Upper Level Loop Alternative

How to save $2 billion from the costs of the LIRR East Side Access project, and make a better station for passengers too

A proposal from the
Institute for Rational Urban Mobility, Inc.
New York, N.Y.

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1 Summary

The Institute of Rational Urban Mobility, Inc, has developed plans that could save $2 billion from the cost of the MTA's East Side Access project. IRUM's scheme would also provide more efficient and potentially safer passenger handling facilities, and may allow completion of the project up to three years earlier.

MTA's current proposal is to deliver LIRR passengers to four new platforms in deep caverns 13 stories under Park Avenue, with long escalator journeys to the surface. Partly because of the complexity of building so far underground, the MTA does not expect completion before 2012. The cost estimate has already increased to $6.3 billion. From experience, this sort of project usually ends up costing more than projected, and is rarely finished on time.

IRUM is proposing instead that MTA bring LIRR trains into existing platforms on the "loop" tracks in the westerly upper level of Grand Central terminal. This was originally proposed as part of the Apple Corridor scheme developed in 1996 by the Committee for Better Transit. In its Final EIS, MTA gave various reasons why it did not select the Apple Corridor loop scheme. IRUM has retained Delcan Corporation, international consultants with experience in similar projects, to review the Manhattan portion of the loop scheme now called "The Upper Level Loop Alternative" (ULLA). Based on their assessment of the ULLA, the following key conclusions are evident:

- Use of the loop platforms would save at least $1.2 billion. Given the potential for more delays and increased costs with MTA's Deep Cavern scheme, possibly as much as $2 billion could be saved, net of all other cost differences.
- The loop platforms would provide more convenient and efficient passenger handling, with shorter distances between trains and street level.
- In an emergency when escalators could be inoperable, ULLA passengers would exit to the surface by several routes from platforms located two stories below the street. This compares with a 13 storey climb for passengers evacuating from the Deep Cavern scheme.
- Construction of track connections into the loop platforms would be simpler and could be completed more quickly than the Deep Cavern scheme, even allowing for preparation of a further Environmental Assessment. There will be some disruption to Metro-North services during construction, but this could be managed to an acceptable level. LIRR trains could run into Grand Central Terminal by mid-2009, three years earlier than in to the Deep Cavern scheme.
- Use of the loop platforms would require some modifications to Metro-North operations, but would not jeopardize current operations or reasonable future capacity increases.

The loop tracks could accommodate 21 trains in the morning peak hour compared with the 24 trains per hour that is possible with MTA's Deep Cavern scheme. There is no absolute requirement to provide for 24 trains per hour. It is not worth spending $2 billion, and possibly delaying completion of ESA by three years, to accommodate three extra peak hour trains. Money saved could help fund other badly needed capital projects, including the Second Avenue Subway and proposed JFK - Lower Manhattan rail scheme. Reducing the

cost of the scheme would also increase the likelihood that the ESA will itself be funded and built to completion.

Detailed conclusions are set out in Delcan's technical report[1], and summarized below. While resources for our work have not matched the millions that MTA has spent preparing its plans, we are nevertheless confident of our conclusions.

