Implementing the Rapid Policy Assessment Tool

Durham-Chapel Hill-Carrboro Metropolitan Planning Organization

Case Study Report

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SHRP2 SOLUTIONS
STRATEGIC HIGHWAY RESEARCH PROGRAM

Acknowledgements

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1. Executive summary

DCHC MPO shares a travel demand model area with another MPO, Capital Area Metropolitan Planning Organization (CAMPO), and the two MPOs work jointly to develop the region's Metropolitan Transportation Plan (MTP). DCHC MPO implemented the RPAT, in partnership with CAMPO, North Carolina Department of Transportation (NCDOT), RSG, and North Carolina State University (NCSU), to evaluate its capabilities to support collaborative long-range planning activities. The expectation of implementing RPAT was to be able to test policies under consideration that could not previously be effectively evaluated, such as auto-operating cost changes, proposed transit oriented development (TOD) land use policies, smart growth development, and the aging population's impact on travel behavior and land use patterns.

The Rapid Policy Assessment Tool (RPAT)

RPAT is a tool that regional decision-makers and land use and transportation planners can use to estimate impacts of changes to the built environment, travel demand, and transportation supply and demand management policies on peak-hour transportation, as well as effects on sprawl, energy reduction, active travel, and carbon footprints. RPAT is designed to provide a high-level analysis at a regional scale that can be used to evaluate smart growth policies during a regional visioning process and at the project or alternative level in a regional transportation plan.

More information and resources related to RPAT as well as a link to download the software for free are available on the TravelWorks website: https://planningtools.transportation.org/551/rapid-policy-analysis-tool.html

Key Outcomes:

- Given its ease of use, and ability to quickly run many scenario variations, DCHC plans to use RPAT for future pre-screening of transportation and land use scenarios in the MTP.
- Based on RPAT's ability to produce unique performance measures related to greenhouse gas emissions, economic efficiency and safety, DCHC MPO plans to use RPAT to provide performance measures for relevant MTP goals and targets.
- DCHC MPO plans to use RPAT to address policy questions that cannot be addressed by the Triangle Regional Model, such as fuel price impacts, travel demand management (TDM) strategies, and Intelligent Transportation Systems (ITS).
- DCHC MPO staff plans to use RPAT to assess policies and projects for other agency planning needs, such as Transportation Improvement Program (TIP) project ranking, regional transportation project assessments, and Comprehensive Transportation Plan (CTP) studies.

2. Background

DCHC MPO is the regional organization responsible for transportation planning for the western part of the Research Triangle area in North Carolina (Figure 1). The DCHC urbanized area includes: Durham County, a portion of Orange County including the Towns of Chapel Hill, Carrboro, and Hillsborough, and Northeast Chatham County. The Triangle Region of North Carolina is a large metropolitan region, and current forecasts project both continued outward growth and infill development in selected locations, most notably in the central parts of Raleigh, Durham and Chapel Hill and at community-defined activity centers like the planned mixed-use center within the Research Triangle Park (RTP). The DCHC MPO works jointly to develop their Metropolitan Transportation Plan (MTP) and the Triangle Regional Model (TRM) with neighboring the Capital Area Metropolitan Planning Organization (CAMPO) for the Raleigh portion of the region.

