

Economic Impact Analysis for HGAC’s High Capacity Transit (HCT) Project

March 21, 2019

Executive Summary

HGAC has estimated the economic impacts of investment in candidate High Capacity Transit (HCT) projects for its new 2045 Regional Transportation Plan with its horizon year of 2045. The analysis covers six scenarios in which HCT project capital and operating costs vary based on different service types. The services include a full range of local, express and High Capacity Transit services, where the service levels (frequency, speed and capacity) of High Capacity Transit varies based on the extent to which the High Capacity transit elements operate within exclusive rights of way (described in preceding sections of this report). The primary results are shown in Table ES.1. Economic benefits of the HCT project consist of:

- Personal user benefits, which arise from personal travel via highways or transit, including commuting, recreational and social trips, and business delivery trips. These benefits include travel time savings, safety benefits arising from the reduced risk crashes as a transit patron and other cost savings to the transit patron.
- Increased personal income, which stems from additional economic growth and wages received by the region’s workforce.

Table ES. 1: Benefits and Costs of the HCT Project

Category	Units	NoBuild	2040Hway	HCT_Low	HCT_ML	HCT_MH	HCT_High
Total User Benefits	Billions of dollars (2018)	-57.0	-2.4	362.1	377.5	418.2	521.3
- Travel Time Savings	Billions of dollars (2018)	-57.5	-4.3	285.5	286.5	287.7	290.2
- Safety Improvements	Billions of dollars (2018)	0.0	2.0	76.7	91.1	130.5	230.6
- Others	Billions of dollars (2018)	0.6	-0.1	-0.2	-0.1	0.0	0.4
Project Costs	Billions of dollars (2018)	18.9	48.1	90.0	98.6	135.8	154.4
Project BC Ratio	-	-3.0	-0.1	4.0	3.8	3.1	3.4
Total Impact Benefits	Billions of dollars (2018)	-83.7	45.1	684.8	711.2	797.1	926.3
Impact BC Ratio	-	-4.4	0.9	7.6	7.2	5.9	6.0
Total Employment	Thousands (Jobs)	516.7	914.8	2049.7	2116.2	2393.7	2541.6
Annual Average Job Growth	Thousands (Jobs)	19.1	33.9	75.9	78.4	88.7	94.1
GDP	Billions of dollars (2018)	65.5	139.5	419.7	430.9	477.6	503.6
Output	Billions of dollars (2018)	136.7	292.4	888.6	912.1	1009.6	1063.7
Personal Income	Billions of dollars (2018)	-26.7	47.5	322.7	333.8	378.9	405.0

With adjustments for the present value of future benefits, total economic benefits will be \$926 billion for the HCT High Costs scenario. Project costs are also reflected in 2018 dollars. Economic benefits are projected through 2045, in line with Regional Transportation Plan timeline.

1. Methodology

The first step is to modify HCT project area network changes. Then we ran through travel demand model by scenarios to reflect network changes. The results are imported into REMI TranSight, to measure the reasonableness of economic activity and transportation efficiencies of the study project.

The macroeconomic effects of HCT are captured in combined societal (user) travel efficiency benefits and economic impacts. Travel efficiency benefits are generated by the reduction in highway traffic. Remaining highway users enjoy less congested facilities as the result of a small percentage of automotive trip takers switching to transit. Additionally, all transit riders benefit from transit improvements, typically through the reduction of door-to-door trip time. This is roughly analogous to highway users benefiting from reductions in congestion or from the opening of new road facilities. It is sometimes referred to as increases in consumer surplus. These benefits in forms of vehicle miles traveled (VMT), vehicle hours travel (VHT) and vehicle total trips (VTT) are inputs to REMI TransSight, which generates estimates for travel time savings, vehicle operating cost savings, emission cost savings, and accident cost reductions. With added HCT project operating expenses, repair and maintenance costs, and facility expansion costs, REMI estimates the number of jobs created, regional GDP increased, and personal income changes, etc., as results of implementation of the HCT project.

2. The Need for Project Impact Analysis

One of the primary reasons for investing in transportation system is to strengthen the economic vitality of a region. Better access to markets and labor force, reduced cost of delay, less congestion, improved safety, lower pollution levels, and a better quality of life are all elements of improving economic vitality. However, the ways in which new and improved highway system influences economic vitality are complex and often indirect, which complicates decisions about transportation projects. Understanding what changes in productivity result from improvements in market accessibility, intermodal connectivity, scheduling, logistics, and international competitiveness helps communities and transportation agencies identify transportation options to meet their goals.

