

Project Risk Register

In the summer of 2012, based on the magnitude and scope of the Durham-Orange Light Rail Transit project (Project), Triangle Transit conducted a Risk Assessment. This Risk Assessment identified areas of risk to the Project's scope, schedule, and costs and analyzed the probability of each identified risk. The attached Project Risk Register reflects the outcome of the Risk Assessment process and has been used by Triangle Transit over the past year to develop plans to minimize critical path items and reduce the associated risks.

PROJECT RISK REGISTER Triangle Transit - Durham-Orange County Corridor REV : 5												Risk Rating		
							Low (1)	Med (2)	High (3)	Very High (4)	Significant (5)	Legend	Rating	
							Likelihood	≤10%	11-35%	36-64%	65-89%	>90%	≤ 7	Low
							Cost Impact	< \$1 M	\$1M >< \$10M	\$10M >< \$40M	\$40M >< \$100M	> \$100M	8 - 20	Medium
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1	4	Design	10	Guideway & Track Elements	Freight Rail Industry Spurs could be added to project requiring a LRT overpass.	Industrial spur clients in the corridor haven't existed in decades. This should be addressed in the NCRR railroad agreement.	2%	1	3	1	4			
2	9	Rqmt	10	Guideway & Track Elements	Additional impacts based on SEHSR Design, bridges and grade crossings. Also, in same area the Durham Traffic Separation Study may require LRT tracks to be lowered or raised to avoid a grade crossing.	The shared corridor is very small. Ninth Street to Alston Ave. (< 3 miles) It is known that they will use two tracks. Risk is if they change their plans from what we have used for our assumptions. Principal issues would be in regards to grade separations and mandates that come from this. There is a traffic separation study in progress in Durham which could lead to future grade separation needs in the design process. Risk percentage based on the likelihood of two future grade separation (by others) requiring a change to the plan and profile of the LRT.	50%	3	2	1	9			
3	17	Design	10	Guideway & Track Elements	Spacing between LRT tracks and Freight tracks goes to 40 feet minimum instead of 26 feet minimum.	Perform study of the cost impact and negotiate with NCRR and NS. Present alternative means to achieve desired safety goals.	25%	2	3	1	8			
4	65	Design	10	Guideway & Track Elements	Option of whether to cross Old Chapel Hill Rd. & Pope Rd. at grade or under I-40 overpass. Chapel Hill is proposing a future roundabout at this intersection plus there is a pump station in the way.	There is concern that current plans will cause problems in regards to the operation of the roundabout and traffic delay and also bike/ped impacts. Traffic study is needed to assess situation.	50%	3	2	1	9			
5	71	Design	10	Guideway & Track Elements	The track alignment is parallel & over the creek at Cornwallis Rd.	NCDENR permitting issue because the tracks will go over the stream . There was not a separate line item in the cost estimate, but the drainage line item was high enough to take into account this effort.	50%	1	1	1	2			
6	73	Design	10	Guideway & Track Elements	The New Hope Creek Advisory Committee has expressed concerns about the alignment across New Hope Creek. In addition, the NCDENR Office of Conservation, Planning and Community Affairs initially expressed concern about the adequacy of the AA document and process, which lead to public concern about the same issue; TTA clarified the process with the Office of Conservation, Planning and Community Affairs, which now better understands that further environmental studies (most notably the NEPA EIS) will be conducted. Their desire is to have it along 15-501 and this could be costly (\$60 to \$100M)	Further evaluation is needed in the EIS/NEPA phase and close coordination with the authorities having jurisdiction will be needed. Cost of potential alternative and the likelihood that an alternative alignment will need to be developed.	25%	2	4	2	12			
7	106	Const	10	Guideway & Track Elements	Delays associated with railroad flaggers being unavailable.	Limit by having RR put up job dedicated positions and a schedule of activities that can be adhered to. Have responsibility placed on the contractor for coordinating with the RRs for flaggers by specification.	10%	1	1	1	2			
8	108	Const	10	Guideway & Track Elements	Lack of available construction staging areas.	Usually park and ride lots make for good construction staging areas as well as the maintenance yard and shop site. This is therefore a right of way acquisition issue. Need to monitor right of way acquisition so that delay to project is avoided.	10%	1	1	1	2			
9	109	Const	10	Guideway & Track Elements	Excessive work site access restrictions due to local street, driveway openings.	Mitigate by defining the access restrictions in the contract specifications. Good public outreach plan during construction is also needed.	10%	1	1	1	2			

