INSTITUTE FOR RATIONAL URBAN MOBILITY, INC.

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June 5, 2006

Joseph Petrocelli
Chief, Finance & Administration
MTA Capital Construction
469 7th Avenue
New York, NY 10018

Re: Additional Comments on Revised Supplemental Environmental Assessment of Proposed 50th Street Vent Facility for MTA LIRR East Side Access Project

Dear Mr. Petrocelli:

Thank you for the opportunity to meet with you and others from MTA and also with Irwin Kessman of FTA on Thursday, June 1, 2006. My associates at the Regional Rail Working Group (RRWG) were especially grateful to be able to share some of their expertise and knowledge at the meeting. The RRWG is an informal coalition of transit advocates from New York, New Jersey and Connecticut. The RRWG and its advisors represent a broad cross-section of transit experts and advocates with many years of experience in planning, design and public participation. We were especially fortunate to have with us Phil Strong, former LIRR transportation engineer, Herb Landow, a retired railroad and transportation consulting executive, Albert L. Papp, Jr., a Director of the New Jersey Association of Railroad Passengers and Secretary of the Board of the National Association of Railroad Passengers, and William K. Guild, a lawyer with a longstanding interest in rail transit matters. The RRWG is hosted by the Institute for Rational Urban Mobility, Inc. (IRUM), a New York City-based not-for-profit corporation concerned with advancing cost-effective measures to reduce motor vehicle congestion in dense urban places.

We are especially appreciative that you extended the deadline so that we could summarize the results of last Thursday's discussion and include them in our comments.

Speed and Capacity of the loop tracks at Grand Central Terminal

This was the central item for discussion at the June 1, 2006 meeting. The loop tracks at Grand Central Terminal are remarkable resources and their increased utilization opens the opportunity for a more customer-friendly and cost-effective plan for LIRR East Side Access. The Committee for Better Transit proposed its "Apple Corridor" plan in June 1996, which called for using platform tracks 38-42 and the Upper Level loop, as the central feature of its plan for LIRR access to Grand Central Terminal. A plan developed by Herb Landow proposed using the Lower Level loop. Both proposals were submitted into the record during the Major Investment Study (MIS) phase and the Draft and Final Environmental Impact Study. The Upper Level Loop Alternative was subsequently developed in greater detail by the Delcan Corporation. A copy of Delcan's report is included with this letter.

Clearly, plans that make use of the loop track must provide a high level of capacity and reliability if a satisfactory service for LIRR passengers is to be realized. The discussion focused on the claims made by MTA in Appendix B -- Upper Level Loop Analysis, April 2006, of the Environmental Assessment (EA), that only 12 trains per hour can use the loop track. This is far below the number needed and would be indeed a fatal flaw of a loop plan.

The key to capacity around the loop is speed. MTA's claim that the maximum speed that can be sustained on this track is four miles per hour was challenged by the experts present at the meeting. MTA backed up its claim by citing the example of the loop tracks leading to Sunnyside Yard used by Amtrak and NJ Transit, which have curves twice as generous as the 333 foot radius at Grand Central Terminal. While that may be the appropriate speed for those tracks given soil conditions, signaling limitations and capacity needs, the maximum speed on the Grand Central loop track can be much higher.

Maximum speed on curves is based on comfort and safety. Very high speed would cause a train to derail and overturn . But a much lower top speed is needed to assure passenger comfort. Assuming there is no superelevation of the track, the maximum speed for the 333 foot radius loop curve at Grand Central would be 15.8 mph. This is determined using the accepted nationwide railway practice of three inches of cant deficiency. The LIRR uses a more conservative 1.5 inches of cant deficiency on its own lines. However, when operating through the Amtrak East River tunnels at 60 mph LIRR passengers regularly experience cant deficiencies of three inches. Further investigation would be needed to determine if the transition at either end of the curve would have a significant effect on determining speeds to maintain passenger comfort levels.

