Triangle Region’s output is presented in Table 6. Spending levels vary on an annual basis with peak direct construction spending of \$241.7 million in 2023. Over the construction period, the Triangle Region’s output will increase by \$1.63 billion.

Table 6: DOLRT Construction – Triangle Region Impact - Output

OUTPUT	2015	2016	2017	2018	2019	2020	2021
Direct	\$16.1 Million	\$16.5 Million	\$19.1 Million	\$24.3 Million	\$27.7 Million	\$27.7 Million	\$109.0 Million
Indirect	\$6.8 Million	\$7.0 Million	\$8.0 Million	\$10.3 Million	\$11.7 Million	\$11.7 Million	\$38.2 Million
Induced	\$4.6 Million	\$4.8 Million	\$5.5 Million	\$7.0 Million	\$8.0 Million	\$8.0 Million	\$22.1 Million
Total	\$27.5 Million	\$28.3 Million	\$32.6 Million	\$41.6 Million	\$47.3 Million	\$47.3 Million	\$169.2 Million

OUTPUT	2022	2023	2024	2025	2026	Total
Direct	\$209.5 Million	\$241.7 Million	\$159.7 Million	\$165.3 Million	\$18.8 Million	\$1.04 Billion
Indirect	\$73.8 Million	\$85.6 Million	\$57.6 Million	\$60.3 Million	\$7.9 Million	\$378.8 Million
Induced	\$41.0 Million	\$47.1 Million	\$31.9 Million	\$33.1 Million	\$5.4 Million	\$218.4 Million
Total	\$324.3 Million	\$374.3 Million	\$249.2 Million	\$258.7 Million	\$32.1 Million	\$1.63 Billion

Source: Go Triangle, IMPLAN, DPF, 2015

As reflected in Table 7, the number of Triangle Region construction period jobs will vary in relation to construction activity over the construction period with total new jobs peaking to 2,555 in 2023.

Table 7: DOLRT Construction – Triangle Region Impact - Jobs

JOB	2015	2016	2017	2018	2019	2020
Direct	121.2	124.6	143.6	183.4	208.6	208.6
Indirect	54.5	56.2	64.7	82.5	93.8	93.8
Induced	35.9	36.8	42.6	54.3	61.8	61.8
Total	211.6	217.6	250.9	320.2	364.2	364.2

JOB	2021	2022	2023	2024	2025	2026
Direct	735.9	1,383.8	1,584.0	1,045.6	1,069.4	141.4
Indirect	268.0	520.5	605.6	414.0	439.0	63.6
Induced	171.4	318.4	365.6	247.5	256.7	41.9
Total	1,175.3	2,222.7	2,555.2	1,707.1	1,765.1	246.9

Source: Go Triangle, IMPLAN, DPGF, 2015

In total, the construction of the DOLRT is projected to increase labor income in the Triangle Region by \$653.1 million.

Table 8: DOLRT Construction – Triangle Region Impact - Labor Income

LABOR INCOME	2015	2016	2017	2018	2019	2020	2021
Direct	\$9.5 Million	\$9.7 Million	\$11.2 Million	\$14.3 Million	\$16.3 Million	\$16.3 Million	\$43.9 Million
Indirect	\$3.1 Million	\$3.1 Million	\$3.6 Million	\$4.6 Million	\$5.3 Million	\$5.3 Million	\$14.7 Million
Induced	\$1.7 Million	\$1.7 Million	\$2.0 Million	\$2.5 Million	\$2.9 Million	\$2.9 Million	\$7.9 Million
Total	\$14.2 Million	\$14.6 Million	\$16.8 Million	\$21.5 Million	\$24.4 Million	\$24.4 Million	\$66.6 Million

LABOR INCOME	2022	2023	2024	2025	2026	Total
Direct	\$79.6 Million	\$90.7 Million	\$61.2 Million	\$62.8 Million	\$11.0 Million	\$426.5 Million
Indirect	\$27.9 Million	\$32.2 Million	\$21.9 Million	\$22.9 Million	\$3.6 Million	\$148.3 Million
Induced	\$14.7 Million	\$16.9 Million	\$11.4 Million	\$11.9 Million	\$1.9 Million	\$78.3 Million
Total	\$122.2 Million	\$139.8 Million	\$94.5 Million	\$97.6 Million	\$16.6 Million	\$653.1 Million

Source: Go Triangle, IMPLAN, DPGF, 2015

Construction Impacts of the DOLRT on Durham and Orange Counties

The economic effects, from the \$1.04 billion assumed direct construction spending on the output of Durham and Orange Counties, is presented in Table 9. Spending levels vary on an annual basis with peak direct construction spending of \$241.7 million in 2023. Over the construction period, the output of Durham and Orange Counties is expected to increase by \$1.43 billion.

Table 9: DOLRT Construction – Durham-Orange Counties Impact - Output

OUTPUT	2015	2016	2017	2018	2019	2020	2021
Direct	\$16.1 Million	\$16.5 Million	\$19.1 Million	\$24.3 Million	\$27.7 Million	\$27.7 Million	\$109.0 Million
Indirect	\$4.7 Million	\$4.8 Million	\$5.5 Million	\$7.0 Million	\$8.0 Million	\$8.0 Million	\$22.6 Million
Induced	\$3.6 Million	\$3.7 Million	\$4.3 Million	\$5.4 Million	\$6.2 Million	\$6.2 Million	\$16.6 Million
Total	\$24.3 Million	\$25.0 Million	\$28.8 Million	\$36.8 Million	\$41.9 Million	\$41.9 Million	\$148.2 Million

OUTPUT	2022	2023	2024	2025	2026	Total
Direct	\$209.5 Million	\$241.7 Million	\$159.7 Million	\$165.3 Million	\$18.8 Million	\$1.04 Billion
Indirect	\$43.9 Million	\$51.1 Million	\$34.9 Million	\$37.0 Million	\$5.4 Million	\$232.9 Million
Induced	\$30.8 Million	\$35.4 Million	\$24.0 Million	\$25.0 Million	\$4.2 Million	\$165.4 Million
Total	\$284.2 Million	\$328.1 Million	\$218.7 Million	\$227.3 Million	\$28.4 Million	\$1.43 Billion

Source: Go Triangle, IMPLAN, DPGF, 2015

As reflected in Table 10, the number of DOLRT construction period jobs in Durham and Orange Counties will vary in relation to construction activity over the construction period with total new jobs peaking to 2,278 in 2023.