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10	114	Design	10	Guideway & Track Elements	Proposed at-grade crossings changed to grade separations through heavy LOS intersections (not including NCRR corridors).	Traffic studies are needed in detail. Traffic studies need to take into account that the rail system is present.	60%	3	3	1	12								
11	125	Design	10	Guideway & Track Elements	Concerns with the alignment location within the shopping center at I-40 and US 15/501, and the long aerial structure through majority of the shopping center. and matching at-grade next to the Rose Garden Nursery and internal street networks. Concerned with the alignment/options containing a number of curves (especially tight radii curves) and steep grades for LRT, which places a heavy strain on maintenance of vehicles and track, as well as increased requirements for power sources, as well as locations for substations.	Potentials for design refinement during EIS/PE. The grades have two 4% grades leading into and out of the South Square Station (Alt. D-3) and that is not considered overly steep. Sharp curves have been used only when adjacent to stations to minimize impacts to streets and surroundings.	25%	2	1	1	4								
12	164	Design	10	Guideway & Track Elements	Vertical curves do not meet the recommended 200A or preferred minimum 100A design criteria.	Vertical curves do meet the absolute minimum curve lengths. Optimizing speed was an essential element in both the plan and profile. Potentials for design refinement during EIS/PE.	25%	2	1	1	4								
13	165	Design	10	Guideway & Track Elements	Interlocking locations are not preliminarily located. (e.g. at end-of-line stations - does not appear to be sufficient tangent track to install universal or diamond crossovers).	Potential for design refinement during EIS/PE. The locations are envisioned to be on the tangent sections in front of each end-of-line station.	50%	3	1	1	6								
14	179	Design	10	Guideway & Track Elements	Sheet D-07 The height of the bridge over the wetlands may not be a high enough elevation to clear the ground depending on structure depth. Profile may need to be increased.	Agree. Potential for design refinement during EIS/PE. Estimate assumed normal height structures so there should not be a cost impact.	25%	2	1	1	4								
15	186	Design	10	Guideway & Track Elements	Sheet 11 of 15 Supplemental Near Sta. 359+00 at the light rail bridge, there is a transmission tower adjacent to the alignment. If transmission tower is not elevated enough to account for bridge structure and catenary line, the transmission tower and transmission linew will have to be relocated, raised or replaced.	Clearances will need to be checked.	25%	2	2	1	6								
16		Design	10	Guideway & Track Elements	Railroads may require a crash wall be installed, especially if track centers stay at 26'.	In conjunction with new ID #3 (original ID #17) it is assumed that a 40 foot separation and use of crash walls will not both be required.	75%	4	2	1	12								
17	91	Design	10, 20		Additions to stations & bridges as part of design refinement and ROW agreements and intergovernmental agreements.	Stations need to be designed to budget and amenities prioritized. Bridge architectural treatments are low cost and included in cost estimate.	30%	2	2	1	6								
18	100	Market	10, 20, 30, 40, 50		Spike in global concrete and steel prices above assumed inflation factor.	Early lock-in of prices is essential.	10%	1	3	1	4								
19	103	Market	10, 20, 30, 40, 50		Lack of qualified general contractors for rail project work and segmented bridges raises bids.	Separate track and bridge contractors in the construction packages to achieve highly qualified, specialized contractors. Medium size contracts \$200M to \$300M attract qualified firms, yet keep bonding costs within most large contractors reach.	5%	1	2	1	3								

