



EXECUTIVE SUMMARY

INTRODUCTION AND PURPOSE

Triangle Transit has commissioned a major study to initiate fixed-guideway transit service within Wake, Durham, and Orange counties. The Triangle Regional Transit Program (TRTP) is a collaborative framework for developing an efficient and sustainable regional transportation system that addresses the Triangle's critical need for improved connectivity and mobility choices while promoting its economic prosperity, job growth, and an enhanced quality of life. While previous transportation plans for the region have recommended the introduction of fixed-guideway transit, this study is significant due to the passage of HB 148 by the North Carolina General Assembly, which authorizes Durham, Orange, and Wake counties to hold referenda that, if passed, would allow each county to levy a ½ percent sales tax increase to fund improvements in public transportation.

The studies being conducted over the next year will recommend which transit corridors should initially be built. Planning work being undertaken includes two phases:

- Phase 1: A system-level Transitional Analysis, which is the subject of this report, will define and prioritize up to three transit corridors from the adopted 2035 Joint Long Range Transportation Plan (LRTP) to be studied in further detail in the Phase 2 Alternatives Analysis process. Given the geography of the region, including three counties and two Metropolitan Planning Organizations (MPOs), it is anticipated that one corridor within each of the MPO areas will be carried forward into the Alternatives Analysis process. A third commuter rail corridor spanning the region is possible as an early implementation project, with potential collaboration with the North Carolina Railroad and NCDOT.
- Phase 2: Triangle Transit will conduct Alternatives Analysis studies for up to three priority corridors to evaluate and screen alternative alignments, modes and station locations within each corridor. The Alternatives Analysis process will conclude with the selection and MPO adoption of a Locally Preferred Alternative for each of the priority corridors. The Alternatives Analysis process is a requirement of the Federal Transit Administration (FTA) for a fixed-guideway project to be eligible for federal funds.

It is unlikely that all fixed-guideway transit corridors in the LRTP can be implemented in the near-term, even with a sales tax increase. It is expected that corridors not included in the Phase 2 Alternatives Analysis studies would be implemented in later phases. Fixed-guideway transit projects would also be complemented by improvements and expansion to regional and local bus services so that all communities in the region have improved transit access. Improvements to bus service could begin soon after the referendum if voters approve a ½ percent sales tax increase.

The primary purpose of the Transitional Analysis is to define the corridor(s) for inclusion in the Alternatives Analysis studies. The Transitional Analysis acts as the bridge between the system plan in the LRTP and the more focused and detailed study performed in an Alternatives Analysis.



For the Transitional Analysis, the system plan has been broken down into a set of smaller corridors that have been evaluated in order to recommend a limited number of priority corridors to move forward into the Alternatives Analysis process. This Transitional Analysis applies a set of evaluation criteria and measures to each corridor for evaluation and prioritization of the corridors. For the purposes of this analysis, a corridor consists of a relatively wide band up to one mile wide with major activity centers identified. Examples of activity centers include the Northeast Regional Center (NERC), Downtown Raleigh, NC State Fairgrounds, Cary, Research Triangle Park (RTP), Downtown Durham, and Gateway East. In the detailed Alternatives Analysis, the exact number and locations of stations will be identified, as well as the exact alignment of the planned service, the termini, and the type of vehicles.

CORRIDORS

Using the 2035 Joint LRTP for both the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO (see Figure ES.1), as well as input from Triangle Transit, both MPO's, and other stakeholders, 11 corridors were identified in Wake County and 6 were identified in Durham and Orange counties.

The study corridors were presented to the Capital Area Metropolitan Planning Organization (CAMPO), the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC-MPO or DCHC) and to elected officials. The identification of corridors was also widely communicated to various cities and organizations including the Town of Cary, Town of Chapel Hill and University of North Carolina representatives, the owners and tenants of the Research Triangle Park, and the Wake County Municipalities. The Wake County Technical Committee, the Durham-Orange County Technical Committee and the Public Involvement Steering Committee, which were established for this project, were also presented with the corridors. All known stakeholders attended one of these presentations. Comments received from stakeholders have been considered and incorporated into this Transitional Analysis.

EVALUATION CRITERIA

The corridors were evaluated by the consulting team using the following criteria, which were developed in consultation with Triangle Transit, DCHC-MPO and CAMPO. Where applicable, the evaluation year is noted in parentheses.