In locations with tight lateral clearances, speed would be set lower to avoid having trains strike nearby structural elements. In Appendix B of the E, MTA cites this as the reason for selecting the four mile per hour maximum. The art of clearance analysis is quite well developed. The LIRR's new bi-level cars required an extensive investigation of dynamic clearances at numerous locations. MTA's new M7 commuter rail cars have a much more stable suspension system, and perform much better than the M1s and M3s. Metro-North regularly operates these cars around the Upper Level loop at Grand Central, and would be in an excellent position to conduct field tests to confirm or revise MTA's contention that dynamic clearances should limit speeds to 4 miles per hour. The loop track is fixed to a concrete slab and is in excellent condition, having recently been rehabilitated. At present Metro-North limits trains to 6mph, because this all that is needed to sustain its current operations. A review of early timetables of the New York Central Railroad, in effect shortly after the terminal opened, indicated that speed was limited to 12 mph around this curve.

A key reason for meeting with MTA last Thursday was to review the lateral clearance concerns in detail, identifying locations where problems exist and discern whether structural changes could be made to solve these problems. MTA did not provide this information. No representative from Metro-North was brought in to discuss this issue. MTA made it clear that it had not conducted a specific clearance investigation and arbitrarily assumed the four mile per hour speed.

The speed around the loop is especially important because it essentially determines the capacity of the LIRR terminal. At Thursday's meeting, Herb Landow distributed a spreadsheet and an explanatory memo showing the relationship between speed and capacity. A copy of this material is attached for inclusion in the record. At 4 mph, the loop would have a theoretical maximum capacity of 14.3 trains per hour and a practical capacity of 10.7 trains per hour. At 15 mph, the theoretical capacity would be 45.6 trains per hour and the practical capacity would be 34.2 trains per hour.

Rail wear is not a significant issue. It can be minimized by using standard industry techniques like wheel lubricators and high strength rail. Rail replacement can occur with a minimum of disruption, late at night and on weekends. MTA NYC Transit has considerable experience with rail maintenance on its many much sharper radius curves. Only a few yards away from the loop, the Lexington Avenue subway – NYC Transit's busiest line -- has curves ranging in radius from 220 to 270 feet. Usage on each track is more than double that expected on the LIRR loop track.

Single point of failure

At last Thursday's meeting MTA raised the issue of the reliability of a loop operation, pointing out that a stalled train on the loop would bring service to a halt. But this is the nature of two-track railways. Regardless of the terminal design, under the East River there is only one track in each direction. Should a peak hour train become inoperable at any point between the Manhattan terminal and the junction with the existing LIRR trackage at Sunnyside, service would be greatly impaired. Most equipment malfunctions can be detected before trains reach the East River tunnels. Trains can be unloaded at stations in Queens and directed to extra tracks that are available. Should a malfunction be discovered after the train has entered the tunnels it can be taken out of service and temporarily held on one of the five platform tracks in the loop plan. This would not reduce capacity on the loop, but it would require trains to shorten their dwell times in the station. The Delcan study recommended consideration of adding a pocket track between the inbound and outbound tracks in the vicinity of 59th Street to 62nd Street.

The PATH World Trade Center terminal, and its predecessor Hudson Terminal, have operated very successfully as five track loop terminals for nearly a century. The reliability of the PATH fleet and the LIRR M7 fleet are comparable. Before 9/11, the PATH routinely operated trains at 90 second headways (40 trains per hour) during the busiest portion of the peak hour. The sharpest PATH curves have a 115 foot radius.

Other issues

Many other comments were offered by IRUM in a statement distributed at the May 17, 2006 Public Hearing on the EA and in an April 10, 2006 letter to Mysore Nagaraja. Copies of both documents are attached for inclusion in the record. Some additional comments that expand on these documents are offered in the paragraphs that follow.

Travel Time Savings

MTA has not taken exception to the estimates of travel time savings of the Upper Level Loop Alternative compared with the Deep Cavern made by the Delcan Corp. in its report to IRUM. The extra three to four minutes of travel time per trip, in each direction, add considerably to the burden of LIRR passengers using the Deep Cavern alternative. Since the LIRR East Side Access project is expected to save some 15 minutes of travel time per day, the deep cavern station diminishes this gain considerably.