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20	120	Design	10.00 and 40.00		A few local streets with proposed at-grade crossings that would require re-profiling the streets in order to meet the design criteria for at-grade crossings (Cedar Berry Lane, Snow Crest Trail, Lyckan Pkwy, Westgate Dr, Blackwell St.).	Need to address in detailed design. Roadway estimate unit prices reflect the degree of difficulty.	60%	3	2	1	9			
21	14	Design	20	Stations, Stops, Terminals	Additional work due to Traffic Studies such as at Friday Center Dr. in Chapel Hill and Fulton St/Erwin St. intersection in Durham.	Friday Center is currently grade separated for alternative C-1. Erwin St. analysis is needed and it will be important to work with NCDOT and Duke University.	25%	2	1	1	4			
22	15	Design	20	Stations, Stops, Terminals	Additional Overhead Pedestrian Walkways. Potential for one to be added at the Alston Ave location connecting to commuter rail station. Also at the VA Hospital on west end of Duke Medical Station.	Any pedestrian bridge at Alston Ave. would be necessitated by the introduction of a Commuter Rail station in the Commuter Rail project and hence such cost would be part of that project. VA Medical center needs study in light of the fact that there is no pedestrian access to the west end of the Duke Medical Center station.	60%	3	2	1	9			
23	117	Design	20	Stations, Stops, Terminals	ROMF locations, in general, need to meet zoning requirements; which local zoning classifications and land use plans need to be revised to reflect the presence of a maintenance facility.	Schedule risk in regards to the ROMF and station locations. There should be sufficient time to acquire any zoning change during the final design phase. It does become an issue if the preferred ROMF location changes after the determination of the site at the conclusion of the EIS phase.	25%	2	1	2	6			
24	163	Design	20	Stations, Stops, Terminals	Stations are shown at >1% grades. Most agencies do not allow longitudinal grades >1%. Could be an ADA issue with excessive slopes. With the combination of station grade and cross slope, the slopes of station platforms could exceed ADA minimums.	Potentials for design refinement during EIS/PE.	25%	2	1	1	4			
25	48	Rqmt	30	Support Facilities	Conflict in locating alignments and Operations and Maintenance Facility in or near the New Hope Creek corridor (There is concern from the City/County of Durham – and the public – regarding potential impacts to the New Hope Creek wetlands and the cost of environmental mitigation between Patterson Place and MLK Parkway; Durham also indicates that the location of an O&M facility near Patterson Place because it is not consistent with the LRTP, it would eliminate a TOD opportunity and it would require a Comp Plan amendment and Zoning Map change; sites at Farrington Road and Leigh Village would also require a Comp Plan amendment and Zoning Map change, as well as a Major Special Use Permit in the Major Transportation Corridor Overlay District of I-40; potential issues with adjoining uses including a Jewish school at Cornwallis Road site).	ROMF sites with significant issues will not be chosen. See new ID #23 (original ID #117) for discussion on zoning.	5%	1	2	1	3			
26	10	Design	40	Sitework & Special Conditions	Environmental Impact of alignment through Wetlands, C-1 vs. C-2	Wetland issues will be studied in the EIS Process and wetland impacts are budgeted.	25%	2	1	1	4			
27	52	Design	40	Sitework & Special Conditions	Undercutting of poor subgrade soils where design grade is near existing grade.	Poor soils from previous plans were already identified, this information was proportioned into the rest of the alignment - this risk is for exceeding those allowances.	10%	1	1	1	2			

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28	53	Design	40	Sitework & Special Conditions	Rock removal in deep excavation areas that exceeds expected costs.	Rock is known to be along the NCRR ROW and Alston area, and the lack of blasting ability is a constraint. Borings should identify.	60%	3	2	1	9			
29	54	Design	40	Sitework & Special Conditions	Contaminated soils remediation. Particularly where alignment within RR R-O-W. Potential concern is arsenic historically used by NCRR as herbicide and also concern regarding the presence of heavy metals.	Line item allowance has been incorporated. RR contamination is usually rather shallow.	60%	3	1	1	6			
30	55	Design	40	Sitework & Special Conditions	Permanent (and aesthetic) noise walls in multiple residential and commercial areas beyond what is included in current costs and schedule.	EIS will reveal these needs, and a conservative allowance is included in the current costs and schedule.	15%	2	2	1	6			
31	57	Design	40	Sitework & Special Conditions	Fill behind Dean Smith Center. Much greater and more complex than shown on Conceptual Plans.	This is evident in the conceptual plans and this has been accounted for in the estimate. Complications may arise in regards to the interface of the station with the Dean Smith Center.	30%	2	2	1	6			
32	80	Design	40	Sitework & Special Conditions	Unanticipated Utility Relocations and approvals.	Existing costs and schedule have significant contingencies for utility relocation. Due diligence will involve early identification of utilities in need of relocation and effective coordination with utility owners during design. An aggressive subsurface utility investigation is warranted.	50%	3	2	1	9			
33	84	Design	80	Professional Services	Costs, delays due to environmental mitigation burdens Encounter unknown historic/archeological sites.	More will be known after the EIS - no specific allowance in budget for archeological finds since area has few occurrences.	20%	2	1	1	4			
34	99	Design	40	Sitework & Special Conditions	Greater than budgeted utility relocations required on Erwin Rd segment.	See comment above. The track slab is only 18" thick.	30%	2	2	1	6			
35	110	Design	40	Sitework & Special Conditions	Vibration impact to eye care center.	An allowance is contained in the cost estimate.	20%	2	2	1	6			
36	111	Design	40	Sitework & Special Conditions	Visual impacts due to aerial structures and alignment to general land uses and potential historical sites (Downtown Durham) within a 100' buffer.	These shall be identified through EIS. Effective side treatment to aerial structures helps mitigate impact.	25%	2	2	1	6			
37	175	Design	40	Sitework & Special Conditions	Sheet C1-03 There is a large amount of fill required for the LRT along the houses adjacent to Cedar Berry Ln. The alignment will pass very close to the houses there and may have issues with getting a 10'+ tall retaining wall near the house without specialized construction.	This is known. The elevation change is dramatic.	25%	2	2	1	6			
38	176	Design	40	Sitework & Special Conditions	Sheet C1-03 There are 40'+ tall retaining walls located in the area with the walking trails. Retaining walls here will be very expensive, however, fill slopes will eliminate most of the walking trails.	AA option provides conservative estimate. Design development to refine the option alternatives.	10%	1	1	1	2			