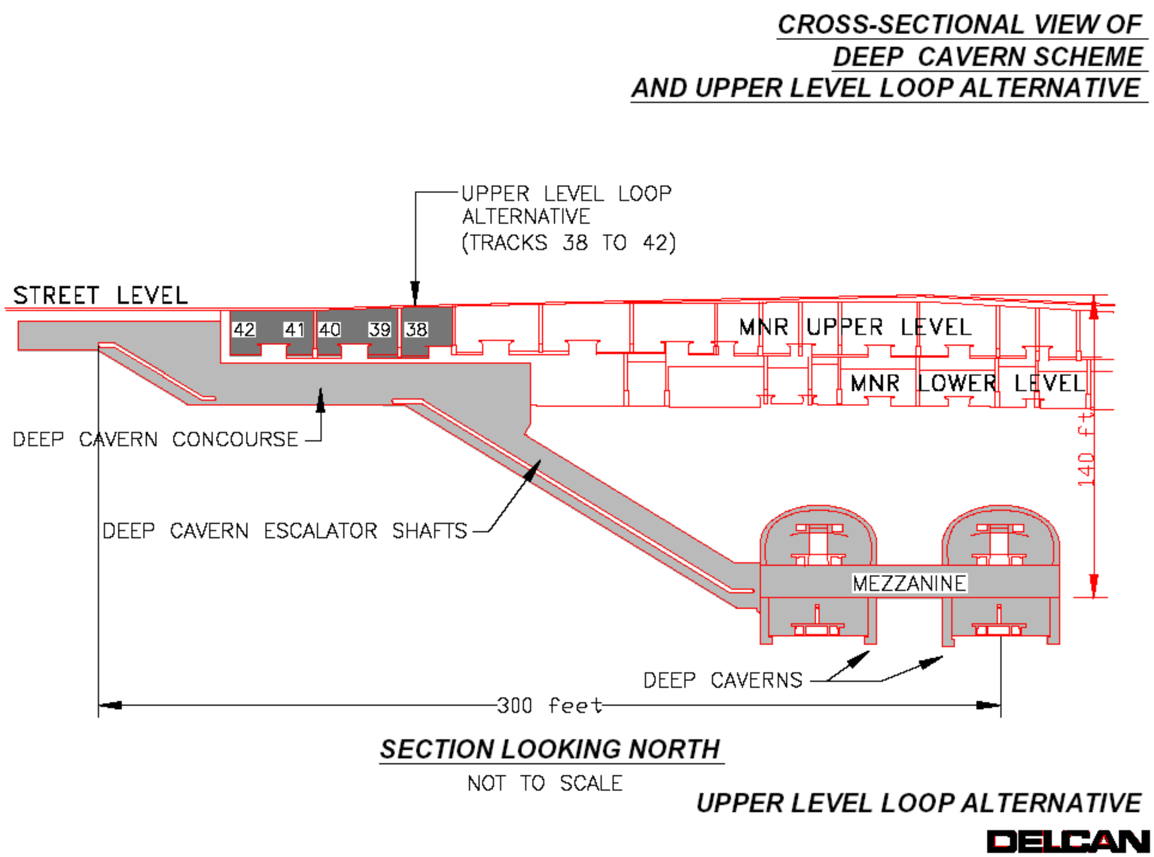

Figure 1 Cross Section showing Deep Cavern and ULLA platforms and access (from Delcan technical report)

2 Background

MTA has developed the East Side Access project to provide a direct route for Long Island Railroad passengers to the east side of Manhattan, avoiding the need to travel via Penn Station. More than half of LIRR commuters arriving at Penn Station would have a shorter journey using ESA. It will utilize the empty lower level of the 63rd Street rail tunnel, built in the 1960s for this purpose. New facilities are required in Queens to connect into the

[1] See *Assessment of the Upper Level Loop Alternative for the Manhattan Portion of the East Side Access Project, Final Report*, prepared for Institute for Rational Urban Mobility Delcan Corporation, Toronto October 2004.

LIRR and provide train storage, and in Manhattan to allow trains to run south from 63rd Street to Grand Central Terminal (GCT).

One of the most expensive and complex parts of the ESA scheme is the provision of terminal facilities at GCT. Originally, MTA planned to run LIRR trains into platforms on the site of the "Madison Yard", the western lower level tracks within GCT. In preparation, MTA built a new yard at High Bridge in the Bronx, so Metro-North would no longer need the Madison Yard to store and service trains. MTA's original scheme required tunneling under office towers on the west side of Park Avenue, to connect the 63rd Street Tunnel into the Madison Yard.

In 1996, the Committee for Better Transit (CBT) put forward a scheme to make use of the existing upper level platforms and "loop track" in GCT as the terminal for ESA trains. The CBT's "Apple Corridor" scheme also included proposals to operate direct trains from JFK Airport over the ESA route. MTA rejected the proposal.

During preparation of the Final EIS in 2000, MTA chose a very different scheme involving the construction of eight tracks with four platforms in new caverns 13 stories below Park Avenue (the lower platforms would actually be about 155 feet below street level). The Madison Yard area would be used as an intermediate passenger concourse, with large amounts of retail space and offices for LIRR staff.[2] Tunneling under existing office buildings on Park Avenue would not be required. There would also be fewer impacts on Metro-North operations during construction, although Metro-North would still lose the use of the Madison Yard. Capital costs were estimated, initially, at $4.3 billion.