Mobility

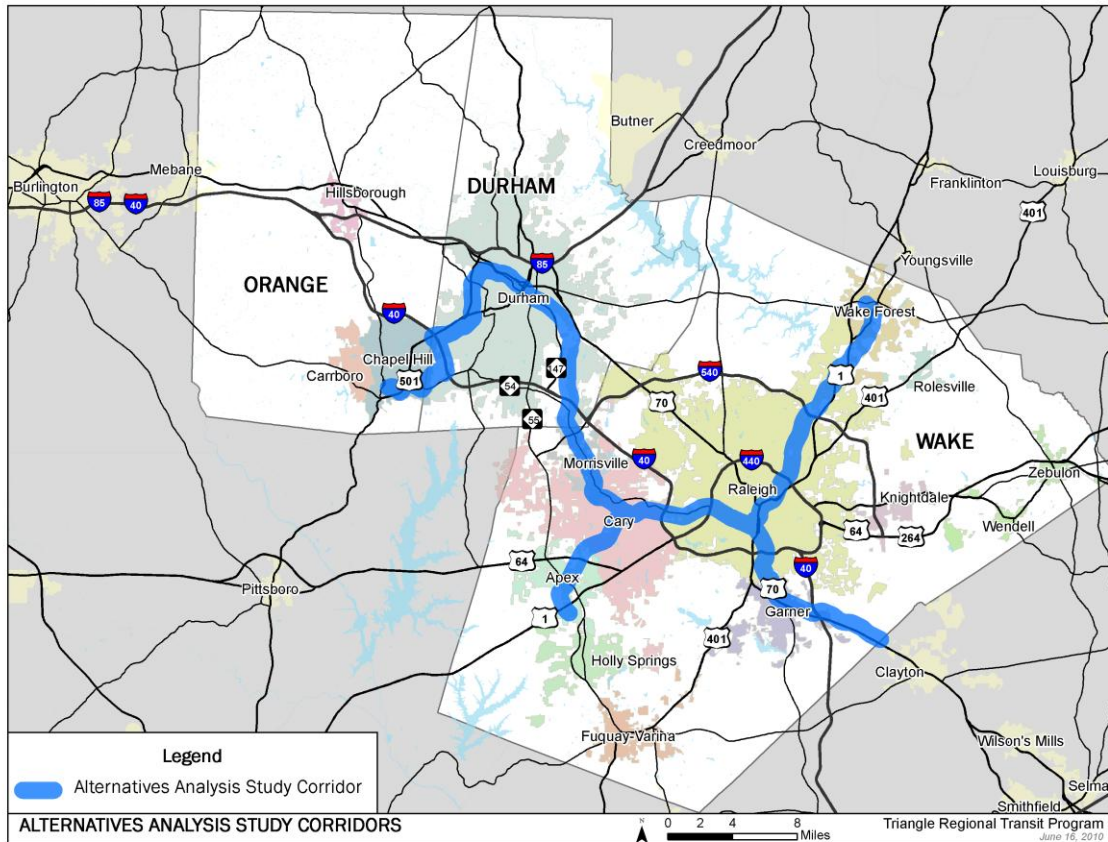
- Number of daily total trips in corridor (2035) (normalized as daily total trips/mile)
- Number of daily transit trips in corridor (2035) (normalized as daily transit trips/mile)
- Transit passenger miles traveled (PMT) for rail (2035)
- Relative peak hour corridor travel times for rail and highway travel (2035)

Socioeconomic

- Population and density within a mile-wide corridor (2005 and 2035)
- Number and density of low-income households within a mile-wide corridor (2000)
- Number and density of minority households within a mile-wide corridor (2000)
- Number and density of jobs within a mile-wide corridor (2005 and 2035)



Figure ES.1 Transitional Analysis Study Corridors (Derived from 2035 LRTP)



Land Use

- Supports Transit Oriented Development (TOD) (Existing master plans consistent with TOD concepts, level of public sector support and private interest)
- Activity centers served (employment, retail, major institutions, mixed use, special attractions)
- Planned developments in corridor (pipeline development and private sector development plans)

Financial

- Total capital cost (2010 dollars)
- Capital cost per mile (2010 dollars)
- Capital cost per weekday transit trip
- Capital cost per weekday transit passenger mile traveled
- Total Operating and Maintenance (O&M) cost (2010 dollars)
- O&M cost per weekday transit trip
- Annual O&M cost per weekday transit passenger mile traveled



Public Input

Citizens and project stakeholders will be provided an opportunity to review and comment on the evaluation criteria and the draft results of the corridor analysis. This information will be presented at a series of six public workshops that will be held between September 14 and September 23, 2010. In addition to the technical evaluation criteria listed above, the comments received during the public workshops (to included in Appendix X) will be considered by the DCHC-MPO, CAMPO, and TTA in identifying the corridors to be studied in the Alternatives Analysis.