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39	180	Design	40	Sitework & Special Conditions	Sheet D3-01 The light rail is set between the road and the Super Target below. This is a very steep slope (1:1 or steeper) and is already supported by a segmental block wall which is most likely not reinforced. With the large elevation difference (>80'), this wall will need to be battered for that height. That will most likely extend the wall to conflict with the lower wall which may not be designed for those loads. Therefore, either a wall for the full height will need to be designed or this area will need to be an aerial structure to eliminate transferring loads.	This is the current plan and hence this is a known risk and has been budgeted for.	25%	2	2	1	6			
40	181	Design	40	Sitework & Special Conditions	Sheet D3-03 The retaining wall adjacent to 15-501 is also located in a tight clearance area. Based on the available width (20' to 30'), this will need to be supported by a wall that can also serve as a crash wall. Due to the close proximity of the travel lanes, soil nails or tie backs will not be permitted. Therefore, the wall type may need to be cast-in-place which would potentially force the closure of at least one lane on 15-501. This lane could also include the merge lane from Pickett Rd.	The design is to have the rail profile at the profile of 15-501 and hence any retaining wall would be on the east side of the LRT tracks away from 15-501. This is how the profile was done. Also, the property to the east is the existing Pepsi Plant and this will most likely be redeveloped by the Jewish community and TTA will continue to work with a developer or with the owner	10%	1	2	1	3			
41	187	Design	40	Sitework & Special Conditions	Sheet 13 of 15 Supplemental The existing drive located at Sta. 435+50 is already very steep. With the light rail creating a plateau adjacent to University Dr., the driveway will have to tie in further away, causing the drive to be even steeper. Other than grading and adding walls for the adjacent business, the drive may be too steep.	Design refinement during PE.	25%	2	1	1	4			
42	191	Design	40	Sitework & Special Conditions	Structured parking requirements particularly Leigh Village or Gateway - parking may end up being in a structure rather than at grade.	Leigh Village is now budgeted for a 1000 stall structured parking in the revised estimate.	20%	2	3	1	8			
43	39	Design	50	Systems	Number of traction power substations may increase - no traction power study performed to-date.	Budget conservative enough such that overrun risk is minor.	10%	1	1	1	2			
44	168	Design	50	Systems	Risk that estimate is not sufficient to provide TPSS for maintenance facility, if required.	This has been accounted for in the estimate.	25%	2	1	1	4			
45	169	Design	50	Systems	Risk that system costs will exceed estimate and allocated contingency.	This has now been accounted for in the revised estimate.	10%	1	2	1	3			
46	43	Const	60	Row, Land, Existing Improvements	Inability to acquire real estate in a timely manner.	Procure real estate in accordance with real estate acquisition management plan and in accordance with project schedule.	20%	2	1	3	8			
47	64	Design	60	Row, Land, Existing Improvement	Check the 100-year floodplain at the south end of Erwin Road.	Although small scale maps may indicate the vicinity of the south end of Erwin Road is in the 100-year floodplain, whether Erwin Road itself is within the floodplain needs to be determined. The EIS will need to have more clarification on the issue. Federal funds cannot be used in 100-year floodplain areas.	33%	2	2	1	6			