Since the FEIS was published, MTA's estimated cost to complete the project has increased almost 50%, to $6.3 billion. The MTA and other government agencies are struggling to fund ESA and other capital projects, including the Second Avenue Subway, a single-train service from JFK Airport to lower Manhattan, as well as ongoing renewals and modernization of the existing subway and commuter rail systems. All of these must compete for scarce federal and state funding. Any savings in the cost of one scheme can improve the prospects of it and the other schemes progressing to completion, and reduce the pressure to raise transit fares.

In view of the rising costs of the project, IRUM, a not-for-profit public interest group, has revisited the CBT proposals. IRUM retained Delcan to review the Manhattan portion of the earlier CBT proposal, to estimate the potential savings and any other implications from using the loop platforms and to review the reasons given in the Final EIS for rejecting CBT's proposals. Delcan is a multi-disciplinary engineering firm based in Toronto, Canada, with expertise in design, construction and implementation of similar urban commuter rail and urban transit projects. This paper summarizes key findings of the Delcan technical report, to which readers should refer for further details.

We are sharing our findings here and urge the MTA to revisit its analysis before committing to what we think is unnecessary and indeed counter-productive expenditure of $2 billion.

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[2] The area of the proposed concourse is 350,000 square feet, equivalent to the total floorspace of a typical 25 story office tower.

3 Scheme Description

MTA proposes to extend the 63rd Street tunnel south, in the bedrock about 100 feet below Park Avenue. The inbound tunnel would widen out and connect into four platforms on two levels, which would be constructed in two large caverns deep under Park Avenue. Tail tracks for reversing and storing trains would extend south to 38th Street. Escalators would take passengers from the platforms to deep level cross passages, which would connect on long escalators up to an intermediate concourse in the Madison Yard. Escalators would link this intermediate concourse to street level, with exits mostly within buildings on the east side of Madison Avenue.

IRUM's ULLA proposal is much simpler and requires far less new construction. The inbound track from the 63rd Street tunnel would be connected directly into existing track "I" under Park Avenue, between 55th and 52nd Streets. Track "I" runs into tracks 38 - 42 on the west side of the existing GCT. LIRR trains would use the existing platforms S, T and U on these tracks for both unloading and loading passengers. Trains would continue around the existing upper level loop track. This feeds directly into Track "C", which would be lowered between 51st Street and 55th Street, to connect into the outbound 63rd Street tunnel.

To provide operational flexibility, two storage tracks could be provided as part of the ULLA. One would be in the new tunnel, between the tracks under Park Avenue north of 55th street. The second would be the existing track 2, on the eastern end of the loop under GCT.

Passengers could use a variety of routes between train platforms and street level. They could exit to the GCT concourse, or by the 47th Street cross passage which was constructed as part of the Grand Central North project. Access would also be provided to new cross passages at 48th Street and 45th Street, and probably through the basement of the Roosevelt Hotel.

A second stair would be constructed to each platform from the existing 47th Street cross passage, and a stair and escalator would be constructed to each platform from the new 48th Street cross passage. The ramps on platforms T and U would be converted to a stair and escalator, and a stair and a possible elevator would be connected to the new 45th Street/Roosevelt passageway. It would also be possible to provide elevators to the platforms, in conjunction with either the 45th Street or the 47th Street cross passage. The 47th Street cross passage could also be extended east to a new concourse under the Waldorf Astoria, space that is currently used to store Metro-North trains. Not all of these exits are required to handle the projected demand, and further study is required to determine the optimum arrangement.

As with the Deep Cavern scheme, all tunnel works for the connection into GCT would be under Park Avenue, with no disruption to existing surface traffic. There would be no need for tunneling under existing buildings outside the existing GCT "footprint".

Our goal is to create a more cost-effective terminal, making effective use of the capacity through the 63rd Street Tunnel. Our scheme only differs from the MTA's current ESA scheme from approximately 60th Street, south into GCT. We do not propose any change to the MTA's current ESA scheme, east and north of 60th Street.

4 MTA Criticisms of Upper Level Loop Scheme

The MTA responded to the Apple Corridor Proposals in Appendix 1, pages A-22 and A-23, of the Final Environmental Impact Statement. The MTA's criticisms are summarized in the first paragraph of page A-23, where it states

"Apple Corridor called for the use of the five westernmost tracks (38-42) [the Upper Level Loop tracks] for both LIRR and airport access service. This would have had a number of adverse impacts on Metro-North, would not have been sufficient to handle projected LIRR passenger volumes, and would have been more costly than originally envisaged."