RESULTS

Each of the corridors was evaluated based on these criteria. This section presents the results of this evaluation for the Wake County corridors and for the corridors in Durham and Orange counties. Tables ES.1 and ES.2 summarize the evaluation criteria that were most helpful in distinguishing between corridors.

Wake County

Eleven corridors in Wake County were evaluated and the results can be seen in Table ES.1. A summary of the findings follows the table.

Conclusions

Results of the analysis indicate that Wake Alternatives 9 (from Downtown Cary to the Northeast Regional Center) and 10 (from the State Fairgrounds to the Northeast Regional Center) are the overall highest performers. Primary discriminators between the alternatives include mobility and cost-effectiveness, as discussed here:

- Wake Alternatives 9 and 10 have the highest daily rail trip estimates on a per mile basis, with 394 and 402 rail trips per mile respectively. The comparatively stronger ridership is a reflection of the large concentrations of people living within the vicinity of the corridors and the number of dense employment nodes – including downtown Raleigh, NERC, and Cary – that are served by both corridors.
- From a cost perspective, Wake Alternatives 9 and 10 are relatively expensive to build when compared to other corridors on a cost per mile basis. Wake Alternatives 9 and 10 would cost \$65M per mile and \$67M per mile respectively. The higher cost, as compared with other corridors, can be attributed to more expensive infrastructure needs related to limited right-of-way and required infrastructure improvements, particularly in the vicinity of downtown Raleigh. On a per mile basis, longer corridors can spread out the costs associated with these infrastructure upgrades. Unlike other corridors however, Wake Alternative 9, which is 16 miles and Wake Alternative 10, which is 12 miles, are not long enough to spread out the costs of the infrastructure improvements required in the vicinity of downtown Raleigh.
- Although they are higher on a capital cost per mile basis than other corridors, Wake Alternatives 9 and 10 perform relatively well in terms of cost effectiveness due to their strong ridership. The capital cost per transit trip for Wake Alternative 9 is approximately \$54 per trip and the capital cost per transit trip for Wake Alternative 10 is approximately \$55 per trip.

Table ES.1 Evaluation Criteria Summary (Wake County)

Study Corridor	Corridor Length (mi)	Mobility		Socioeconomic				Land Use		Financial		
		Total In Corridor Trips per Mile	Rail Trips/Mile	Population Density	Employment Density	Low Income Population Density	Minority Population Density	Supports Transit Oriented Development	Development Potential	Capital Cost per Mile	Capital Cost per Weekday Transit Trip	Operating & Maintenance Cost/ Weekday Transit Trip
Wake Alternative 1 (UNC Hospitals to Wake Forest)	59	●	●	○	○	●	●	●	○	●	●	●
Wake Alternative 2 (Triangle Metro Center to Wake Forest)	33	●	○	●	○	○	○	●	●	●	●	●
Wake Alternative 3 (Veridea to Wake Forest)	33	●	○	●	○	○	○	●	●	●	●	●
Wake Alternative 4 (Downtown Cary to Wake Forest)	25	●	○	●	●	○	○	●	●	●	●	●
Wake Alternative 5 (State Fairgrounds to Wake Forest)	20	●	○	●	●	○	○	●	●	●	○	○
Wake Alternative 6 (Downtown Raleigh to Wake Forest)	17	●	○	●	●	○	○	●	●	●	○	○
Wake Alternative 7 (Triangle Metro Center to NERC)	24	●	●	●	●	○	○	○	●	●	●	●
Wake Alternative 8 (Northwest Cary to NERC)	18	●	●	●	●	●	●	●	●	●	●	●
Wake Alternative 9 (Downtown Cary to NERC)	16	●	●	●	●	●	●	●	●	●	●	●
Wake Alternative 10 (State Fairgrounds to NERC)	11	●	●	●	●	●	●	●	●	○	●	●
Wake Alternative 11 (Downtown Raleigh to NERC)	8	●	●	●	●	●	●	●	●	○	○	●