Space for LIRR passengers at Grand Central Terminal

At the June 1, 2006 meeting, and at other times, MTA again raised the concern about adding peak hour LIRR passengers, and overtaxing busy facilities used by Metro-North passengers, at the existing concourse at Grand Central Terminal. A comparison of impacts between the Deep Cavern plan and the Upper Level Loop Alternative is needed. The Deep Cavern plan brings passengers to the Lower Level of Grand Central in a concourse fashioned from Metro-North's Madison Yard tracks. For this option, LIRR passengers heading to the historic concourse on the Upper Level must use existing crowded escalators and stairs that connect the two levels. Some expansion of these stairs is contemplated in the MTA plan. With the Upper Level Loop Alternative, LIRR passengers are already at the concourse level. Other than this, both plans are very similar in terms of passenger movement through the terminal, including the added congestion to the Lexington Avenue subway.

To ease flow for the Upper Level Loop Alternative, concessions in the Vanderbilt Room and at several locations just east of this room could be relocated. The opportunity exists to add escalators to 43rd Street, adjacent to the existing staircase, to increase capacity and comfort. Consolidated ticket offices, waiting rooms and information systems would make sense. Passenger accumulation due to minor delays in the evening peak period can be handled using the considerable space available in the Vanderbilt Room and the Main Concourse. As with the Deep Cavern terminal, really significant delays in the evening would require measures to restrict access to the terminal. With either option, delays of more than fifteen minutes would mean that LIRR passengers, if properly informed, would chose other travel options, like using Penn Station or the E train to Jamaica.

North of the Main Concourse, along Vanderbilt Avenue from 44th Street to 49th Street, numerous opportunities exist for adding passenger access and waiting facilities. These have been discussed in the other materials included with this letter. MTA is in an excellent position to consider real estate development plans for the buildings it owns and for adjacent buildings above the Upper Level Loop platforms. A comprehensive plan could combine development and access, providing added revenue for MTA.

Ventilation Requirements

The 50th Street Vent Facility is not be needed to support the Upper Level Loop Alternative. MTA advanced this massive and costly facility after the FEIS and the Record of Decision were completed, when it discovered that the planned subsurface vent plant was inadequate to meet the ventilation and air conditioning requirements of the extensive Deep Cavern terminal and its accompanying Madison Yard concourse. In the Upper Level Loop Alternative, LIRR trains would reach existing Metro-North trackage at 52nd Street, two blocks north of this facility. The other vent plants further to the north and east would be comparable in scale for either alternative. Since the addition of the 50th Street facility is a significant change in the original plan, it makes sense to review alternatives that would avoid the need for this facility entirely.

Metro-North is advancing a ventilation plan for its tracks and platforms at Grand Central Terminal, including the platform tracks serving the Upper Level Loop. Because Metro-North uses its abundance of tracks at Grand Central for mid-day storage, many trains sit idle all day. This contributes to the heat load, especially in the Lower Level. Use of the Upper Level Loop tracks for the LIRR will actually reduce the heat load, since trains will move through the station in an expeditious manner. The piston action of the frequent train movements will draw fresh air into the platform areas adjacent to these tracks. At the northern portion of the station, these tracks are only a few feet below the surface, visible through grates in the sidewalk.

Ventilation for additional access elements north of the Main Concourse have already been considered in the Delcan plan for the Upper Level Loop Alternative.

Impact on Metro-North Operations

In addition to the comments already provided in the attached documents relating to MTA's assessment of impacts on Metro-North, it is important to note that as many as eight Metro-North platform tracks were taken out of service during the construction of North End Access at Grand Central Terminal. This was done at the same time that one of Metro-North's four mainline tracks on Park Avenue was taken out of service to repair the viaduct and tunnel. Metro-North has considerable slack in it current operations. In examining a recent operating plan it appears that no more than 36 trains are berthed at platforms at one time. Even with the loss of five platform tracks for LIRR service, Metro-North will have 41 platform tracks in place. It may have to give up the luxury of taking platform tracks out of service for construction work during weekday peak periods, and holding other tracks in reserve. Several senior operating officials at Metro-North have expressed their view that loss of five upper level loop tracks is not an operating problem for Metro-North, but a "policy" matter.