Economics and demographics of a region are changing over time. Project effects today are much differently than in the future. Every region's travel networks and economy are different. It is desirable to score projects based on travel demand and economics as a complete system. Excellent economic impact assessment tools for transportation projects are available, but they tend to be relatively time-consuming and expensive to use. Until now, this has meant that the economic impacts of potential projects often have not been considered in the early stages of planning and programming when many possible project alternatives are being considered. With REMI TranSight, economic impacts can be considered during planning for transportation projects or during public and stakeholder involvement for long-range system planning or corridor planning.

3. What is REMI TranSight?

REMI TranSight is the leading tool for evaluating the total economic effects of changes to transportation systems. Grounded in over 20 years of transportation modeling experience, TranSight provides an integrated system for comprehensive evaluation of transportation systems. This approach allows analysts to thoroughly describe the far-reaching economic and operational effects of transportation projects.

Integrating economics with travel demand modeling, TranSight dynamically demonstrates how transportation makes economies competitive. Users can test alternative transportation changes and observe the short and long-term impact on jobs, income, population, and other economic variables. TranSight is a sophisticated modeling tool that integrates travel demand models with the REMI model and is constructed with extensive data on emissions, safety valuation factors, and other data.

The graphic is titled "REMI Models" and is set against a light green background. It features two logos: "PI+" with a blue and green icon, and "TranSight" with a yellow and blue icon. The PI+ logo is associated with a yellow box containing three bullet points. The TranSight logo is associated with a blue box containing two bullet points.

REMI Models

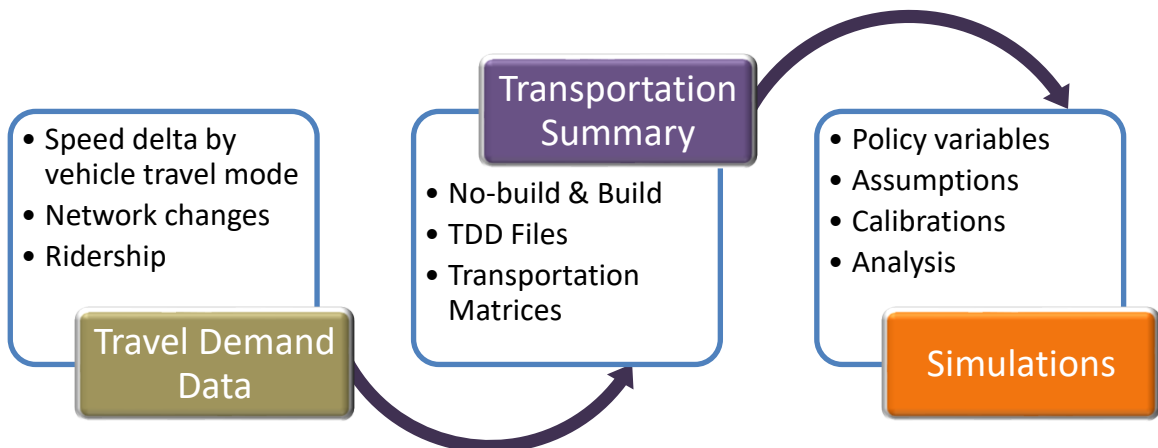
- PI+**
 - The next generation Policy Insight model
 - Comprehensive modeling estimating economic and demographic effects
 - Up to 169 industry sectors across 3,089 U.S. counties including 6,000 + fully adjustable policy variables updated yearly
- TranSight**
 - Comprehensive tool for evaluating the total economic effects of changes to transportation systems
 - Integrates travel demand data, data on emissions, safety valuation factors, etc., and 3 additional transportation-related cost matrices with PI+

4. REMI TranSight Model Linkages

While stand-alone transportation models produce forecasts of travel-demand responses to a proposed transportation project, TranSight provides a more complete perspective by predicting the full array of economic and demographic effects that will result from completing the project. It translates the key outputs generated by the transportation models into a series of cost and amenity variables that can be incorporated into a single-region or multi-region impact analysis, as driven by the powerful PI+ engine, which is also the core of

REMI’s PI+ model. The output of this process shows such key economic indicators as employment by industry, output, and value added by industry, personal income, population, and many more.