Table 10: DOLRT Construction – Durham-Orange Counties Impact - Jobs

JOB	2015	2016	2017	2018	2019	2020
Direct	121.2	124.6	143.6	183.4	208.6	208.6
Indirect	38.4	39.6	45.5	58.1	66.1	66.1
Induced	28.1	28.9	33.3	42.5	48.4	48.4
Total	187.7	193.1	222.4	284.0	323.1	323.1

JOB	2021	2022	2023	2024	2025	2026
Direct	735.9	1,383.8	1,584.0	1,045.6	1,069.4	141.4
Indirect	180.8	356.9	417.8	288.4	309.4	44.8
Induced	130.0	240.8	276.6	187.8	195.1	32.8
Total	1,046.7	1,981.5	2,278.4	1,521.8	1,573.9	219.0

Source: Go Triangle, IMPLAN, DPGF, 2015

In total, the construction of the DOLRT is projected to increase cumulative labor income in Durham and Orange Counties by \$583.8 million.

Table 11: DOLRT Construction – Durham Orange Counties Impact - Labor Income

LABOR INCOME	2015	2016	2017	2018	2019	2020	2021
Direct	\$9.5 Million	\$9.7 Million	\$11.2 Million	\$14.3 Million	\$16.3 Million	\$16.3 Million	\$43.9 Million
Indirect	\$2.1 Million	\$2.2 Million	\$2.5 Million	\$3.2 Million	\$3.6 Million	\$3.6 Million	\$9.4 Million
Induced	\$1.3 Million	\$1.4 Million	\$1.6 Million	\$2.0 Million	\$2.3 Million	\$2.3 Million	\$6.1 Million
Total	\$12.9 Million	\$13.2 Million	\$15.3 Million	\$19.5 Million	\$22.2 Million	\$22.2 Million	\$59.4 Million

LABOR INCOME	2022	2023	2024	2025	2026	Total
Direct	\$79.6 Million	\$90.7 Million	\$61.2 Million	\$62.8 Million	\$11.0 Million	\$426.5 Million
Indirect	\$17.8 Million	\$20.6 Million	\$14.2 Million	\$14.9 Million	\$2.4 Million	\$96.4 Million
Induced	\$11.3 Million	\$13.0 Million	\$8.8 Million	\$9.2 Million	\$1.5 Million	\$60.9 Million
Total	\$108.7 Million	\$124.4 Million	\$84.2 Million	\$86.9 Million	\$15.0 Million	\$583.8 Million

Source: Go Triangle, IMPLAN, DPGF, 2015

DOLRT Construction - State and Local Tax Effects

As shown in Table 12, the construction of the DOLRT is expected to generate total (direct, indirect, and induced) State and local taxes of approximately \$44.5 million over the construction period.²² Direct sales taxes were excluded as it is assumed construction materials purchased for the DOLRT project will be exempt from State and local option sales taxes.

²² To calculate the base taxes for each region, the estimate for the State's Taxes on Production & Imports comes from the U.S. Bureau of Economic Analysis (BEA)'s Gross State Product Series. That data set is then distributed across the 536 IMPLAN sectors based on the Taxes on Production & Imports to Labor Income relationships in the BEA Benchmark Input-Output table. The resultant State Taxes on Production & Imports, by sector, are then distributed to counties based on Labor Income in the respective sectors. The Taxes on Production & Imports are then distributed among the various tax types (for example, property, sales, etc.) based on the State's distributions, as defined by the Annual Census of Government Finances. Accordingly, state and local tax estimates in this analysis are based on the IMPLAN model's averaging techniques.

Table 12: DOLRT Construction - Statewide

STATE AND LOCAL TAXES	2015	2016	2017	2018	2019	2020	2021
Taxes on Production and Imports							
Sales Tax	\$ 224,000	\$ 230,000	\$ 266,000	\$ 339,000	\$ 387,000	\$ 387,000	\$ 1,562,000
Property Tax	208,000	213,000	246,000	316,000	358,000	358,000	1,397,000
Other	38,000	39,000	46,000	57,000	65,000	65,000	254,000
Corporate Profits Tax	6,000	6,000	7,000	9,000	11,000	11,000	93,000
Personal Tax							
Income Tax	46,000	210,000	239,000	306,000	349,000	349,000	1,028,000
Other	824,000	47,000	54,000	69,000	77,000	78,000	227,000
Total State and Local Taxes	\$ 1,645,000	\$ 844,000	\$ 972,000	\$ 1,241,000	\$ 1,412,000	\$ 1,413,000	\$ 5,145,000

STATE AND LOCAL TAXES	2022	2023	2024	2025	2026	Total
Taxes on Production and Imports						
Sales Tax	\$ 2,995,000	\$ 3,584,000	\$ 2,381,000	\$ 2,493,000	\$ 261,000	\$15.1 Million
Property Tax	2,665,000	3,066,000	2,022,000	2,083,000	243,000	\$13.2 Million
Other	485,000	558,000	368,000	379,000	45,000	\$2.4 Million
Corporate Profits Tax	189,000	222,000	144,000	152,000	7,000	\$0.9 Million
Personal Tax						
Income Tax	1,922,000	2,210,000	1,489,000	1,545,000	238,000	\$9.9 Million
Other	425,000	489,000	330,000	342,000	53,000	\$3.0 Million
Total State and Local Taxes	\$ 9,789,000	\$ 11,267,000	\$ 7,466,000	\$ 7,708,000	\$ 959,000	\$44.5 Million