Summary of Evaluation Criteria and Rankings													
High Performer	=	●	>22,060 Trips/Mile	>3635 Trips/Mile	>39 Households/Acre	>13.3 Jobs/Acre	>0.61 Persons/Acre	>1.61 Persons/Acre	High & High/Moderate	High & High/Moderate	<\$62.0 M/Mile	<\$56.9/Trip	<\$9.9/Trip
Average Performer	=	●	18,452 - 22,060 Trips/Mile	311.3-3635 Trips/Mile	29 - 39 Households/Acre	10.3 - 13.3 Jobs/Acre	0.38 - 0.61 Persons/Acre	1.04 - 1.61 Persons/Acre	Moderate	Moderate	\$62.0 - \$66.3 M/Mile	\$56.9-66.4/Trip	\$9.9-12.1/Trip
Low Performer	=	○	<18,452 Trips/Mile	<311.3 Trips/Mile	<29 Households/Acre	<10.3 Jobs/Acre	<0.38 Persons/Acre	<1.04 Persons/Acre	Low & Low/Moderate	Low & Low/Moderate	>\$66.3 M/Mile	>\$66.4/Trip	>\$12.1/Trip

Note: The breakpoints for the bins are ±0.5 standard deviations from the mean. Data results are given in greater detail in Chapter 6.





While Wake Alternatives 9 and 10 are the overall strongest performers among the Wake corridors, Wake Alternative 8, which extends the transit line an additional two miles from downtown Cary to NW Cary, is not significantly far behind in performance. A terminal station in downtown Cary could be problematic due to limited property available for locating an end-of-line park and ride. A relatively short extension to NW Cary, therefore, may improve the feasibility of this corridor by providing more opportunities to locate a park-and-ride and related transit infrastructure and potentially increasing ridership. Given that this is a high-level screening process and that Wake Alternatives 8 and 11 are not significantly less in performance than Wake Alternatives 9 and 10, consideration should be given to performing the detailed analysis on Wake Alternative 8 which incorporates all of the alignments coincident to Wake Alternatives 9, 10, and 11.

The detailed Alternatives Analysis can fine tune this larger corridor in looking at the most optimal, best-fit initial starter line that may involve cutting back on the alignments at both ends to arrive at the most effective corridor for New Starts funding. This is in recognition of Federal Funding capacity and that most starter lines initially constructed are in the 10-12 mile range. Extensions from the initial line start the full build-out process consistent with the funding availability.

Durham-Orange Counties

Six corridors in Durham and Orange counties were evaluated and the results can be seen in Table ES.2. A summary of the findings follows the table.

Conclusions

Results of the analysis indicate that Durham-Orange Alternatives 4 (from UNC Hospitals to Alston Avenue), 5 (from UNC Hospitals to Gateway) and 6 (from Gateway to Alston Avenue) are the overall highest performers (note that Alternatives 5 and 6 are subsets of Alternative 4). Primary discriminators between the alternatives include mobility, socio-economics and cost-effectiveness, as discussed here:

- Durham-Orange Alternatives 4 and 5 have the highest daily rail trip estimates on a per mile basis, with 394 and 399 rail trips per mile respectively. This primarily reflects the high employment at UNC and UNC Hospitals, Duke University and Duke Medical Center, and downtown Durham. Several significant mixed-use developments also exist or are planned within the corridor.
- Durham-Orange Alternatives 4 and 6, both of which terminate at Alston Avenue, are the most effective at reaching transit-dependent populations.
- From a cost perspective, Durham-Orange Alternatives 4 and 5 are relatively more expensive to build compared to other corridors (\$68M per mile and \$66M per mile respectively). This is because these corridors are primarily on new alignment that requires more right-of-way acquisition and infrastructure improvements than alternative corridors that use existing railroad right-of-way (e.g., Durham-Orange Alternatives 1 and 2).
- Although they are higher on a capital cost per mile basis than other corridors, Durham-Orange Alternatives 4 and 5 perform better in terms of cost effectiveness due to their strong



ridership. The capital cost per transit trip for Durham-Orange Alternative 4 and 5 is approximately \$55 and \$53 per transit trip, respectively.