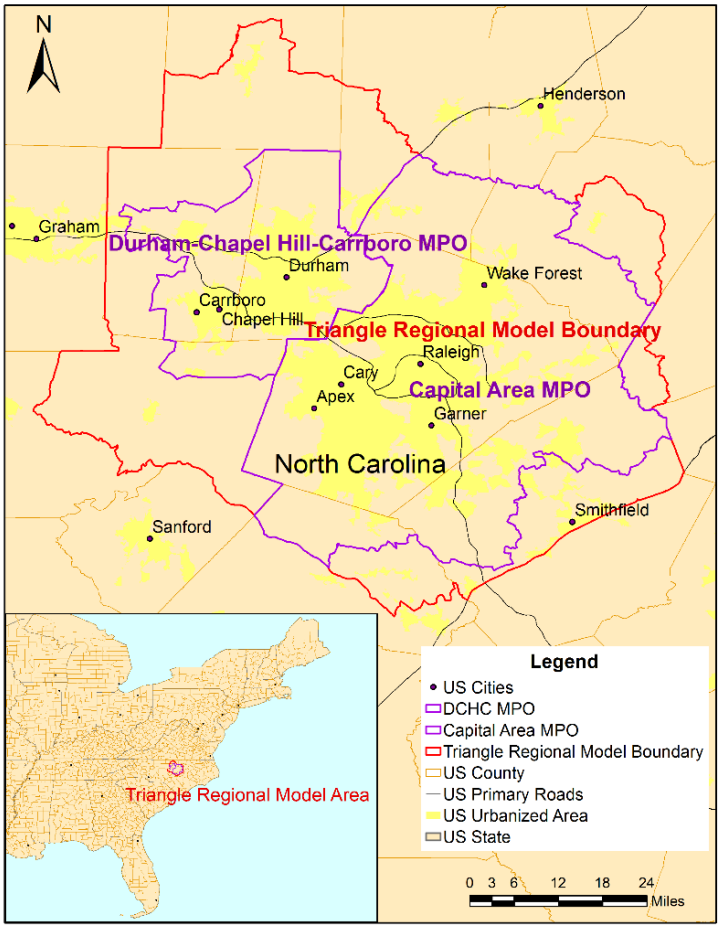

Figure 1. RPAT User Incentive recipient, DCHC MPO, with CAMPO and the Triangle Regional Model boundary highlighted

Durham and Chapel Hill are the two largest municipalities within the DCHC MPO, and they combine to form the population, employment, and cultural center of the western side of the Triangle region of North Carolina. In 2011 and 2012, taxpayers in both counties voted by 20-point margins to approve Bus and Rail Investment Plans in both communities, including the initiation of the Durham-Orange Light Rail Transit project, which was accepted by FTA into Project Development in February of 2014. The City of Durham and Town of Chapel Hill have both made land use decisions that are supportive of Transit-Oriented Development (TOD) along the 17-mile line. The DCHC MPO large jurisdictions have created the Compact Design District, a form-based code district that has already been applied to neighborhoods surrounding the proposed light rail stations. While these early successes in TOD planning demonstrate the DCHC MPO local jurisdictions' commitment to complementing light rail with appropriate land uses, there is relatively less commitment from CAMPO collar counties.

A key challenge for DCHC's and CAMPO's transportation plans is to match the agencies' visions for how the communities should grow with the transportation investments to support this growth. Their close proximity, shared TRM, and often-different approaches to planning pose challenges when developing an MTP. DCHC implemented the Rapid Policy Assessment Tool (RPAT) to help cooperation between the two planning agencies and support dialogs on region wide growth policies.

3. Project Goals & Objectives

The DCHC MPO, in collaboration with the CAMPO, North Carolina Department of Transportation (NCDOT), RSG, and North Carolina State University (NCSU), implemented RPAT for the Triangle Region in North Carolina using a User Incentive award from the SHRP 2 C16 Implementation Assistance Program

The project's primary goals were to support the MTP study process, Transportation Improvement Program (TIP) project ranking, regional transportation project assessments, and address policy questions such as the impact of smart growth on travel demand, greenhouse gas emissions, safety, and economic efficiency. The secondary goal was to support the assessment of policies and projects for an MPO that shares a travel demand model area with another MPO and to evaluate RPAT's performance metrics for travel demand, health, and other smart growth strategies for the MTP process. A successful RPAT implementation would address the primary goals of the project by developing a methodology for using RPAT in support of pre-screening transportation and land use scenarios in the MTP process and in assessment of regional transportation policy and projects.

Gaps and deficiencies in the previous MTP process prompted the evaluation of implementing RPAT. In previous MTP studies, applied evaluation methods were not sensitive to policy strategies under consideration by the MPO boards. The methods for evaluating auto-operating cost changes, proposed TOD land use policies, and smart growth development did not yield significantly different results. In the previous MTP process, challenges arose representing and modeling the aging population's impact on travel behavior and land use patterns. Having the quantified benefits from a specific policy change or regional project while accounting for socio-economic variables that are not standard in travel demand models would have helped the previous MTP study. The expectation of implementing RPAT was that the tool would help address these gaps and deficiencies in the next MTP study process.