Source: Go Triangle, IMPLAN, DPF, 2015

Ongoing Operations of the ROMF

This section describes the economic effects the annual operations of the Rail Operations and Maintenance Facility will have on the State, the Triangle Region, and Durham and Orange Counties. An analysis-by-parts approach was used to estimate the impacts based on annual stabilized labor income and operating budget information supplied by GT and the importing of the spending pattern for Sector 524, *Local Government Passenger Transit*.²³

According to the results in Table 13, the annual \$16.9 million ROMF budget will increase Statewide annual output by \$22.3 million; Triangle Region annual output by \$22.3 million; and annual output of Durham and Orange Counties by \$21.7 million.

Table 13: ROMF Operations - Annual Output

OUTPUT	STATEWIDE	TRIANGLE REGION	DURHAM-ORANGE COUNTIES
Direct	\$16.9 Million	\$16.9 Million	\$16.9 Million
Indirect	\$1.7 Million	\$1.6 Million	\$1.5 Million
Induced	\$3.7 Million	\$3.7 Million	\$3.3 Million
	\$22.3 Million	\$22.3 Million	\$21.7 Million

Source: Go Triangle, IMPLAN, DPF, 2015

GT estimates the ROMF annual operations will generate 235 direct jobs. Based on the IMPLAN model, the ROMF operations will increase jobs in the State by 275.1; jobs in the Triangle Region by 273.6; and jobs in Durham and Orange Counties by 270.3.

²³ Appropriate adjustments were made to Sector 524, *Local Government Passenger Transit* as the direct effect is based on the operating budget instead of ticket revenue.

Table 14: ROMF Operations - Annual Jobs

JOB	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	235.0	235.0	235.0
Indirect	10.4	10.0	9.2
Induced	29.7	28.6	26.1
	275.1	273.6	270.3

Source: Go Triangle, IMPLAN, DPGF, 2015

GT estimates the ROMF annual operations will generate additional direct labor income of \$11.2 million. Based on the IMPLAN model, the ROMF annual operations will increase annual labor income in the State by \$13.4 million; annual labor income in the Triangle Region by \$13.3; and annual labor income in Durham and Orange Counties by \$13.1 million.

Table 15: ROMF Operations - Annual Labor Income

LABOR INCOME	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	\$11.2 Million	\$11.2 Million	\$11.2 Million
Indirect	762,000	743,000	694,000
Induced	\$1.4 Million	\$1.4 Million	\$1.2 Million
	\$13.4 Million	\$13.3 Million	\$13.1 Million

Source: Go Triangle, IMPLAN, DPGF, 2015

Construction of New TOD Commercial Buildings

A summary of the value capture analysis of select station sites (Leigh Village, Gateway – BCBS, South Square, and Dillard Street) prepared by DPGF and included in the IMGRebel report titled, “Durham-Orange Light Rail Transit Project Financial Plan” dated June 23, 2014, is presented in Table 16. The 5.6 million square feet of new retail and office uses forms the basis for the direct economic effects of the construction of the new TOD commercial buildings and the ongoing operations of the new TOD commercial business establishments (discussed later in this report).

Table 16: New TOD Commercial Building Square Footage

STATION	RETAIL SQUARE FEET	OFFICE SQUARE FEET	TOTAL SQUARE FEET
Leigh Village	313,632	1,777,248	2,090,880
Gateway - BCBS	638,699	864,122	1,502,821
South Square	329,423	868,478	1,197,901
Dillard Street	78,408	705,672	784,080
	1,360,162	4,215,520	5,575,682

Source: Go Triangle, IMGRebel, DPGF, 2015

Assuming an estimated construction cost per square foot of \$218 based on data provided in the R.S. Means, “*Square Foot Costs*,” 36th Edition, 2015, the average annual economic impact during the construction period of the new TOD commercial buildings is as follows.

Average annual new TOD commercial building construction activity is expected to increase Statewide annual output by \$96.2 million; Triangle Region annual output by \$86.3 million; and annual output of Durham and Orange Counties by \$74.9 million.

Table 17: New TOD Commercial Buildings Average Annual Construction Period Output

OUTPUT	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	\$59.0 Million	\$59.0 Million	\$59.0 Million
Indirect	\$24.8 Million	\$17.1 Million	\$8.5 Million
Induced	\$12.4 Million	\$10.1 Million	\$7.4 Million
	\$96.2 Million	\$86.3 Million	\$74.9 Million

Source: Go Triangle, IMGRebel, IMPLAN, DPGF, 2015

The construction of the new TOD commercial buildings is projected to generate average annual jobs over the construction period as shown in Table 18.

Table 18: New TOD Commercial Buildings Average Annual Construction Period Jobs

JOBS	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	424.3	424.3	424.3
Indirect	139.7	100.8	55.9
Induced	96.1	78.8	58.0
	660.1	603.9	538.2

Source: Go Triangle, IMGRebel, IMPLAN, DPGF, 2015

Based on the IMPLAN model, the construction of the new TOD commercial buildings will increase the average annual construction period labor income for the State by \$34.3 million; the Triangle Region by \$31.7 million; and in Durham and Orange Counties by \$27.9 million.