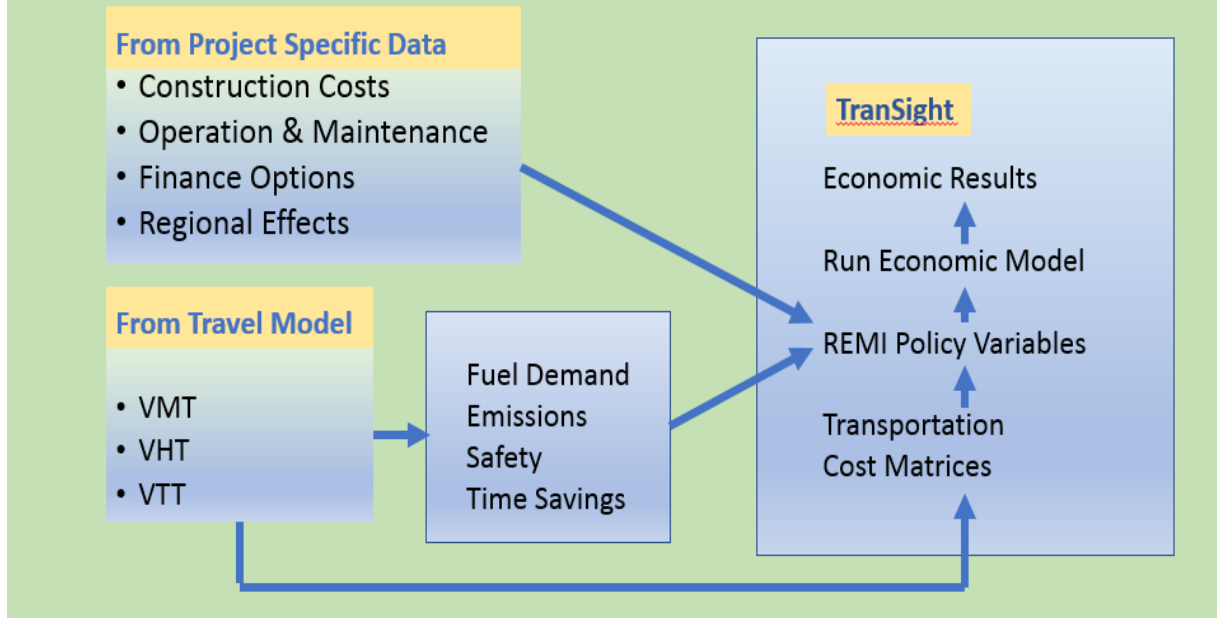
TranSight allows the user to specify the financial dimensions of an upgrade to the transportation infrastructure, including expected construction costs, financing, and annual operation/maintenance costs. In addition, it calculates several indirect types of costs and benefits that may ensue from the project, including changes in safety, emissions, operating costs, and transportation costs. Some of these computations require user input regarding construction, finance, and operations, while others use the output from travel-demand model scenarios. Collectively, this information is transferred into PI+, which produces multi-year forecasts of economic and demographic trends under the transportation upgrade, and compares them with a baseline forecast. In capturing the full effects of the project, TranSight can assist government in determining where allocating funds to a particular transportation upgrade is a winning proposition relative to funding other policy initiatives.



5. How REMI TranSight Estimates Benefits

The model structure is represented pictorially in Figure x below, which reveals both the components of the model and the manner in which information flows between them. Outputs from the transportation model are combined with built-in cost parameters and project-specific information to produce values for policy variables designed to simulate the project’s direct impact. The PI+ engine processes these results to generate comprehensive forecasts of the project’s macroeconomic effects.

REMI TranSight Inputs for Transportation Projects



6. What Results Are Available from REMI

REMI provides a variety of output options. They can be grouped into three categories: economic impact, societal (user) benefit, and transportation cost summary.

- 6.1. Economic impact measurement includes employment, personal income, output, regional product, property value, and productivity.
- 6.2. Societal (user) benefits measurement includes emission reduction, safety improvement, vehicle operating cost improvement and value of time savings.
- 6.3. Transportation summary index measures improvement in labor and commodity access costs, production cost and delivered price impacts. It evaluates impact of transportation efficiency on the community and economy.

7. HCT Economic Impact Scenario Building

The HCT project runs from 2018 to 2045. Four capital expenditure scenarios were developed for the Vision network, ranging from a “low” scenario to a “high” scenario. It is understood that the different capital expenditure scenarios are likely to have different economic benefits.