4.1 Metro North Operations

The FEIS page A-23 states:

"The use of five upper level tracks would have provided LIRR and Airport Access at the expense of existing and future Metro North service . . . use of the five westernmost upper level tracks would have completely taken away Metro-North's access to the upper level loop track - severely constraining Metro-North operations."

GCT is the largest passenger rail terminal in the world, by a wide margin. It has massive excess capacity and can be modified to accommodate the ESA project without seriously constraining Metro-North operations.

GCT was built in the early 20th century for use by trains from the Midwest and New England, but is now primarily used by commuter trains. There are 46 platform tracks used by 51 trains in the peak hour. Each platform is used, on average, by one train every 54 minutes. In contrast, Penn Station, as well as rail terminals in London and Paris, typically have one train every twelve to twenty minutes at each platform. Virtually all other commuter rail terminals have two or three times as many trains, per platform per hour, as GCT.

Table 1 Comparative Rail Terminal Capacities

	Platform tracks	Peak hour train arrivals	Minutes per peak hour arrival per platform
GCT - Metro North Railroad	46	51	54.1
Penn Station - LIRR	9	37	14.6
London Fenchurch Street	4	20	12.0
London Liverpool Street	18	58	18.6
London Waterloo (Domestic)	19	57	20.0
GCT - ESA Deep Cavern scheme	8	24	20.0
GCT - Metro-North without tracks 38-42	41	51	48.2
GCT - ESA Upper Level Loop scheme	5	21	14.3

Metro-North has, quite reasonably, designed its operating plans to utilize all of the available facilities at GCT, and the upper level loop scheme will require some changes. Specifically, Metro North will lose the use of:

- two tracks “C” and “I” through the “throat”;
- five platform tracks 38 to 42 inclusive and platforms S,T,U;
- the loop track and the “Waldorf” yard which extends under the Waldorf Astoria Hotel.

Section 2.3 of the Delcan technical report explains in more detail how Metro-North operations could be altered. Essentially, the loss of capacity can be mitigated by:

- Changing track utilization;
- Double-berthing of short train sets;
- Reducing the lengthy service times at the platforms;
- Reinstating some platforms and tracks on the lower level.

These changes, in combination, can offset the entire loss of capacity. Metro-North will need to change its operations, but not in a way that can be described as “*severely constraining*”.

There will be some increase in Metro-North annual operating costs, however these are minor in comparison to the capital cost savings. LIRR’s costs to operate the ULLA would be significantly lower than the costs to supervise, operate and maintain the Deep Cavern station.

The FEIS makes only indirect reference to future Metro-North expansion plans, however the desire to keep spare capacity “fallow” at GCT rather than share it with ESA may be one of the reasons MTA prefers the Deep Cavern scheme.

In fact, even with ESA taking over the upper level loop, there will be substantial spare capacity at GCT for Metro-North. While we are proposing that ESA take over the upper level loop, the lower level loop and Madison Yard remain virtually unused and available for future Metro-North capacity growth. ESA is a current project, which MTA should be seeking to build and fund most efficiently. There are many other constraints on Metro-North capacity, including flat junctions and short platforms on the Upper Harlem Line and elsewhere. MTA has not made a case for investing in the removal of these constraints. It should not be proposing to spend $2 billion, risking the viability of the ESA project, to “keep open its options”

Nothing in our proposal would preclude future extension of Metro-North service south from the Lower Level towards Lower Manhattan or via Penn Station to New Jersey. Nothing in our proposal precludes future construction of the Deep Cavern scheme, if it is ever required to provide additional capacity.

4.2 LIRR Operations

The FEIS states that (page A-23):

“*The Apple Corridor proposal would not have created sufficient capacity to handle LIRR peak hour service. Track and platform alignments would have accommodated only 18* *trains/hour (versus GCT via Main Line's 24 trains/hour) and would have utilized existing platforms of insufficient width to accommodate large LIRR crowds*."

MTA's criticism is apparently directed at capacity of the tracks and signaling for the required train movements, loading and unloading on the platforms, and pedestrian flow through the station facilities. After detailed analysis particularly with respect to emergency egress requirements, we have concluded that the ULLA cannot accommodate 24 trains/hour. However, it could handle 21 trains/hour in the AM peak hour, or about 90% of MTA's target. In the afternoon, when peak demand is about 15% lower, the ULLA could accommodate 18 trains/hour.

We address each aspect of operational capacity, in turn.