Table 19: New TOD Commercial Buildings Average Annual Construction Period Labor Income

LABOR INCOME	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	\$21.6 Million	\$21.6 Million	\$21.6 Million
Indirect	\$8.4 Million	\$6.4 Million	\$3.6 Million
Induced	\$4.4 Million	\$3.6 Million	\$2.7 Million
	\$34.3 Million	\$31.7 Million	\$27.9 Million

Source: Go Triangle, IMGRebel, IMPLAN, DPGF, 2015

Cumulative construction period labor income for the construction of the new TOD commercial buildings is presented in Table 20.

Table 20: New TOD Commercial Buildings Cumulative Construction Period Labor Income

LABOR INCOME	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	\$476.1 Million	\$476.1 Million	\$476.1 Million
Indirect	\$183.8 Million	\$140.7 Million	\$78.7 Million
Induced	\$95.8 Million	\$79.8 Million	\$60.1 Million
	\$755.7 Million	\$696.6 Million	\$614.8 Million

Source: Go Triangle, IMGRebel, IMPLAN, DPGF, 2015

Cumulative statewide state and local taxes for the construction of the new TOD commercial buildings is presented in Table 21.

Table 21: New TOD Commercial Buildings Cumulative Construction Period State and Local Taxes

STATE AND LOCAL TAXES	STATEWIDE
Taxes on Production and Imports	
Sales Tax	\$26.5 Million
Property Tax	\$17.2 Million
Other	\$3.1 Million
Corporate Profits Tax	\$1.4 Million
Personal Tax	
Income Tax	\$10.6 Million
Other	\$2.4 Million
Total State and Local Taxes	\$61.2 Million

Source: Go Triangle, IMGRebel, IMPLAN, DPGF, 2015

Ongoing Activities of New TOD Commercial Establishments

The economic impacts from the annual operations of the new TOD commercial facilities were modeled using Industry Change, which is the increase or decrease in economic activity due to the expansion or change in production of new businesses. Instead of value of production or value added, new employment by industry sector was used as a proxy for production changes.

Table 22: New TOD Commercial Buildings – Annual Ongoing Operations Employment

SELECT STATION	RETAIL SQUARE FEET	SQ FT PER RETAIL EMPLOYEE	VACANCY RATE	RETAIL EMPLOYEES
Leigh Village	313,632	750	10%	376
Gateway - BCBS	638,699	750	10%	766
South Square	329,423	750	10%	395
Dillard Street	78,408	750	10%	94
Total	1,360,162			1,631

SELECT STATION	OFFICE SQUARE FEET	SQ FT PER OFFICE EMPLOYEE	VACANCY RATE	OFFICE EMPLOYEES
Leigh Village	1,777,248	225	10%	7,109
Gateway - BCBS	864,122	225	10%	3,456
South Square	868,478	225	10%	3,474
Dillard Street	705,672	225	10%	2,823
Total	4,215,520			16,862
Totals SF/Employment	5,575,682			18,493

Note: Square feet per employee estimates considers the gross building area which includes common areas, restricted areas, interior encroachments, occupant void areas, unassignable and assignable areas, and secondary circulation.

Source: International Facility Management Association Research Report #34, Space and Project Management Benchmarks," *Planner's Estimating Guide: Projecting Land-Use and Facility Needs*, Go Triangle, IMGRebel, DPGF, 2015

Because the future tenants of the new office and retail facilities are not yet known, the 18,493 new employees (Table 22) were distributed in Table 23 across the existing retail and office occupying sectors based on current Durham-Orange Counties study area employment. The square feet per employee methodology used to estimate employment is based on full-time equivalent employment. The IMPLAN model considers both full-time and part-time employees; therefore, an appropriate conversion was made in Table 23 to properly define the direct effect of the new office and retail ongoing activities.

Table 23: New TOC Commercial - Annual Ongoing Operations Direct Employment by Industry Sector

SECTOR #	SECTOR NAME	SECTOR EMPLOY- MENT	%	TOD EMPLOY- MENT	IMPLAN CONVERSION FACTOR	CONVERTED TOD EMPLOY- MENT
397	Retail - Furniture and home furnishings stores	631.9	3.4%	55	0.8575111955	64
398	Retail - Electronics and appliance stores	889.6	4.7%	77	0.8575111955	90
399	Retail - Building material and garden equipment and supplies stores	1,539.7	8.2%	134	0.8575111955	156
400	Retail - Food and beverage stores	4,236.9	22.5%	367	0.8577194753	428
401	Retail - Health and personal care stores	1,546.2	8.2%	134	0.8575111955	156
402	Retail - Gasoline stores	994.0	5.3%	86	0.8575111955	100
403	Retail - Clothing and clothing accessories stores	2,373.8	12.6%	206	0.8575111955	240
404	Retail - Sporting goods, hobby, musical instrument and book stores	866.0	4.6%	75	0.8575111955	87
405	Retail - General merchandise stores	3,752.3	19.9%	325	0.8575121163	379
406	Retail - Miscellaneous store retailers	1,980.3	10.6%	172	0.8575111955	201
	Total Retail	18,810.6	100.0%	1,631		1,901
SELECT OFFICE SECTORS						
433	Monetary authorities and depository credit intermediation	1,611.8	1.9%	320	0.9692949204	330
434	Nondepository credit intermediation and related activities	1,122.5	1.3%	219	0.9692949204	226
435	Securities and commodity contracts intermediation and brokerage	4,916.2	5.7%	961	0.9700115340	991
436	Other financial investment activities	1,155.8	1.3%	219	0.9700115340	226
437	Insurance carriers	6,138.2	7.1%	1,197	0.9690635452	1,235
438	Insurance agencies, brokerages, and related activities	866.0	1.0%	169	0.9690635452	174
439	Funds, trusts, and other financial vehicles	1,905.4	2.2%	371	0.7500000000	495
440	Real estate	10,553.8	12.2%	2,057	0.9128137384	2,253
447	Legal services	1,737.9	2.0%	337	0.9494773519	355
448	Accounting, tax preparation, bookkeeping, and payroll services	1,091.0	1.3%	219	0.9494214259	231
449	Architectural, engineering, and related services	2,611.8	3.0%	506	0.9494214259	533
450	Specialized design services	342.4	0.4%	67	0.9494214259	71
451	Custom computer programming services	5,362.5	6.2%	1,045	0.9690635452	1,078
452	Computer systems design services	1,818.8	2.1%	354	0.9491525424	373
453	Other computer related services, including facilities management	736.5	0.8%	135	0.9491525424	142
454	Management consulting services	2,550.8	2.9%	489	0.9494214259	515
455	Environmental and other technical consulting services	372.3	0.4%	67	0.9494214259	71
456	Scientific research and development services	20,235.6	23.3%	3,929	0.9494214259	4,138
457	Advertising, public relations, and related services	930.1	1.1%	185	0.9494214259	195
458	Photographic services	331.7	0.4%	67	0.9494214259	71
459	Veterinary services	624.1	0.7%	118	0.9494214259	124
460	Marketing research and all other miscellaneous professional, scientific	1,722.1	2.0%	337	0.9494214259	355
461	Management of companies and enterprises	1,527.2	1.8%	304	0.9463601533	321
462	Office administrative services	1,095.3	1.3%	219	0.9101841413	241
463	Facilities support services	125.8	0.1%	17	0.9101841413	19
464	Employment services	7,546.3	8.7%	1,467	0.9101841413	1,612
465	Business support services	1,252.5	1.4%	236	0.9101841413	259
466	Travel arrangement and reservation services	164.6	0.2%	34	0.9101841413	37
475	Offices of physicians	3,371.5	3.9%	658	0.8969706289	734
476	Offices of dentists	1,804.9	2.1%	354	0.8969706289	395
477	Offices of other health practitioners	1,146.5	1.2%	205	0.8969706289	229
	Total Office	86,771.8	100.0%	16,862		18,029
TOTAL RETAIL AND OFFICE						18,493
						19,930