In its assessment of impacts on Metro-North operations, MTA claims that two approach tracks are needed for each mainline track, in order to provide capacity for trains that are traveling at 60 mph on the mainline tracks to transition to 10 mph in the terminal. But this transition occurs north of the terminal at 59th Street, where an array of low speed turnouts exists that are not suitable for 60 mph operation. Shorter block lengths are needed in this transition area. In any event, the loss of two of its ten approach tracks leaves Metro-North with eight approach tracks, two for each mainline track. The Delcan study described an option for altering Track B, one of the Lower Level approach tracks, instead of Track C, for the LIRR to approach to the Upper Level. An assessment of this option as part of a review of Metro-North's operating plan would make sense.

In the longer term, a high capacity signal system on the four track main stem and a flyover at Mott Haven Junction in the Bronx are needed, if Metro-North is to sustain further service increases. Some of the reduction in cost resulting from the Upper Level Loop Alternative can be used to finance these improvements.

It should be noted that transit advocates from New Jersey and New York have long advanced a plan to link Penn Station with Grand Central Terminal. One option for this link was carefully examined in the Major Investment Study (MIS) phase of the Access to the Region's Core (ARC) project, co-sponsored by MTA, NJ Transit and the Port Authority of NY and NJ as part of a plan to construct a new two-track tunnel under the Hudson River. This link would attract the most riders, produce the greatest auto diversion and result in the highest operating cost reductions of the three alternatives considered in 2003 MIS Final Report. It would cost 15% less to construct then the alternative calling for a Deep Cavern station under 34th Street and Macy's.

This link would convert Grand Central Terminal into a through terminal, greatly increasing its capacity. In order for this alternative to meet trans-Hudson capacity goals, all trains using the link would have to be through-routed. Transit agencies on either side of the Hudson have been unable to agree on an operating plan. Transit advocates from west of the Hudson have raised concerns about the passenger inconvenience and safety of Deep Cavern stations, similar to those raised by transit advocates in New York and therefore support alternatives to both proposed Deep Cavern terminal stations. Comments about the ARC proposal, prepared by the New Jersey Association of Railroad Passengers (NJ-ARP) for the North Jersey Transportation Planning Authority, are attached.

Cost Considerations

MTA estimated the cost to complete the LIRR East Side Access Project at $6.3 billion before it found that it needed to construct the 50th Street Vent facility. The EA shows a cost estimate of $176 million for the facility including property acquisition. On the other hand, the tunnel boring machine contract for the Manhattan tunnels which had to be re-bid because of the delays associated with the 50th Street Vent facility is reported to have come in at $62 million below estimate. The project is now expected to be completed sometime in 2013, instead of the second quarter of 2012. To the extent the project cost continues to rise, the $1.2 billion in cost savings from the Upper Level Loop Alternative can be expected to increase. The gain could be as much as $2.0 billion, by one estimate. A revised cost estimate is clearly needed, before the Federal Transit Administration completes its analysis to qualify this project for Federal “New Starts” funding.

The economic consequences of the removal of five very valuable properties from the tax rolls should also be estimated as part of the “no build” alternative. The likely economic gain to the city and the region from the redevelopment of these properties without the vent facility should also be specified in the EA.

Security Considerations

Other documents submitted with these comments have already raised serious security concerns. IRUM has joined with four other transit advocacy organizations requesting a full and comprehensive review by appropriate police, fire and security officials. A copy of the letter requesting this review is attached.

The appropriateness of National Fire Protection Association Code 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems has been called into question. MTA claims that its design for the Deep Cavern station meets the standard, because passengers can reach a “point of safety” in six minutes. MTA defines this as the mezzanine between the upper and lower track levels in its Deep Cavern station, some 140 feet below Park Avenue. The code is ambiguous in its definition of a “point of safety. As many as 8,000 passengers could be trapped at this location if a fire or terrorist attack should occur. In contrast, passengers using the Upper Level Loop Alternative would be just below the surface, with many routes to the street. A paper discussing the adequacy of the NFPA 130 code, prepared by Herb Landow and presented at the Annual Meeting of the Transportation Research Forum held this year in New York City, is attached to this letter.