Table 8.1. Summary of Travel Demand Changes

2045 INPUTS	NoBuild			2040 Highway Build			HCT-Low		
	VMT	VHT	VTT	VMT	VHT	VTT	VMT	VHT	VTT
Roadway	304,088,267	11,791,465	29,772,874	301,520,028	11,245,871	29,761,575	300,695,737	8,267,339	29,670,438
Transit	86,947,545	5,971,539	4,846,375	86,947,545	5,961,200	4,938,328	220,063,071	13,293,913	6,593,179
2045 INPUTS	HCTTF-Med-Low			HCTTF-Med-High			HCTTF-High		
	VMT	VHT	VTT	VMT	VHT	VTT	VMT	VHT	VTT
Roadway	299,762,204	8,228,311	29,589,644	298,442,136	8,143,278	29,389,274	290,808,735	7,927,642	28,864,663
Transit	220,063,071	13,293,913	6,945,455	220,058,813	12,962,273	8,143,040	220,058,813	12,939,654	10,786,424

Table 8.2. Summary of Project Input Costs

SCENARIO	Highway and Transit No-Build	Highway Build / Transit No-Build	HCTTF Vision Low	HCTTF Vision Medium Low	HCTTF Vision Medium High	HCTTF Vision High
Buildout Year	2045	2045	2045	2045	2045	2045
Annual Boardings, All Services	228,879,096	236,063,845	515,153,585	542,678,428	636,250,959	852,790,031
Fixed Route	218,604,676	225,466,901	492,028,257	518,317,506	607,689,550	804,957,050
Demand Response & Paratransit	5,683,722	5,862,139	12,792,735	13,476,255	15,799,928	20,928,883
Vanpool	4,590,698	4,734,805	10,332,593	10,884,668	12,761,481	26,904,099
Annual Passenger Miles, All Services	1,235,228,117	1,272,773,882	2,700,696,565	2,967,766,399	3,699,973,053	5,563,669,897
Annual Passenger Hours, All Services	75,850,048	78,353,616	155,304,181	164,686,091	176,399,017	251,235,482
Annual Transit Vehicle Trips, All Services	4,846,375	4,938,328	6,593,179	6,945,455	8,143,040	10,786,424
Annual Transit Vehicle Revenue Miles, All Services	86,947,545	86,947,545	220,063,071	220,063,071	220,058,813	220,058,813
Annual Transit Vehicle Revenue Hours, All Services	5,971,539	5,961,200	13,293,913	13,293,913	12,962,273	12,939,654
Annual Net O&M Cost, All Services, Full Buildout	\$570,219,870	\$569,194,470	\$1,408,788,116	\$1,408,788,116	\$1,358,961,265	\$1,358,495,074
Gross O&M Cost, Full Buildout	\$659,213,723	\$658,028,289	\$1,628,656,782	\$1,628,656,782	\$1,571,053,485	\$1,570,514,537
Less Estimated Farebox (13.5%)	\$88,993,853	\$88,833,819	\$219,868,666	\$219,868,666	\$212,092,220	\$212,019,463
Capital Cost, Cumulative 2020-2045	\$3,500,000,000	\$3,500,000,000	\$34,675,017,500	\$43,238,367,500	\$81,325,517,500	\$100,402,027,500
Guideway and Services Expansion	\$0	\$0	\$26,979,630,000	\$35,542,980,000	\$73,630,130,000	\$92,706,640,000
Facilities Expansion	\$0	\$0	\$3,791,200,000	\$3,791,200,000	\$3,791,200,000	\$3,791,200,000
Safety, Accessibility & SOGR	\$1,500,000,000	\$1,500,000,000	\$947,800,000	\$947,800,000	\$947,800,000	\$947,800,000
Bus Fleet Replacement	\$2,000,000,000	\$2,000,000,000	\$2,956,387,500	\$2,956,387,500	\$2,956,387,500	\$2,956,387,500

8. How to Understand REMI Results

8.1. Economic Impacts

Economic impact analyses often estimate multiple types of impacts. An output impact is the total increases in businesses sales revenue. In turn, local businesses use some of this new revenue to pay for goods and services outside of the study region, so the output impact is not the same as local business profits. A more conservative measure of economic activity is the values added impact., which estimates the increase in the study region's gross regional product. The gross regional product (GRP) is very similar to nation's gross domestic product (GDP), and represents the total size of the local economy. This impact estimates the increase in local employee wages plus local business profits.