Source: Go Triangle, IMGRebel, IMPLAN, DPF, 2015

The economic impact from the annual operations of the new TOD retail and office facilities was modeled using Industry Change; however, new employment by industry sector of 19,930 was used as a proxy for production changes.

Average annual new TOD commercial ongoing activity is expected to increase Statewide annual output by \$5.36 billion; Triangle Region annual output by \$5.19 billion; and annual output of Durham and Orange Counties by \$4.73 billion.

Table 24: New TOD Commercial Ongoing Activities – Annual Output

OUTPUT	STATEWIDE	TRIANGLE REGION	DURHAM-ORANGE
			COUNTIES
Direct	\$3.27 Billion	\$3.27 Billion	\$3.27 Billion
Indirect	\$1.33 Billion	\$1.23 Billion	\$0.91 Billion
Induced	\$0.76 Billion	\$0.69 Billion	\$0.54 Billion
	\$5.36 Billion	\$5.19 Billion	\$4.73 Billion

Source: Go Triangle, IMGRebel, DPGF, 2015

The annual 19,930 ongoing new TOD commercial activity jobs are projected to generate 35,085 Statewide jobs, 33,761 Triangle Region jobs, and 30,485 jobs in Durham and Orange Counties.

Table 25: New TOD Commercial Ongoing Activities – Annual Jobs

JOBS	STATEWIDE	TRIANGLE REGION	DURHAM-ORANGE
			COUNTIES
Direct	19,930.0	19,930.0	19,930.0
Indirect	9,330.7	8,518.5	6,295.3
Induced	5,824.1	5,312.8	4,259.8
	35,084.8	33,761.3	30,485.1

Source: Go Triangle, IMGRebel, DPGF, 2015

Total ongoing new TOD commercial activity is projected to generate \$2.14 billion in annual labor income Statewide, \$2.09 billion in annual labor income for the Triangle Region; and \$1.89 billion in annual labor income for Durham and Orange Counties.

Table 26: New TOD Commercial Ongoing Activities – Annual Labor Income

LABOR INCOME	STATEWIDE	TRIANGLE REGION	DURHAM-ORANGE
			COUNTIES
Direct	\$1.35 Billion	\$1.35 Billion	\$1.35 Billion
Indirect	\$523.2 Million	\$486.5 Million	\$349.2 Million
Induced	\$269.1 Million	\$247.0 Million	\$193.1 Million
	\$2.14 Billion	\$2.09 Billion	\$1.89 Billion

Source: Go Triangle, IMGRebel, DPGF, 2015

The new TOD commercial ongoing activities yields annual state and local taxes of \$175.6 million annually based on the IMPLAN methodology.

Table 27: New TOD Commercial Ongoing Activities – Annual State and Local Taxes

STATE AND LOCAL TAXES	STATEWIDE
Taxes on Production and Imports	
Sales Tax	\$74.8 Million
Property Tax	\$48.6 Million
Other	\$8.8 Million
Corporate Profits Tax	\$6.9 Million
Personal Tax	\$0.0 Million
Income Tax	\$29.8 Million
Other	\$6.6 Million
Total State and Local Taxes	\$175.6 Million

Source: Go Triangle, IMGRebel, DPGF, 2015

Construction of New TOD Residences

The previously referenced IMGRebel report titled, “Durham-Orange Light Rail Transit Project Financial Plan” projected 3,240 new residential units at the station sites referenced in Table 29. The economic impacts associated with the construction of these new housing units are described in this section.