Train movements

The Delcan technical report presents train graphs showing that 24 train/hour operation is feasible through the five platforms and around the loop tracks.

Operating 24 trains per hour around the loop requires LIRR to raise the maximum speed on the loop from 6 mph to 12 mph, with an average speed of 10 mph. This presents no significant safety risk, and indeed the horizontal acceleration experienced by passengers on trains going around the loop will be no more severe than they currently experience when their train passes through switches on the approach to Jamaica or Penn Station (or indeed as will be required on the approaches to the Deep Cavern platforms).

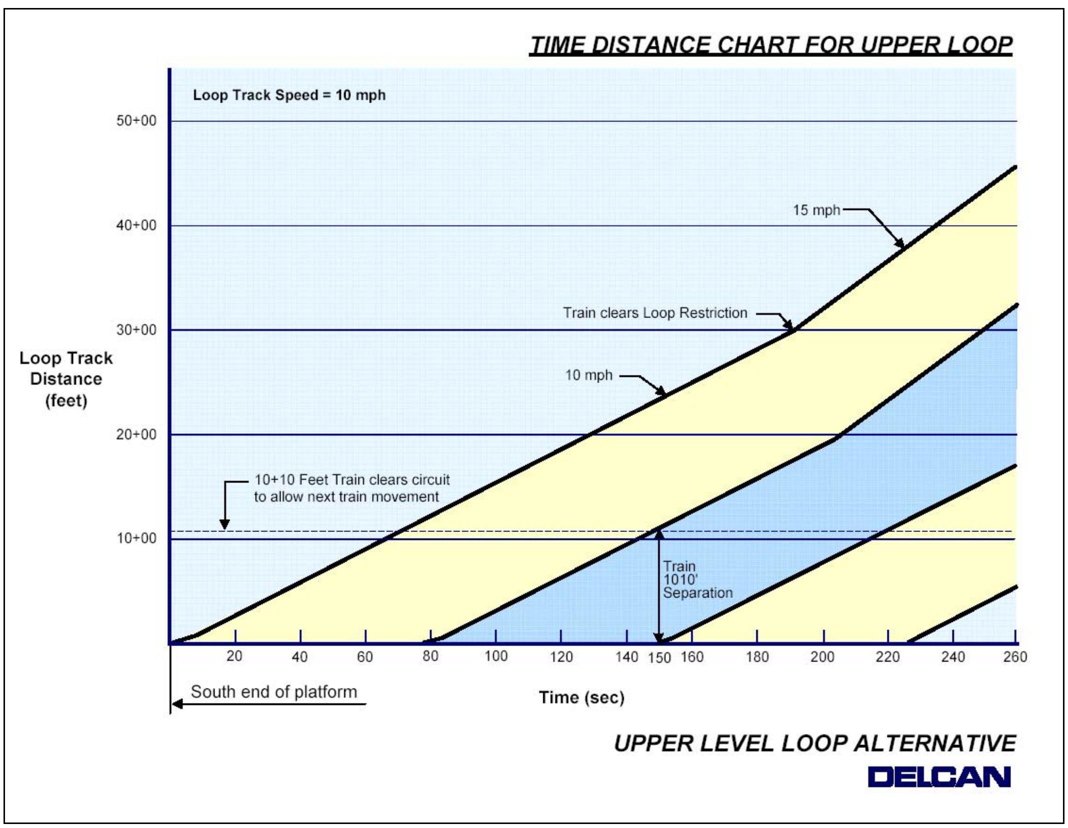

Figure 2 Time Distance Chart showing operation of trains around the loop at 10 mph

This analysis takes account of specific characteristics of LIRR rolling stock and train control systems. It does not involve consideration of passenger handling requirements, which are discussed below.

In the Deep Cavern scheme, LIRR would be able to use four to six platforms for midday storage. In comparison, with use of the upper level loop platforms only two or three LIRR trains could be stored in GCT. The difference, two or three trains, would need to run empty for midday storage probably at Sunnyside Yard. It is estimated that this would increase LIRR operating costs by about $1 million per year.

Passenger Circulation to Platforms

The five loop platforms were not originally designed for use by commuter services. They have only a single ramp at the south end to the GCT concourse, and a stair near the north end connecting to the 47th Street cross passage which was constructed in the 1990s as part of the Grand Central North End Access project.