4. Results

4.1. Inputs

RPAT requires population and employment data, tabulations of land use, and transportation system characteristics for a 'base year', or baseline condition. Future year growth patterns, transportation infrastructure investments and other transportation policy changes can then be evaluated relative to the baseline alternative. Every data point is important and thus RPAT depends on good data to represent a region accurately.

DCHC MPO was primarily responsible for the development of input data, with support and guidance from RSG. Guidance included the review of proposed data sources, review of proposed data processing approaches, and review of developed RPAT inputs. The model calibration and validation revisited this step, reevaluated source material choices, and adjusted input values as necessary.

The data inventory process identified the appropriate data sources, which are enumerated in Table 1, by RPAT model input. The sources included Triangle Regional Model (TRM), TRM Socio-Economic data (TRM SE), CommunityViz Land Use Model, Employment Geocoder data (with refined InfoUSA data), U.S. Decennial Census data (1990, 2000 and 2010), and American Community Survey (ACS) data.

DCHC's final project report describes the development of several of the more complex inputs that were built from source data and required significant processing. This includes discussion of the resulting inputs for the three setups that were done: (1) the entire region covered by TRM, including both DCHC MPO and CAMPO jurisdictions; (2) the DCHC MPO region, including the DCHC MPO jurisdiction and its collar counties covered by TRM; and (3) the CAMPO region.

4.2. Scenarios

DCHC MPO staff developed a set of scenarios to evaluate using RPAT, including several that could be compared with the results of earlier work analytically carried out to develop the region's MTP. Table 1 shows a matrix of Transportation supply and demand that together describe the scenario. The scenarios were developed and later run for all three of the regional RPAT setups (whole region of DCHC + CAMPO, DCHC only, CAMPO only).

The four scenarios that mirror the work on the MTP were combined with several sensitivity tests around the MTP scenario. These sensitivity scenarios first test an additional network policy to invest in ITS, then test an alternative land use scenario by moving a portion of suburban growth to denser urban areas, and finally combine both the supply and land use changes.

Table 1. Tested scenarios - Triangle Region

		Demand (& Land Use) Scenarios			
		Community Plan (CommP)	All-In-Transit	Metro Transp. Plan (MTP-D)	MTP-D w/ 20% Growth Shift to Dense Area
Supply (& Network) Scenarios	Existing Plus Committed			E+C*	
	Transit Intensive		TRN*		
	Highway Intensive	Hwy*			
	Metro Transp Plan (MTP-S)			MTP*	MTPx20DA
	MTP-S w/ 20% ITS Treatment			MTP w20ITS	MTPx20DAwITS

Figure 2 and Figure 3 show the variation in population and employment across scenarios by area type and development type respectively. Notable differences between scenarios in land use allocations occur for the two scenarios that include 20% growth transferred to higher density areas where population in particular grows in the urban core. In addition, the TRN scenario (transit intensive/all-in-transit) leads to the conversion of some locations to transit oriented development and so alters the development type allocation.