Table 28: New TOD Residences, in Units

STATION	SQUARE	
	FEET	UNITS
Leigh Village	2,250,000	1,800
Gateway - BCBS	1,008,000	840
South Square	440,000	400
Dillard Street	200,000	200
	3,898,000	3,240

Source: Go Triangle, IMGRebel, DPGF, 2015

The average annual direct construction costs of \$70.0 million are projected to increase Statewide output by \$134.9 million; Triangle Region output by \$122.8 million; and \$107.5 million of output for Durham and Orange Counties over the construction period.

Table 29: New TOD Residential – Average Annual Construction Period Output

OUTPUT	STATEWIDE	TRIANGLE	DURHAM-
		REGION	ORANGE
			COUNTIES
Direct	\$70.0 Million	\$70.0 Million	\$70.0 Million
Indirect	\$47.9 Million	\$38.8 Million	\$27.1 Million
Induced	\$17.0 Million	\$13.9 Million	\$10.4 Million
	\$134.9 Million	\$122.8 Million	\$107.5 Million

Source: Go Triangle, IMGRebel, DPGF, 2015

On average, the construction of the new TOD residences will generate 917 annual jobs Statewide, 835 annual jobs for the Triangle Region, and 743 annual jobs for Durham and Orange Counties over the construction period.

Table 30: New TOD Residential – Average Annual Construction Period Jobs

JOBS	STATEWIDE	TRIANGLE	DURHAM-
		REGION	ORANGE
			COUNTIES
Direct	379.3	379.3	379.3
Indirect	405.6	347.0	282.8
Induced	131.8	108.3	81.0
	916.7	834.6	743.1

Source: Go Triangle, IMGRebel, DPGF, 2015

Average annual new TOD residential construction period labor income of \$42.7 million is projected Statewide; whereas, \$39.0 million is projected for the Triangle Region and \$34.2 million for Durham and Orange Counties.

Table 31: New TOD Residential – Average Annual Construction Period Labor Income

LABOR INCOME	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	\$20.7 Million	\$20.7 Million	\$20.7 Million
Indirect	\$16.0 Million	\$13.4 Million	\$9.7 Million
Induced	\$6.0 Million	\$5.0 Million	\$3.8 Million
	\$42.7 Million	\$39.0 Million	\$34.2 Million

Source: Go Triangle, IMGRebel, DPGF, 2015

Cumulative new TOD residential construction period labor income for the three study areas is reflected in Table 32.

Table 32: New TOD Residential – Cumulative Construction Period Labor Income

LABOR INCOME	STATEWIDE	TRIANGLE REGION	DURHAM- ORANGE COUNTIES
Direct	\$206.9 Million	\$206.9 Million	\$206.9 Million
Indirect	\$160.3 Million	\$133.6 Million	\$97.4 Million
Induced	\$59.8 Million	\$49.9 Million	\$38.1 Million
	\$427.0 Million	\$390.4 Million	\$342.5 Million

Source: Go Triangle, IMGRebel, DPGF, 2015

As shown in Table 33, the construction of the new TOD residences is projected to generate cumulative state and local taxes of \$35.9 million.

Table 33: New TOD Residential – Cumulative Construction Period State and Local Taxes

STATE AND LOCAL TAXES	STATEWIDE
Taxes on Production and Imports	
Sales Tax	\$15.7 Million
Property Tax	\$10.2 Million
Other	\$1.9 Million
Corporate Profits Tax	
Personal Tax	
Income Tax	\$6.7 Million
Other	\$1.5 Million
Total State and Local Taxes	\$35.9 Million

Source: Go Triangle, IMGRebel, DPGF, 2015

COMMENTS AND OBSERVATIONS REGARDING ESTIMATION OF ECONOMIC IMPACT

Any aggregate estimation of direct and indirect economic impacts and economic development benefits associated with a new LRT line and/or TOD will include some economic activity that would have been realized without the transit investment and subsequent development. The Triangle Region will continue to grow with or without a DOLRT line or TOD. The Triangle's burgeoning population will acquire housing somewhere, and additional office and retail properties will develop whether or not the Region elects to invest in LRT. Relevant considerations include the quality, character, nature, extent, and value of the development that

might result from LRT/TOD less than that which would have developed otherwise. Another valid consideration is the extent to which community development under a DOLRT/TOD scenario contributes to the region's economic development, vitality, and security in a manner materially different than that expected as a result of extension of current patterns. The valid consideration is not the gross impact of any particular infrastructure investment decision, but the net difference between that decision and any particular alternative.

REFERENCES

- Adams, J. S., Vandrasek, Barbara J. (2007). Transportation as Catalyst for Community Economic Development. In T. A. I. o. Architects (Ed.), *Moving Communities Forward No. 2*: University of Minnesota Digital Conservancy.
- Adler, H. A. (1966). Evaluating transport projects: economic art of evaluating transport projects in less developed countries [with emphasis on highway projects]. *Finance and Development*, 3, 49-57.
- APTA. (2015). American Public Transportation Association. Retrieved 2015.04.05, from <http://www.apta.com/resources/statistics/Pages/ridershipreport.aspx>
- ASCE. (2013). 2013 Report Card for America's Infrastructure. 2015, from <http://www.infrastructurereportcard.org/a/-p/home>
- Atkinson-Palombo, C. (2010). 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*.
- Baird, B. (2005). Public Infrastructure and Economic Productivity: A Transportation-Focused Review. *Transportation Research Record: Journal of the Transportation Research Board*, 1932(-1), 54-60. doi: 10.3141/1932-07
- Banister, D., & Berechman, Y. (2001). Transport investment and the promotion of economic growth. *Journal of Transport Geography*, 9(3), 209-218. doi: [http://dx.doi.org/10.1016/S0966-6923\(01\)00013-8](http://dx.doi.org/10.1016/S0966-6923(01)00013-8)
- Bartholomew, K., & Ewing, R. (2011). Hedonic price effects of pedestrian-and transit-oriented development. *Journal of Planning Literature*, 26(1), 18-34.
- Beldon, Russonello, & Stewart. (2011). The 2011 Community Preference Survey What Americans are looking for when deciding where to live. WASHINGTON D.C.: NATIONAL ASSOCIATION OF REALTORS.
- Bidwell, S. (2012). Review of studies that have quantified the economic benefits of interventions to increase walking and cycling for transport. *Christchurch: Community and Public Health, Canterbury District Health Board*.
- Burchell, R., et al. (2002). Costs of Sprawl—2002. Washington D.C.: TRANSPORTATION RESEARCH BOARD — NATIONAL RESEARCH COUNCIL.
- Carlino, G. A., Chatterjee, S., & Hunt, R. M. (2007). Urban density and the rate of invention. *Journal of Urban Economics*, 61(3), 389-419.
- Cervero, R. (2004). *Transit-oriented development in the United States: experiences, challenges, and prospects* (Vol. 102): Transportation Research Board.
- Cervero, R. (2009). Transport Infrastructure and Global Competitiveness: Balancing Mobility and Livability. *The Annals of the American Academy of Political and Social Science*, 626(1), 210-225. doi: <http://dx.doi.org/10.1177/0002716209344171>
- Cervero, R., & Duncan, M. (2001). Rail transit's value added: Effect of proximity to light and commuter rail transit on commercial land values in Santa Clara County California. *National Association of Realtors Urban Land Institute*.