Thank you again for the opportunity comment on this EA.

Sincerely,

George Haikalis
President
Institute for Rational Urban Mobility, Inc.

attachments

List of Attachments

(1) Institute for Rational Urban Mobility, Inc., "Statement at May 17, 2006 Public hearing on Revised Supplemental Environmental Assessment of Proposed 50th Street Vent Facility for MTA LIRR East Side Access Project"

(2) Institute for Rational Urban Mobility, Inc., April 10, 2006 letter to Mysore L. Nagaraja

(3) Herb Landow, memo and accompanying spreadsheet "Speed and Capacity at the GCT Loop", distributed at June 1, 2006 meeting with MTA Capital Construction/FTA

(4) Phil Strong, May 31, 2006 memo "Evaluation of GCT Loop Track for Revenue Service Operation"

(5) Phil Strong, May 31, 2006 memo "Estimate of Headway Leaving Station for Proposed LIRR East Side Access to Grand Central Terminal"

(6) Phil Strong, May 12, 2006 memo "Rolling Stock Dynamic Envelope on the MNR Loop Tracks"

(7) New Jersey Association of Railroad Passengers, *et al* May 2, 2006 letter to Commissioner Raymond Kelly *et al*

(8) Herbert T. Landow, "Safe Egress from Deep Stations, Flawed Criteria in NFPA 130", paper presented at Annual Meeting, Transportation Research Forum, New York, NY, March 2006.

(9) New Jersey Association of Railroad Passengers, "Statement to the Planning and Economic Development Committee, North Jersey Transportation Planning Authority, Inc.", August 29, 2005.

(10) Delcan Corporation, "Assessment of the Upper Level Loop Alternative for the Manhattan Portion of East Side Access Project", Delcan Corporation, Toronto, Canada, in association with Michael Schabus, London, England, October 2004. (Available at www.irum.org/delcan_r.pdf)

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Statement at May 17, 2006 Public Hearing on Revised Supplemental Environmental Assessment of Proposed 50th Street Vent Facility for MTA LIRR East Side Access Project

My name is George Haikalis and I am President of the Institute for Rational Urban Mobility, Inc. (IRUM), a New York City-based not-for-profit corporation concerned with advancing cost-effective measures to reduce motor vehicle congestion in dense urban places. I am a civil engineer and a transportation planner, and Life Member of both the American Society of Civil Engineers and the Institute for Transportation Engineers. I worked for 19 years with the Tri-State Regional Planning Commission, where I was Director of Research and also served as Director of Revenue Budget and Fare Structure Analysis at NYC Transit.

IRUM is proud to host the Final Report -- "Assessment of the Upper Level Loop Alternative for the Manhattan Portion of the East Side Access Project" -- prepared by the Delcan Corporation, of Toronto, Canada. It is available on our website www.irum.org and I am submitting a copy of this report for the record. This report, funded by opponents of the 50th Street Vent Facility, is a technical evaluation of the feasibility of a plan first developed by the Committee for Better Transit in 1996. The Delcan Corporation is one Canada's leading engineering firms, with extensive experience in rail transit projects.

Among the many remarkable features of the massive railroad infrastructure at Grand Central Terminal, constructed by the New York Central Railroad in 1913, are the loop tracks. The terminal with its 46 platform tracks is the world's largest railway station. The Upper Level Alterative calls for using the five existing platform tracks that connect to the loop for the LIRR East Side Access. The Delcan study found that the Upper Level Loop Alternative is feasible and could meet LIRR needs while minimizing disruption to Metro-North commuters. When compared with MTA's Deep Cavern Plan which required the massive 50th Street Facility that is the subject of tonight's hearing, this alternative would save $1.2 billion in construction cost, speed completion of this project by three years and save LIRR commuters three to four minutes of travel time per trip, each way.