An even more conservative measure is the labor income impact, which represents the increase in total money paid to local employees in the form of salaries and wages. The increases in income may come in the form of raises and/or increased hours for existing employees, or new jobs for the unemployed. This is a measure of the economic impact on just personal incomes, not business revenues or profits. A similar measure is the employment impact, which measures the increase in the number of total employees in the local region. Instead of measuring the economic impact in terms of money, this measure presents the impact on the number of jobs in the region.

Another measure of economic impact is the property value impact, which measures the increase in total property values, and it is the reflection of generated income and wealth, both personal and business.

9.1.1 Total Employment

Employment comprises estimates of the number of jobs, full-time plus part-time, by place of work. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included.

9.1.2. Gross Regional Product (GRP)

Gross regional product (GRP) is a monetary measure of the market value of all final goods and services produced in a region or subdivision of a country in a period (quarterly or yearly) of time.

9.1.3. Output

Output in economics is the “quantity” of goods or services produced in a given time period, by a firm, industry, or country, whether consumed or used for further production.

9.1.4. Personal Income (DPI)

Personal income refers to an individual's total earnings from wages, investment enterprises, and other ventures. It is the sum of all the incomes received by all the individuals or households during a given period. Personal income is often monitored as one of the many key economic indicators used to gauge the overall state of the economy.

9.2. Social Benefits

The word social here refers to three different aspects of a benefit-cost analysis. Firstly, it is used to denote the idea that included in the evaluation are the effects of the project on all the individuals in society, not just the parties directly involved (the consumers and the producers of the project). For example, everyone would be affected if the project caused any environmental impacts. Secondly, it is used to recognize that distributional effects are being included with the efficiency effects. Without the distributional effects one is making an economic rather than a social evaluation. Lastly the word social is used to emphasize that market prices are not always good indices of individual willingness to pay. A social price would therefore mean that the market price was being adjusted to include effects that the market does not record, or records imperfectly.

9.2.1. Travel Time Savings

The present value in the evaluation year of user benefits from changes in travel times and delays. Travel time benefits include changes in costs to employers for travel time associated with business trips or commerce and also the value that leisure travelers would be willing to pay to reduce travel time.

9.2.2. Vehicle Operating Cost Savings

The present value in the evaluation year of user benefits from changes in vehicle operating costs. User spending on gasoline, oil and motor vehicle maintenance may change as the result of the project.

9.2.3. Safety Benefits

The present value in the evaluation year of user benefits from changes in crash rates or severity of crashes. Safety benefits include changes in medical, property, and legal costs associated with accidents as well as monetary value assigned to fatalities and injuries.

9.2.4. Emission Benefits

The present value in the evaluation year of user benefits from changes in vehicle emissions. A monetary value is assigned to changes in air and water pollution as the result of the project.

9.2.5. Project Net Benefits

The present value in the evaluation year minus the total cost of the project. If the net benefits of a project exceed its costs, then, the project is worth to proceed.

9.2.6. Benefit Cost Ratio

The ratio of the present value of benefits to the initial agency investment cost of a project. A benefit-cost ratio is an indicator, used in cost-benefit analysis, that attempts to summarize the coverall value for money of a project or proposal. If the ratio of project benefits divided by project costs exceeds unity (1.0), then the project's benefits exceed its costs, when discounted at the opportunity cost of capital, and the project should be funded.