- Cervero, R. F., Christopher; Murphy, Steven. (2002). *Transit-Oriented Development and Joint Development in the United States: A Literature Review*. Transit Cooperative Research Program.
- Congress, U. (2005). *Safe, accountable, flexible, efficient transportation equity act (SAFETEA-LU)*. Paper presented at the US Congress, Washington, DC.
- CTOD. (2011). Transit and Regional Economic Development Center for Transit Oriented Development.
- De la Fuente, Á. (2010). *Infrastructures and productivity: an updated survey*: Universitat Autònoma de Barcelona, Departament d'Economia i d'Història Econòmica, Unitat Fonaments de l'Anàlisi Econòmica.
- Dittmar, H., & Ohland, G. (2004). *The new transit town: best practices in transit-oriented development*: Island Press.
- DOHS. (2010). *Aging Infrastructure: Issues, Research, and Technology*. Washington, DC: Retrieved from <http://www.dhs.gov/xlibrary/assets/st-aging-infrastructure-issues-research-technology.pdf>.
- Duncan, M. (2010). The impact of transit-oriented development on housing prices in San Diego, CA. *Urban studies*.
- Eberts, R. W. (1990). Public infrastructure and regional economic development. *Economic Review*, 26(1), 15-27.
- Florida, R. L. (2002). *The rise of the creative class: and how it's transforming work, leisure, community and everyday life*: Basic books.
- Flyvbjerg, B. (2009). Survival of the unfittest: why the worst infrastructure gets built—and what we can do about it. *Oxford review of economic policy*, 25(3), 344-367.
- Fogarty, N., Srivastava, S., Gehrke, A., Nemirow, A., Austin, M., & Economics, s. o. S. (2013). *Downtowns, Greenfields and Places In Between Promoting Development Near Transit*: Center for Transit Oriented Development.
- Freilich, R. H. (1998). The land-use implications of transit-oriented development: Controlling the demand side of transportation congestion and urban sprawl. *The Urban Lawyer*, 547-572.
- . FTA NEW STARTS ECONOMIC DEVELOPMENT CRITERIA (2006). BERKELEY, CALIFORNIA Strategic Economics
- Greene, R. K. (2009). Transit-Oriented Development As Economic Stimulus. *Area Development Site and Facility Planning*, 44(2), 57-61.
- Katz, B., & Wagner, J. (2014). THE RISE OF INNOVATION DISTRICTS: A New Geography of Innovation in America. In B. Institute (Ed.). Washington, D.C.: Brookings Institute.
- Kessides, C. (1993). *The contributions of infrastructure to economic development: A review of experience and policy implications* (Vol. 213): World Bank Publications.
- Knaap, G. J., Ding, C., & Hopkins, L. D. (2001). Do Plans Matter? The Effects of Light Rail Plans on Land Values in Station Areas. *Journal of Planning Education and Research*, 21(1), 32-39. doi: 10.1177/0739456x0102100103
- Lakshmanan, T. (2011). The broader economic consequences of transport infrastructure investments. *Journal of Transport Geography*, 19(1), 1-12.