Delcan has identified several locations for new stairs to each platform, which will be able to accommodate the expected passenger flows without excessive crowding. Costs of these additional stairs will be substantially less than the costs to provide passenger access to the platforms in the Deep Cavern scheme.[3]

Platform Capacity

The Delcan technical report presents an analysis of passenger handling requirements, and conceptual designs for additional stairs and escalators to each platform.

Delcan has concluded that the ULLA can safely handle 21 trains in the morning peak hour and 18 trains in the PM peak hour.

In the AM Peak hour, each of the five platforms would be used by one train every 14.3 minutes. This allows time for trains to run into the platform, unload and load passengers, and accelerate out of the station. This is slightly more intensive usage than LIRR currently achieves at Penn Station, where 37 trains unload in the peak hour on 9 platforms, but is less intensive than on some European commuter rail systems. For example, 20 trains terminate on only four tracks at London’s Fenchurch Street terminus in the morning peak hour, or one train every 12 minutes on each track. The four tracks share two island platforms, which are virtually the same width as the platforms at GCT. Moreover, the Fenchurch Street platforms are obstructed columns and even benches for waiting passengers, whereas the GCT platforms are column-free. As evidence that this does not jeopardize operations, punctuality of the Fenchurch Street lines is comparable with Metro-North and LIRR performance.[4]

Delcan has also concluded that it is feasible and safe to load 18 trains in the PM peak hour, on the five loop platforms. The number of trains that can be safely handled in the afternoon peak hour is lower than in the morning peak hour because people are accumulating on trains and platforms and so a larger number of people might need to be evacuated in an

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[3] The Grand Central North Access project, which included two cross passages and stairs to all upper and lower level platforms, was completed in 1999 for $112 million.

[4] See www.c2c-online.co.uk . Metro North punctuality is normally in the range of 95% to 98%, while LIRR is slightly lower in the range of 93% to 95%. MTA considers a train to be on time if it arrives within 5 minutes 59 seconds of schedule compared with 4 minutes 59 seconds on British railways.

emergency. In the morning peak, most passengers leave the station immediately after arrival of their train.

Traffic in the PM peak hour is about 15% lower than in the AM peak hour, because traffic is spread out over a longer peak period. LIRR and Metro-North currently operate fewer trains in the PM peak hour and can be expected to do the same on ESA. A capacity of 18 trains/hour in the PM peak is consistent with capacity of 21 trains/hour in the AM peak.

Demand
While MTA is projecting that ESA will attract more passengers onto the LIRR, at least in the near term it will mostly attract passengers away from Penn Station. There are currently 37 peak hour LIRR trains into Penn Station, and half of the passengers will save time if they can travel instead via ESA to GCT. So at current traffic levels it would make sense to divert half of the LIRR trains into GCT, or about 18 trains/hour.

MTA has apparently decided to design the route for 24 trains/hour, because this is a normal target for a two-track commuter railway.[5] In fact, capacity of 21 trains/hour will slightly exceed the 2020 forecast of 29,000 passengers in the peak hour. While half the people using Penn Station would save time using ESA to GCT, for people traveling to places between the two terminals, the saving will be very small. Certainly the benefit of diverting the last few trains onto ESA will be much less than for the first 10 or 15 trains.

IRUM's view is that 24 trains/hour is not an absolute requirement. An ESA with capacity for only 21 trains/hour would give 90% or more of the benefits. Delcan have confirmed that the Upper Level Loop alternative can deliver 90% of the benefits, sooner and for much less money. The ULLA is better value, and better use of taxpayer's money.

4.3 Costs

The FEIS states (page A-23) that the Apple Corridor proposal

"would have been more costly to construct than originally envisaged" and "Apple Corridor's cost estimate, which was significantly lower than that of GCT via Main Line, did not include key elements that would have brought its costs into line with those of GCT via Main Line, including throughput connections at Harold Interlocking; mitigation for loss of Metro North Tracks, platforms, and upper loop; design and construction of additional exits and cross passageways at GCT; real estate/easement costs; mitigation of Lexington Avenue subway impacts; and midday storage, among others."

Delcan's analysis of MTA's breakdown of costs indicates that the Upper Level Loop Alternative would cost at least $1.2 billion less to build. For further details see Section 3 of the Delcan technical report.

MTA suggested CBT's scheme "*would have cost more than originally envisaged*".[6] Specifically, they cited:

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[5] MTA runs 51 trains in the peak hour into GCT, by operating three tracks in the peak direction and one track in the contra-peak direction. This is only possible because there is space in GCT to store the 25+ trains per hour that cannot be run back out of the station.