Durham-Orange Alternative 4 is the combination of Durham-Orange Alternatives 5 and 6, and hence advancing this longer corridor allows for the most optimal starter line analysis for submission for Federal Funding.

Regional Connection

It is recognized that Durham-Orange Alternative 2 does appear to perform well too. However, in terms of Federal Funding opportunities, which are based on total transit trips per mile versus passenger miles travelled, make this corridor less optimal from that perspective (along with all of the other factors). If connecting the region is a high priority over maximizing the potential for federal funds, then consideration should be given to this alternative. However, if federal funds are achieved with the other, better performing corridors as noted above, then full build out towards Wake Forest and Chapel Hill will occur sooner.

The best advice may be to complete the Alternatives Analysis on the best performing corridors for both Wake and Durham-Orange Counties and see if Federal Funding prevails. If these corridors fail to be competitive for federal funds, then the decision can be revisited on which corridor to advance into preliminary engineering. The opportunity for federal funding will become evident relatively soon after the New Starts submittal in the Fall of 2011.

Table ES.2 Evaluation Criteria Summary (Durham-Orange Counties)

Study Corridor	Corridor Length (mi)	Mobility		Socioeconomic				Land Use		Financial		
		Total In Corridor Trips per Mile	Rail Trips/Mile	Population Density	Employment Density	Low Income Population Density	Minority Population Density	Supports Transit Oriented Development	Development Potential	Capital Cost per Mile	Capital Cost/ Weekday Transit Trip	Operating & Maintenance Cost/ Weekday Transit Trip
Durham-Orange Alternative 1 (UNC Hospitals to Wake Forest)	59	●	●	○	○	●	●	●	○	●	●	●
Durham-Orange Alternative 2 (Duke Medical to Downtown Raleigh)	29	●	○	●	●	●	●	●	●	●	●	●
Durham-Orange Alternative 3 (UNC Hospitals to Triangle Metro Center)	26	○	●	○	○	●	●	●	○	●	●	●
Durham-Orange Alternative 4 (UNC Hospitals to Alston Ave)	17	○	●	○	●	●	●	○	○	○	●	●
Durham-Orange Alternative 5 (UNC Hospitals to Gateway)	7	○	●	○	○	●	○	●	○	●	●	●
Durham-Orange Alternative 6 (Gateway to Alston Ave)	10	●	●	●	●	●	●	●	○	○	○	○

Summary of Evaluation Criteria and Rankings													
High Performer	=	●	>22,060 Trips/Mile	>363.5 Trips/Mile	>3.9 Households/Acre	>13.3 Jobs/Acre	>0.61 Persons/Acre	>1.61 Persons/Acre	High	High & High/Moderate	<\$62.0 M/Mile	<\$56.9/Trip	<\$9.9/Trip
Average Performer	=	●	18,452 - 22,060 Trips/Mile	311.3-363.5 Trips/Mile	2.9 - 3.9 Households/Acre	10.3 - 13.3 Jobs/Acre	0.38 - 0.61 Persons/Acre	1.04 - 1.61 Persons/Acre	High/Moderate	Moderate	\$62.0 - \$66.3 M/Mile	\$56.9-66.4/Trip	\$9.9-12.1/Trip
Low Performer	=	○	<18,452 Trips/Mile	<311.3 Trips/Mile	<2.9 Households/Acre	<10.3 Jobs/Acre	<0.38 Persons/Acre	<1.04 Persons/Acre	Moderate	Low & Low/Moderate	>\$66.3 M/Mile	>\$66.4/Trip	>\$12.1/Trip

Note: The breakpoints for the bins are ±0.5 standard deviations from the mean. Data results are given in greater detail in Chapter 6.



Regional Corridor

The current LRTP prepared by both the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO includes a regional rail system that is comprised of both light rail transit (LRT) and commuter rail service, with the majority of the system being LRT, to be implemented in stages. This systems plan includes the provision of LRT service between Raleigh and Durham and between Durham and Chapel Hill. There is an overlap in the LRT plans and the commuter rail plans from downtown Raleigh to the Northeast Regional Center (in the location of Capital Boulevard and I-540). The purpose of the Transitional Analysis is to select which segments or corridors of the LRT system should be implemented first with the full system to be constructed in future phases. It is not practical or financially feasible to construct the entire LRT system as a single project and only the most effective segments or corridors should be initiated first, particularly if funding is to be requested from the Federal Transit Administration (FTA) under the New Starts program.