10. HCT Economic Impacts

Chart 10.1 2018-2045 HCT Project Employment Growth by Year

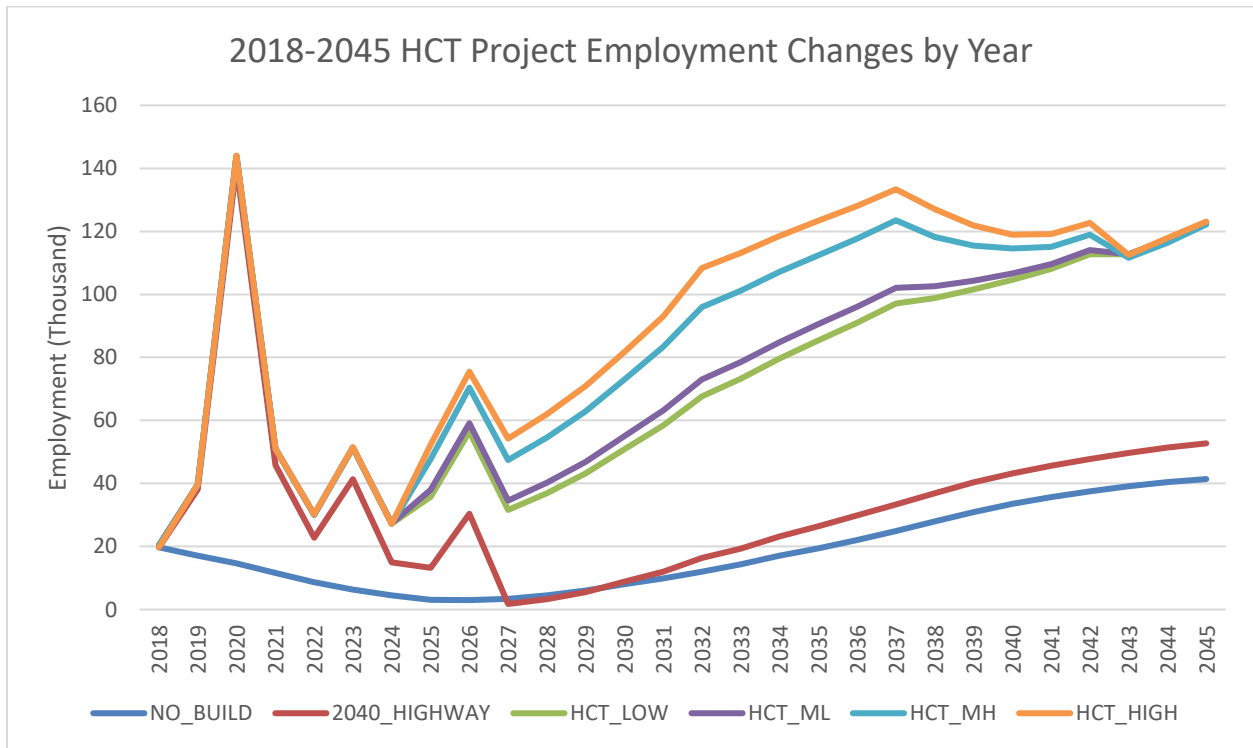
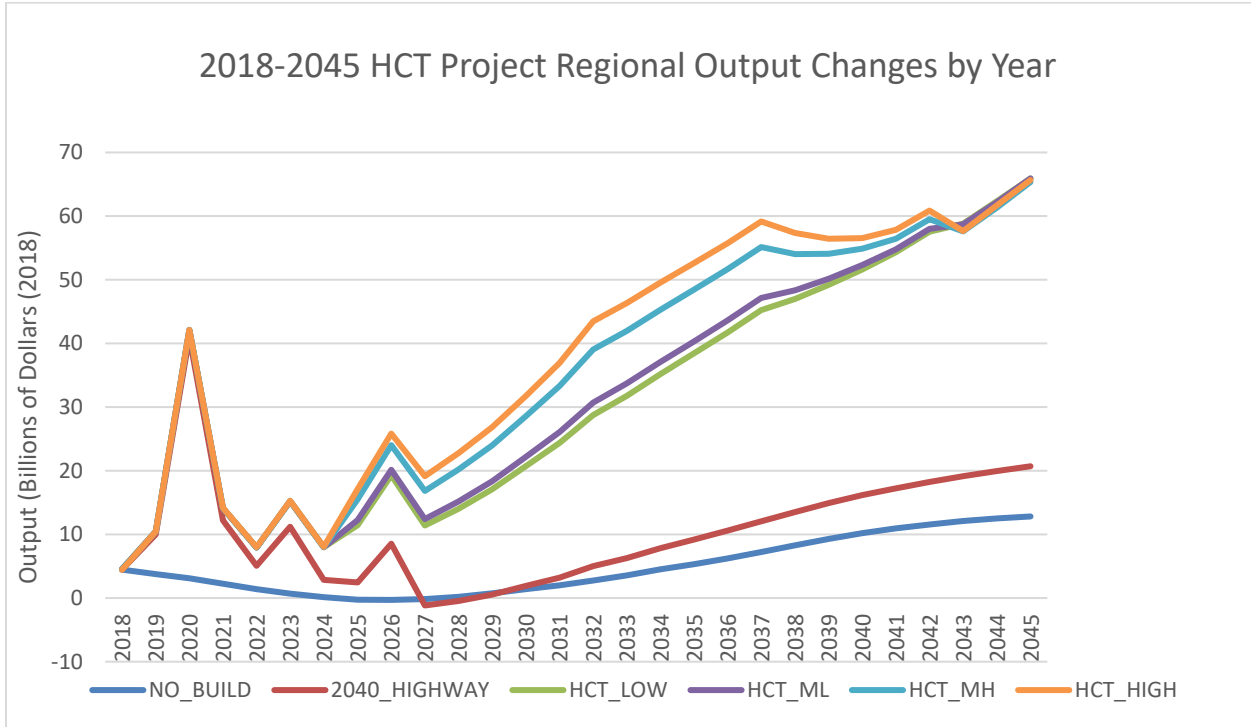