[6] It is in fact MTA's scheme which is costing "more than originally envisaged", having increased from $2 billion when planning commenced in 1996, to £4.3 billion in 2000, to £6.3 billion today.

- ***Costs for connections at Harold Interlocking***: This apparently relates to CBT's 1996 proposal for use by JFK Airport trains and does not relate to choice of Manhattan terminal;
- ***Metro-North's loss of the upper level loop, etc***: We have allowed costs to mitigate this, including re-instating lower level platforms and Track "A", and more servicing and platform staff**;**
- ***Costs for pedestrian exits and cross-passageways***: Based on the Grand Central North Access project that was completed in 1999 for $112 million, the pedestrian exits and passages for the ULLA should cost substantially less than the Deep Cavern scheme. The Deep Cavern scheme requires fit out of eight tracks and four platforms, each 1,020 feet long. It requires 4 escalators from the lower platforms up to the mezzanine (20 feet rise), 4 escalators from the upper platforms down to the mezzanine (15 foot rise) and 17 long escalators from the mezzanine to the lower concourse (91 foot rise). Stair and escalator runs for the ULLA scheme are much shorter. The Deep Cavern scheme will have higher costs to run the escalators and elevators.
- ***Real estate/easement costs***: Use of the upper level loop platforms should not incur any additional costs as similar properties are required;
- ***Lexington Avenue Subway mitigation costs***:[7] These should be the same for either the Deep Cavern or Upper Level Loop schemes;
- ***Rolling stock, track and signaling***: Costs will be similar for either scheme. The Deep Cavern scheme will actually require more new track and signaling, however the upper level loop scheme will require changes to existing tracks and signaling.

The biggest single difference, which MTA does not discuss in its EIS, is the amount of excavation. The Deep Cavern scheme will require mining of 600,000 cubic yards of rock and haulage back through the tunnels to Queens. In comparison the ULLA requires excavation of only 10,000 cubic yards, about 2% as much.

Given the high risks still inherent in the Deep Cavern scheme, we think the ultimate cost difference is likely to be more like $2 billion.

4.4 Implementation Schedule and Risks

The MTA currently expects to complete the ESA project in eight years, with passenger services commencing in 2012. Again, MTA has not provided us with a detailed construction schedule so Delcan has made assumptions based on experience.

Construction of the Deep Cavern tunnels and access passageways to the surface is one of the most time-consuming parts of the current scheme, and is probably on the project "critical path". Construction of the deep caverns is also one of the most risky parts of the project, and one of the most likely areas of possible delay. While there is a great deal of experience with deep rock tunneling under Manhattan, most recently with the Third City Water Tunnel, it remains a dangerous and often unpredictable activity. It is also slow,

[7] This refers to costs to increase capacity of the Lexington Avenue Subway station at GCT/42nd Street, which is already severely overloaded and which may become even more overloaded with the ESA scheme.

because of the limitations on access to the work face. Excavation of the deep caverns in Manhattan will require removal of all rock through the tunnel more than three miles to Queens.

If a decision is made now to use the upper level loop platforms, the ESA project completion will not be jeopardized. Indeed the scheme would still probably open earlier because there is much less tunneling work with much less risk. Delcan believes that the Manhattan portion of the ESA project could be completed in 2009, given the relatively short lengths of new tunnel that are required and the much simpler works required with the scheme. Delcan has prepared a work schedule for the Upper Level Loop Alternative.