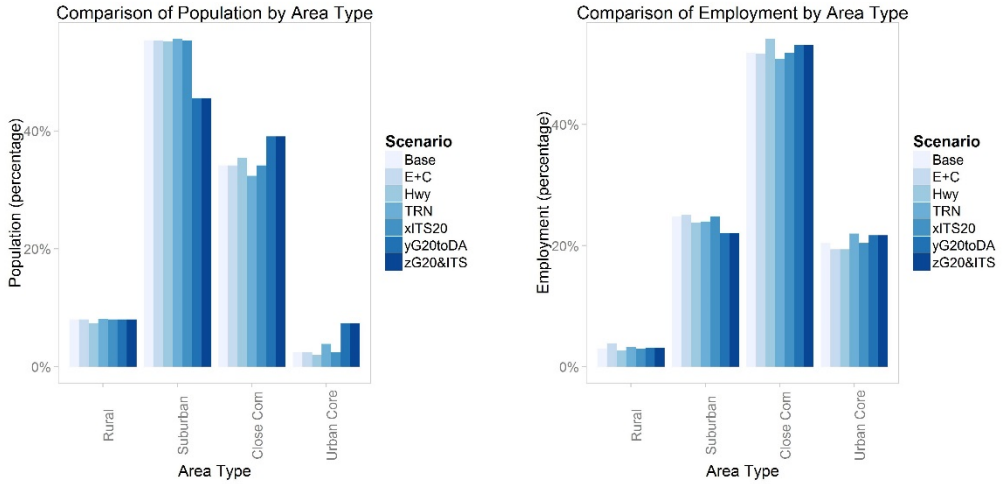

Figure 2. Scenario population and employment by area type

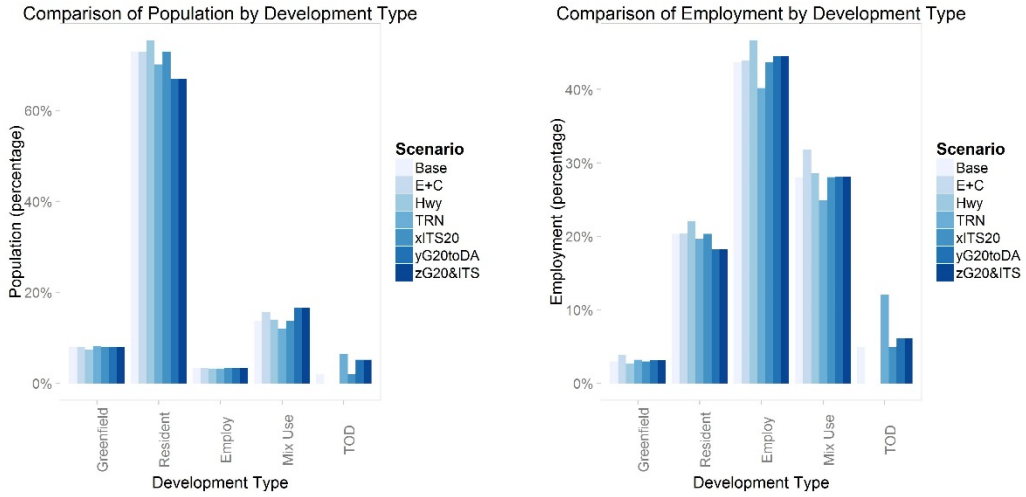

Figure 3. Scenario population and employment by development type

4.2.1. Validation and Model Adjustments

In addition to the various inputs required to construct scenarios, RPAT has several parameter input files. These include, for example, the elasticity assumptions for changes in vehicle miles traveled, walking, and other performance measures, due to changes in place type. All of these parameters are available for the model user to adjust, if required to better validate the model to represent conditions in a specific study region. Following the development of the input files for the region, DCHC MPO and RSG staff reviewed the results from early scenario tests, and identified then implemented required parameter adjustments. These adjustments were made so that the scenario results from RPAT were better validated to conditions observed in Durham and the Triangle region and to the previous modeling work carried out during the development of the MTP.

At the whole region level, RPAT and the TRM were within 5% for the metrics of VMT, vehicle hours traveled (VHT), transit trips and vehicle trips. When the region was split into two MPO regions, there were large differences between RPAT and the TRM, particularly for VHT, where RPAT was higher than the TRM for the DCHC MPO region and lower for the CAMPO region.

There are some notable differences between the results achieved with RPAT than those from the TRM for the other scenarios. While in general RPAT matched closely to the TRM in terms of transit and vehicle trips, it varied more widely for VMT and in particular VHT. The VHT results from the TRM suggest that the TRM is much more sensitive to transportation supply and congestion than RPAT. For example, in the E+C scenario, the TRM shows a significant decrease in VMT and a large increase in VHT, which RPAT does not reflect.

4.2.2. Generation and Evaluation of Performance Measures

RPAT produces a range of performance measures by default, which provide a range of useful indicators about the impacts and benefits of each scenario. Figure 4 compares VMT per capita across the scenarios. In general, focusing growth in denser areas and improving transit decrease VMT, while focusing growth in less dense areas and improving the highway system increase VMT. The MTP scenario is more effective than the other two investment alternatives at managing VMT, while the land use alternative scenarios that add on to the MTP scenario by focusing growth in urban core areas within the region are particularly effective at reducing VMT relative to the MTP scenario.