Chart 10.2. 2018-2045 HCT Project Regional Output Growth by Year



11. HCT Societal Benefits

Chart 11.1. HCT Project User (Societal) Benefits Results

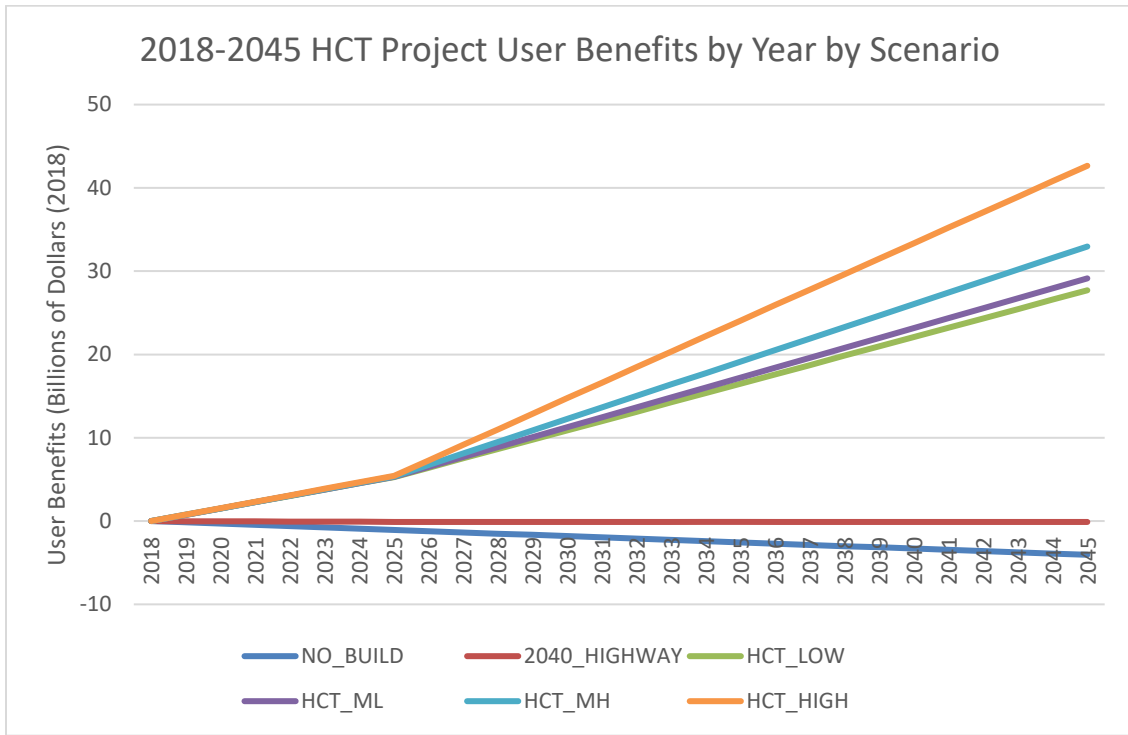


Chart 11.2. HCT Project Combined Total Impact Benefits

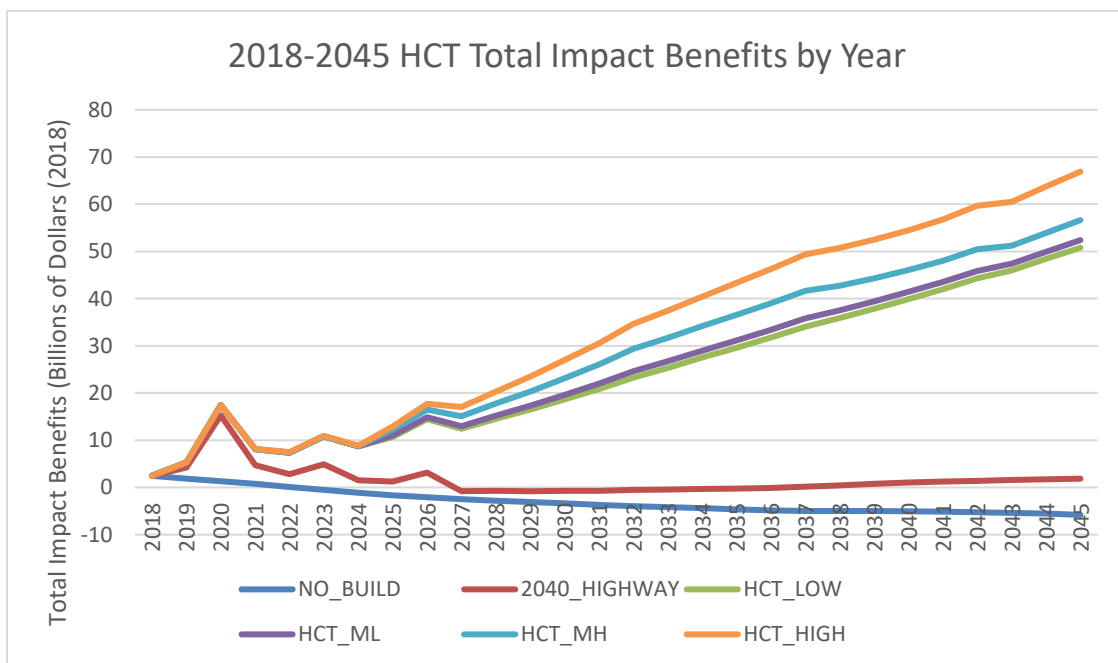
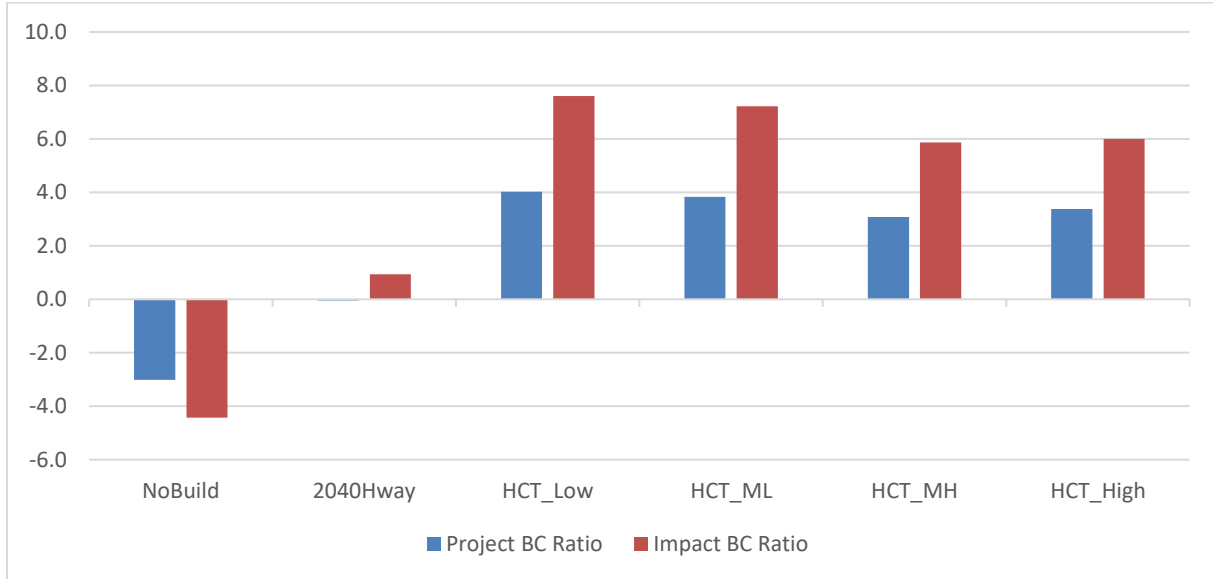


Chart 11.3. HCT Project Benefit Cost Ratio by Scenario



12. Implications

The integration of REMI and the Travel Demand Model has given the region an additional assessment tool to help planners and elected officials make more informed decisions. Travel Demand Model integration with TranSight gives planners a better understanding of economic drivers and impacts on transportation facilities. REMI TranSight is a useful tool to help guide investment for economic development and regional competitiveness, especially for funding. REMI quantifies return on investment from publicly funded projects. Strategic investments in the transportation system are necessary with limited local funding resources to leverage state and federal match. The process increases government transparency with performance-based project selection. Furthermore, the process strengthens the MPO and RPC Long- Range Transportation Plan with data-driven recommendations and implementation strategies.