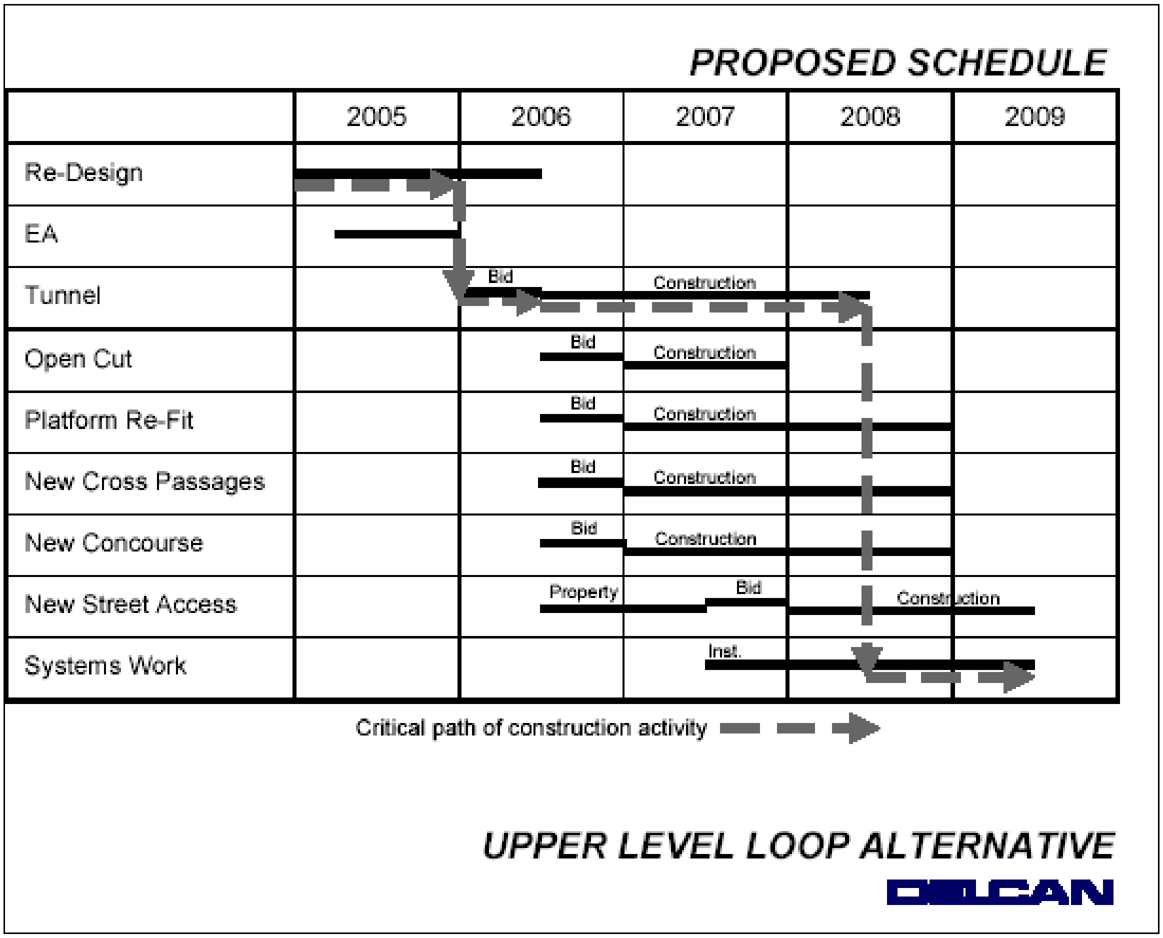

Figure 3 Proposed Implementation Schedule - Upper Level Loop Alternative

5 Safety and Security

Although details have not been provided, we understand that MTA has designed the Deep Cavern scheme to comply with all current safety codes. Delcan has confirmed that the ULLA would also comply with emergency egress criteria for transit facilities, with the provision of additional stairs and escalators connecting the platforms to existing and new cross passages.

Compliance with codes does not guarantee an absolute level of safety. It is our view that the Deep Cavern scheme, even if built to comply with all codes, will provide an inferior level of overall safety as compared with the ULLA scheme. This is because the Deep Cavern scheme puts thousands of passengers deep underground, deeper than at almost any existing station in the New York area. Emergency egress routes are, necessarily, very long and it will take a considerable time for fire and emergency personnel to gain access to platform level. All entry and egress is through a small number of passenger routes. If these routes are compromised, thousands of passengers could be trapped far below ground. Without operating escalators or elevators, many passengers will have great difficulty exiting a station that is 13 stories underground.

This paper has been prepared for IRUM by Michael Schabas, an Independent Consultant based in London England who has wide international experience with urban rail project design, implementation, and operation. He is currently a Director in the rail division of FirstGroup Plc, which operates seven rail companies in the UK serving London, Manchester, Glasgow and Edinburgh and carrying over 80 million passengers per year.

The Institute for Rational Urban Mobility, Inc. is a New York City based not for profit corporation concerned with efficient public investment in transportation facilities. This report makes a strong case for using existing rail infrastructure at Grand Central Terminal to reduce cost, improve passenger safety and convenience and speed the completion of the LIRR East Side Access Project. It was our pleasure to participate in this effort.

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