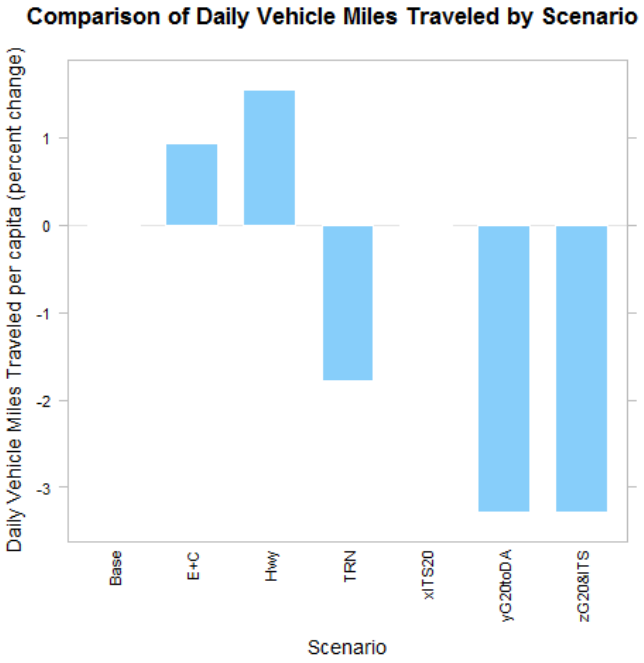

Figure 4. Comparison of daily vehicle miles traveled per capita by scenario

Vehicle hours of travel (VHT) per capita was also evaluated across the scenarios (Figure 5). In this case, adding no additional highway capacity that leads to congestion can increase travel time overall, while adding more additional highway capacity in the highway intensive scenario that leads to longer distance travel with additional travel time overall as well. Operational strategies such as ITS to reduce congestion impacts are particularly effective at reducing VHT as travel speeds at peaks hours are increased.

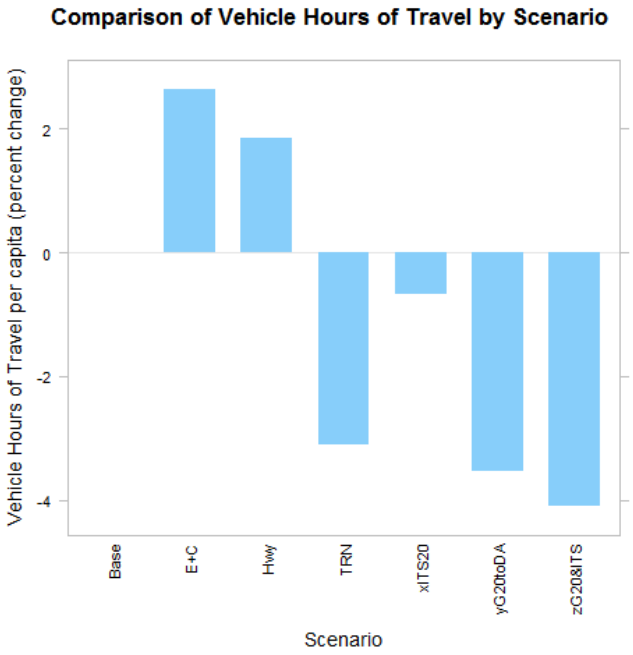

Figure 5. Comparison of vehicle hours of travel per capita by scenario

Other travel metrics that were evaluated across the scenarios include number of vehicle and transit trips per capita and amount of walking per capita. The changes in vehicle trips are not entirely intuitive, with more trips in the transit investment scenario, but it is also coupled with more transit trips. The land use scenarios where more population growth occurs in the urban core lead to the expected outcomes of fewer vehicle trips and more transit trips as more of the new activity in the region takes place in walkable and transit friendly locations. Regarding the amount of walking per capita, the amount of walking amongst new residents of the region is significantly higher when they locate in denser and more transit friendly locations.

In addition to the travel metrics discussed above, RPAT can also derive cost, safety and environmental related measures. RPAT demonstrated that highway infrastructure costs vary from very low for the E+C scenario to very high in the highway intensive scenario (Figure 6). Since RPAT's accidents metric is proportional to VMT, the change in the number of accidents tracks the change in VMT (Figure 7). The land use alternative scenarios that lead to a reduction in VMT as more activity takes place in the urban core also lead to a corresponding reduction in the number of accidents. The land use alternative scenarios lead to a reduction in the GHG emission as more non-vehicular activities takes place in the urban core (Figure 8). In general, the trends seen at the MPO level are similar to those seen at the regional level.