The Transitional Analysis examined a total of 16 corridors, including those that connected the two MPO regions and those that were entirely within either the CAMPO region or the DCHC-MPO region. The corridor alternatives were evaluated in the context of all day, frequent service that is typical of a LRT system. By contrast, a commuter rail system provides service only during the AM and PM peak period trips using a lower frequency of service (typically every 30-60 minutes). While LRT must operate on exclusive tracks, commuter rail can, and typically does, operate on tracks shared with freight and other intercity passenger rail service. In the Triangle Region, the term “express rail” has been identified to include the combination of existing AMTRAK passenger rail, existing and expanded NCDOT passenger rail service between Raleigh and Charlotte, and the additional commuter rail service during the peak periods.

The initial findings of the Transitional Analysis indicate that the corridor alternatives that operate in Wake County from Cary through downtown Raleigh and to the Northeast Regional Center (NERC) perform the best in terms of ridership, riders per mile, and cost per rider. This set of corridor alternatives is followed in performance by those that operate from UNC Hospitals to downtown Durham. The corridor alternative that connects Durham to Raleigh, passing through the Research Triangle Park, performed below both of the previous sets of alternatives. While the provision of LRT service between Durham and Raleigh is not the most cost-effective alternative for initial implementation, the early connection of these two major areas in the region can be provided by commuter rail or express rail service that can be implemented with lower costs than either of the LRT projects. Future extensions of the LRT systems in Wake and Durham counties would connect the two areas with LRT as identified in the LRTP. The major investments in commuter rail would not be wasted because the tracks could continue to be used by other freight and intercity passenger rail service (including the potential High Speed Rail service) and the vehicles could be moved to extensions of the commuter rail service to the areas on the edges of the region serving the downtowns of Raleigh and Durham.

For these reasons, an additional study will be prepared that evaluates commuter rail service versus LRT. The LRT service would connect the ends of the two initial LRT systems in Wake and Durham Counties versus commuter rail service that extends from downtown Durham to east of Clayton using the existing NCRR alignment. We will also compare LRT service from



Durham to Raleigh against commuter rail service from Durham to Raleigh with the assumption that the Wake County and Durham county LRT systems are not implemented.

Other Considerations

With these recommendations, rail transit extensions to the Research Triangle Park, Wake Forest, Apex, and points beyond are not carried forward for further consideration in the more detailed Alternatives Analysis studies. This initial recommendation does not, however, mean that service to these areas would be eliminated; it simply recognizes that they will be studied in greater detail at a later time. These extensions are truly noteworthy as the system expands, but the purpose of this first set of Alternative Analysis studies is to focus on the most effective corridors for initial transit investment and implementation. This is the formula other cities have used to develop and implement system-wide extensions.

Therefore, for those areas of the region that are not directly considered for initial detailed study in the Alternatives Analysis, the project team recommends the following:

- Extension of LRT to Garner: Technical memorandum detailing the future extension of the rail transit service from Raleigh to Garner.
- Extensions of commuter rail to Wake Forest and Apex: Technical memoranda analyzing implementation of commuter rail service to Wake Forest and Apex. (This has been suggested by CAMPO as a viable alternative). Considerations could include the following: termini, freight track alignments, operations, and cost.
- Extension to Carrboro: Technical memorandum analyzing the immediate needs of the Town of Carrboro. It is recommended that a separate study be conducted on potential route alignment extension(s) along with discussions on how this alignment could operate in conjunction with the initial segment of the light rail corridor in the Alternatives Analysis.
- Extension of commuter rail service to Hillsborough and Zebulon: There have been requests for extensions to both Hillsborough and to Zebulon to be included in the study. The purpose of the Transitional Analysis is to determine the priority corridors for early implementation, but not preclude future extensions. White papers further discussing these two extensions are included as Appendix A and B.

When completed, the memoranda will be included as Appendices to this Transitional Analysis before it is finalized. These memoranda, along with the results of the Alternatives Analysis process can be used by both the Capital Area MPO and the Durham-Chapel Hill- Carrboro MPO as input to the updates of their respective long range transportation plans.

NEXT STEPS

On September 29, 2010 there will be a special joint meeting of the Durham-Chapel Hill-Carrboro MPO and the Capital Area MPO to review and comment on the corridors for study in the Alternatives Analysis.