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48	69	Rqmt	60	Row, Land, Existing Improvements	Agreement with Duke University on the alignment through Duke property ,may lead to additional projects costs associated with the Duke agreement.	Risks will be lessened if there is an agreement locking in plans early in the process that holds continuity through administration changes. Key issues have been the total width of the new street, traffic flow, bicycle accommodations, and crossing safety. Not coming to an agreement with Duke could lead to alignment changes or increase in ROW acquisition cost. Duke may still have reservations in regard to the LPA. There is a conceptual agreement in regards to the Erwin Rd. Corridor, but there is risk in regards the cost of getting an agreement with Duke and schedule impact if the agreement isn't achieved. Risk will be lessened if a written memorandum of understanding can be achieved early. Intent is to get everything worked out during PE to reduce risk exposure.	80%	4	2	1	12			
49	78	Design	General	Row, Land, Existing Improvements	NCRR Railroad Agreements Cost of ROW usage increases above \$3.8M.	This will be covered in an agreement.	85%	4	2	1	12			
50	127	Market	60	Row, Land, Existing Improvements	Construction/temporary traffic control-patterns could create issues for pedestrian and vehicular access to businesses requiring additional mitigation and cost.	Typical design and construction maintenance of traffic is included in estimate. Specifications need to spell out maintaining access to businesses. There are few businesses on the route though.	10%	1	2	1	3			
51	166	Design	60	Row, Land, Existing Improvements	Risk that Systems elements (TPSS and signal houses) cannot all be located in adjacent ROW/park and ride areas.	Early identification of park and ride lots and TPSS locations is needed.	20%	2	1	1	4			
52	69a	Rqmt	60	Row, Land, Existing Improvements	Duke does not approve the adopted LPA alignment.	New alignment not likely to be required, but if so would be costly.	20%	2	4	1	10			
53	69b	Rqmt	60	Row, Land, Existing Improvements	Ability to come to agreement with The University of North Carolina at Chapel Hill on the alignment through their property will require an increase of project cost.	UNC and Town of Chapel Hill have been integral with development of alignment in the LPA.	10%	1	1	1	2			
54	69c	Rqmt	60	Row, Land, Existing Improvements	Conflict with the VA parking area that leads to additional construction needs.	VA's concern is station location and overall right of way width. A small sliver of VA property is necessary that is within the City ROW or a transit easement.	10%	1	1	1	2			
55	69d	Rqmt	60	Row, Land, Existing Improvements	Ability to come to agreement with NCDOT on the alignment through their property will require additional cost.	Risks will be lessened if there is an agreement locking in plans early in the process that holds continuity through administration changes.	10%	1	1	1	2			
56	101	Market	70	Vehicles	Spike in price for vehicles due to increased global demand or reduced LRV manufacturers.	Early lock-in of prices is essential.	5%	1	2	1	3			
57	102	Market	70	Vehicles	Vehicle procurement delays (piggybacking, "Buy America," etc., Protest during supplier selection, ROMF not available to receive new vehicles).	Late activity, many opportunities to mitigate.	5%	1	1	3	4			

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58	5	Design	80	Professional Services	Delayed Railroad review and approval of design. Schedule may be directly impacted by lags in review time.	Early agreement with NCRR is needed for project success. Timeframes need to be specified with penalty clauses or go forward with consequences of later comments.	80%	4	1	4	20			
59	26	Design	80	Professional Services	Lack of staff to execute PE.	FTA would want certain design positions to be filled before approval of New Starts. Approval can be pending the design lead and key staff designation within Triangle Transit. Potential is schedule conflict because staff is not available.	15%	2	1	3	8			
60	44	Const	80	Professional Services	Inability to secure Construction Management Staff with relevant experience in complex transit projects.	Project is over \$1 billion and will attract highly qualified teams.	5%	1	1	1	2			
61	86	Design	80	Professional Services	Review time for city/town DOT permit & site plan reviews.	Stakeholder review delays possible. Again, agreements needed and partnering needed.	20%	2	1	2	6			
62	7	Rqmt	General	Finance Cost	Late reimbursement of Sales Tax revenues .	Cost risk is potential financing cost to bridge period to receive sales tax distribution from state. Risk was clarified as funding arriving 3-4 months later than scheduled, experience with Mecklenburg County has been that the risk is rare. Mitigation is to adjust schedule assumptions based on the time expected to receive money.	10%	1	1	2	3			
63	21	Const	General		Increased Construction duration due to active RR Operations greater than anticipated.	There is a limited 3 mile section of shared corridor which limit the interface. The impact allowances are conservative.	15%	2	2	3	10			
64	23	Const	General		Increased Flagger Costs during active RR Operations over estimate.	The cost estimate is very conservative for this issue.	5%	1	1	1	2			
65	158	Market	General		Timing of other large construction projects in NC could affect bid prices.	Mitigate by contractor outreach and/or adjust contract packaging to promote interest and competition.	20%	2	3	1	8			