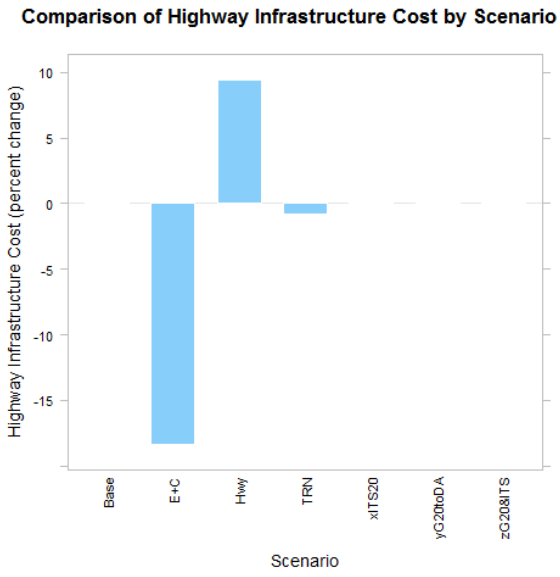

Figure 6. Comparison of highway infrastructure cost by scenario

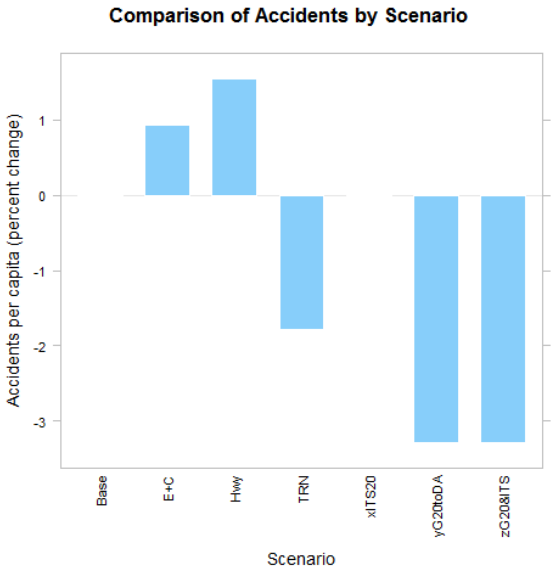

Figure 7. Comparison of traffic accidents per capita by scenario

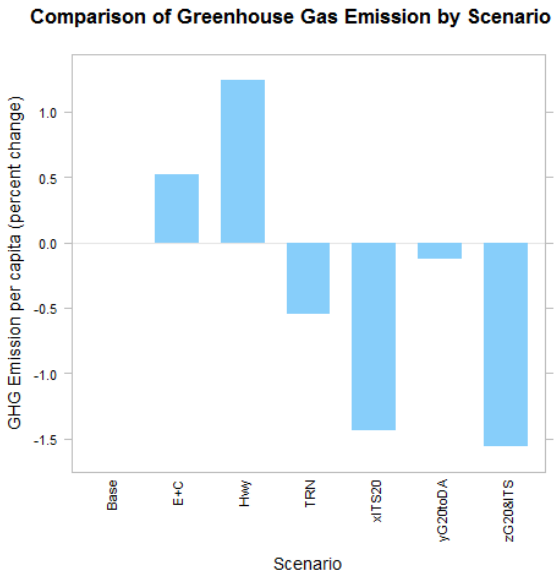

Figure 8. Comparison of greenhouse gas emission per capita by scenario

5. Conclusion

DCHC MPO staff were able to successfully develop a calibrated RPAT model for the joint DCHC and CAMPO region and demonstrated that along most dimensions they were able to adequately replicate previous analyses performed using the TRM for the region's MTP.

The additional scenarios run during the scenario testing portion of this implementation project demonstrated that RPAT is a quick response tool for policy tests that captures growth impacts from a different angle than the traditional travel demand model. It is also sensitive to policies that a travel demand model is generally insensitive too such as economic factors, urban form changes, fuel price variations, ITS and travel demand management policies. Finally, DCHC MPO staff found that it provides additional performance measures that are useful in comparing the impacts of different scenarios.