- Litman, T. (2007). Evaluating rail transit benefits: A comment. *Transport Policy*, 14(1), 94-97.
- Litman, T. (2010). Evaluating transportation economic development impacts. *Victoria Transport Policy Institute*, 8.
- Luger, M. I., & Goldstein, H. (1991). *Technology in the garden: research parks and regional economic development*: Univ of North Carolina Press.
- MacDonald, J. M., Stokes, R. J., Cohen, D. A., Kofner, A., & Ridgeway, G. K. (2010). The effect of light rail transit on body mass index and physical activity. *American journal of preventive medicine*, 39(2), 105-112.
- Mathur, S., & Ferrell, C. (2009, 12/15/2009 Dec 15). Mineta Transportation Institute Publishes Report on the Effect of Transit Oriented Developments (TOD) on Nearby Home Values. *Business Wire*. Retrieved from <http://libproxy.lib.unc.edu/login?url=http://search.proquest.com/docview/443714222?accountid=14244>
- MPO, D.-C. H.-C. (2014). Research Triangle Region – 2040 Metropolitan Transportation Plans Ch. 3. Retrieved 2015.03.04, from <http://www.dchcmpto.org/civicax/filebank/blobdload.aspx?BlobID=28432>
- Muro, M., Rothell, J., Andes, S., Flkri, K., & Kulkarni, S. (2015). America's Advanced industries: What they are, Where they are, and Why they Matter. In B. Institute (Ed.). Washington D.C.: Brookings Institute.
- Porter, M. E. (2001). *Research Triangle: clusters of innovation initiative*: Council on Competitiveness.
- Prall, D. (2013). Strong transit system linked to economic development. *The American City & County*.
- Puentes, R. (2015). America's infrastructure woes are no joke: John Oliver takes on infrastructure.
- Rodriguez, D. A., & Mojica, C. H. (2008). Land value impacts of bus rapid transit: the case of Bogotá's TransMilenio. *Land Lines*.
- Shinkle, D. (2012). Transit-Oriented Development in the States. In N. C. o. S. Legislatures (Ed.), *The Forum for America's Ideas*. Denver CO, Washington, DC: National Conference of State Legislatures.
- Smilor, R., O'donnell, N., Stein, G., & Welborn, R. S. (2007). The research university and the development of high-technology centers in the United States. *Economic Development Quarterly*, 21(3), 203-222.
- SSTI. (2015). Retrieved 2015.04.05, 2015, from <http://www.ssti.us/2014/02/vmt-drops-ninth-year-dots-taking-notice/>
- Stokes, R. J., MacDonald, J., & Ridgeway, G. (2008). Estimating the effects of light rail transit on health care costs. *Health & Place*, 14(1), 45-58. doi: <http://dx.doi.org/10.1016/j.healthplace.2007.04.002>
- Vickerman, R. (2008). Transit investment and economic development. *Research in Transportation Economics*, 23(1), 107-115. doi: <http://dx.doi.org/10.1016/j.retrec.2008.10.007>

Article 26 of North Carolina General Statute 160A enabled the creation of the Go Triangle agency in 1989. Paragraph 7a of NC GS 160A-610 specified that:

“General powers of the Authority shall include [the enhancement of] mobility within the region and [promotion of] sound growth patterns through joint transit development projects as generally described by Federal Transit Administration (FTA) policy ... and implementing guidelines ... with respect to the planning, construction, and operation of joint transit development projects... and to enter into development agreements with public, private, or nonprofit entities to undertake the planning, construction, and operation of joint transit development projects.”

FTA Circular 7050.1, updated August 25, 2014, defines Joint Development as:

“A public transportation project that integrally relates to, and often co-locates with commercial, residential, mixed-use, or other non-transit development. Joint development may include partnerships for public or private development associated with any mode of transit system that is being improved through new construction, renovation, or extension. Joint development may also include intermodal facilities, intercity bus and rail facilities, transit malls, or historic transportation facilities.”

APPENDIX II

North Carolina

N.C. Gen. Stat. §160A-536

As used in this section, the term "transitoriented development" includes the provision within a public transit area of any service or facility listed in this subsection. A public transit area is an area within a one fourth mile radius of any passenger stop or station located on a mass transit line. A mass transit line is a rail line along which a public transportation service operates or a busway or guideway is dedicated to public transportation service. A busway is not a mass transit line if a majority of its length also is generally open to passenger cars and other private vehicles more than two days a week.

The following services and facilities are included in the definition of transit-oriented development if they are provided within a transit area:

- Any service or facility that may be provided in a downtown area as a downtown revitalization project under subdivision (a)(2) and subsection (b) of this section;
- Passenger stops and stations on a mass transit line;
- Parking facilities and structures associated with passenger stops and stations on a mass transit line; and
- Any other service or facility, whether public or public-private, that the city may by law provide or participate in within the city, including retail, residential and commercial facilities.

N.C. Gen. Stat. §136-252

Local government entities are eligible to receive grants from the Congestion Relief and Intermodal 21st Century Transportation Fund for public transportation purposes, which include planning and engineering. The applicant must approve a transit plan that includes a number of criteria, including, among other things: promotion of a pedestrian- and Bike friendly environment around and connected to transit stations; promotion of mixed-use and transitoriented developments and other land use tools that encourage multimodal mobility; and promotion of access to public transportation for those who live in areas with a disproportionate number of households below the area median income.

GENERAL AND LIMITING CONDITIONS

Every reasonable effort has been made to ensure that the data contained in this report are accurate as of the date of this study; however, factors exist that are outside the control of DPFPG and that may affect the estimates and/or projections noted herein. This study is based on estimates, assumptions and other information developed by DPFPG from its independent research effort, general knowledge of the industry, and information provided by and consultations with the client and the client's representatives. No responsibility is assumed for inaccuracies in reporting by the client, the client's agent and representatives, or any other data source used in preparing or presenting this study.

This report is based on information that was current as of July 2015, and DPFPG has not undertaken any update of its research effort since such date.

Because future events and circumstances, many of which are not known as of the date of this study, may affect the estimates contained therein, no warranty or representation is made by DPFPG that any of the projected values or results contained in this study will actually be achieved.

Possession of this study does not carry with it the right of publication thereof or to use the name of "DPFPG" in any manner without first obtaining the prior written consent of DPFPG. No abstracting, excerpting or summarization of this study may be made without first obtaining the prior written consent of DPFPG. Further, DPFPG has served solely in the capacity of consultant and has not rendered any expert opinions. This report is not to be used in conjunction with any public or private offering of securities, debt, equity, or other similar purpose where it may be relied upon to any degree by any person other than the client, nor is any third party entitled to rely upon this report, without first obtaining the prior written consent of DPFPG. This study may not be used for purposes other than that for which it is prepared or for which prior written consent has first been obtained from DPFPG. Any changes made to the study, or any use of the study not specifically prescribed under agreement between the parties or otherwise expressly approved by DPFPG, shall be at the sole risk of the party making such changes or adopting such use.

This study is qualified in its entirety by, and should be considered in light of, these limitations, conditions and considerations.