DCHC MPO staff collated a list of improvements, informed by their own experience using RPAT and what they have heard in peer workshops and during other discussions over the course of the implementation project, which are included in this report. With these additional features, RPAT would form a helpful step in the agency's workflow during the preparation of future MTPs and address the policy questions and during other planning studies

6. Performance Measures and Evaluation

At the start of the project, performance measures were identified in four topic areas (Implementation, Innovation, Deployment, and Communications and Outreach) to ensure the project realizes the intended long term outcomes of the award. Table 2 summarizes some of DCHC MPO's efforts that support these measures.

Table 2. DCHC MPO Performance Measures

Performance Measures	Achievement
Implementation and Deployment	
DCHCMPO partners participate in all required calls/meetings.	DCHC participated in the project kickoff meeting, regular stakeholder meetings, and all project-related conference calls.
Project deliverables are submitted to Volpe/FHWA on time and on schedule and under budget.	All project deliverables, including the final report were submitted on time and on budget.
Agency demonstrates the utility and value of the RPAT tool in MPO system planning.	Based on the use of RPAT for this project, DCHC MPO plans to use RPAT in the prescreening of the regional Community Viz scenarios for the 2045 MTP. RPAT will also be used to evaluate the performance of the selected MTP scenarios.
Agency demonstrates how RPAT outputs correspond with or compare to analysis results from the Triangle Regional Model (TRM; if applicable).	Refinement and calibration of RPAT have shown results that are comparable to those of the TRM. These comparative results are documented in the final project report.
Agency evaluates the effectiveness of RPAT for a range of different Metropolitan Transportation Plan (MTP) scenarios.	RPAT has been used to evaluate three MTP scenarios: 2040, All-in-transit, and Community Plan.
Agency tests RPAT for functionality, ease of use, and understandability of outputs.	DCHC MPO has tested RPAT for functionality, ease of use and understanding of outputs; the findings are described in the final project report.
Agency compares RPAT MOEs to TRM and MTP targets	RPAT MOEs have been compared to TRM and MTP and results of the comparative analysis of the measures were documented for the Peer Exchange.
Agency develops recommendations for refinements to RPAT.	DCHC MPO provided a number of recommendations for refinements to the RPAT tool, which are outlined in the final project report.

Performance Measures	Achievement
Agency supplies lessons learned from participating as a C16 IAP recipient.	DCHC MPO supplied a number of lessons learned, which are outlined in the final project report.
Deployment, Capacity Building and Partnerships	
Agency demonstrates the usefulness of RPAT for building consensus and engaging stakeholders (local planners, CAMPO, RPOs, NCDOT, etc.).	Based on presentations by DCHC MPO about the value of the tool, there has been wide interest from other MPOs and RPOs in the state regarding the utility of RPAT in early stages of land-use scenario planning and transportation plan system planning. EPA staff expressed interest as well.
Agency and partner staff have acquired additional skills and abilities.	Regional technical staff have acquired new skills. The MPO will conduct workshops and presentation to NCAMPO and Triangle Regional technical committee. Regional technical staff members have acquired new skills. The MPO Senior Modeler acquired additional skills as result of collaborative work with RSG. MPO gained valuable experience in the RPAT tool.
Communication and Outreach/ Dissemination	
Project data and information is shared with the academic and practitioner communities.	DCHC MPO provided presentations to NCAMPO and the Triangle Regional Technical Committee. DCHC MPO also provided a presentation at the Peer Exchange and Training in Clark County, Nevada. It is envisioned that more presentations will be conducted when study is completed.
Innovation	
Agency and partners gain new understanding and capability.	The MPO Senior Modeler acquired additional skills as a result of collaborative work with RSG. DCHC MPO gained valuable experience in the RPAT tool.
RPAT offers new system measures, such as greenhouse gas, economic impact, etc., that inform the regional MTP that we wouldn't get it from the regional travel demand model	DCHC MPO plans to use RPAT in the prescreening of the regional Community Viz scenarios for the 2045 MTP. RPAT will also be used to evaluate the performance of the selected MTP scenarios.

For More Information

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