MTA's dismissal of this plan, contained in Appendix B of the Environmental Assessment, is seriously flawed. A discussion of these flaws is contained in an April 10, 2006 letter to MTA Capital Construction Company. A copy of the letter is posted on our website.

In brief, a few of the key flaws in MTA's criticism of the Delcan Study are discussed below:

1. Speed around the loop

The single most critical feature of this alternative is to travel around this loop in a most expeditious manner to maximize its capacity. Using standard railway engineering techniques, and taking into account the LIRR's current practices, Delcan found that the trains could safely and comfortably negotiate this curve at 12 mph. At this speed, 24 trains per hour could be accommodated. MTA asserts that the speed should be held to 4 mph, thus limiting capacity to 12 trains per hour because of the possibility of "lateral motion due to track or equipment defects". This claim is not backed up with any specific data or other information.

2. Access to platforms

Delcan did an extensive analysis of access requirements for the Upper Level Loop platforms and recommended a number of new elements that would enhance access. MTA completely ignores Declan's careful analysis and recommendations about access and asserts that the alternative "would rely on existing circulation elements". This is not just misleading, it is a dishonest statement.

3. Impacts on Metro-North operations.

Delcan did an extensive analysis of Metro-North operations with the collaboration of Michael Schabus, an owner and operator of a number of commuter rail lines in the U.K. Their study found that the 41 remaining platform tracks at Grand Central could easily accommodate Metro-North's needs. Because of the great excess of track capacity, Metro-North can afford the luxury of having three platform tracks taken out of service for maintenance and repair and a fourth platform track reserved for waste disposal. A modest change in operating practice could release the space needed for LIRR operations.

4. Time needed to advance the Upper Level Loop Alternative

MTA has made numerous changes to its LIRR East Side Access Project, since it was first proposed. The additional modifications have modest impacts and can be quickly advanced New subsurface easements can readily be obtained, since they closely mirror the alignment proposed during the Major Investment Study phase of this plan. The subtle changes to Metro-North operations could be made over the next several months, releasing the tracks needed for LIRR operations, with no noticeable impact on existing riders. MTA's successful completion of the local-express connection to the Queens Boulevard subway line in Long Island City took place without any weekday closing of services. This could be emulated with an equally resourceful detailing of the construction plan for the Upper Level Loop at Grand Central, which is far simpler. Because much less construction is needed, the project could be completed very quickly.

5. Concerns about fire safety and egress

MTA's assertion that assuring safe access and egress from a deep cavern terminal station, some 140 feet below Park Avenue, would be less challenging than reaching Upper Level Loop platforms and tracks that are just below street level makes no sense. An even-handed comparison of the relative safety and egress considerations of these two options by fire safety experts is needed. In this age of concern about terrorism this assessment is especially urgent.

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April 10, 2006

Mysore L. Nagaraja
President, MTA Capital Construction
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Copies to: Hon. Nancy Shevell Blakeman, Chair, MTA Capital Construction, Planning and Real Estate Committee and members of committee, members of the Permanent Citizen's Advisory Committee to the MTA, Peter Cannito, James Dermody, and other interested parties

Dear Mr. Nagaraja:

Your March 24, 2006 letter to Susan Blakeman makes it quite clear that MTA's plan for a Deep Cavern station for the LIRR is fundamentally flawed. That letter states that the emergency egress plan for this station is to evacuate passengers from the platforms to the mezzanines, some 140 feet below Park Avenue, which would be considered "Points of Safety". Long before 9/11 transit advocates argued that a ***terminal*** station this far below the surface, unprecedented in railway practice, would result in a great inconvenience to LIRR passengers, adding three to four minutes per trip when compared with using existing platforms located in Grand Central Terminal's Upper Level. Now, according to your letter, it seems that MTA has made no provision for evacuating passengers from the Deep Cavern station in a timely manner in case of a terrorist attack, or even a routine fire. As many as 8,000 passengers might be trapped in the mezzanine, and forced to climb some 90 feet up stopped escalators to reach the concourse, and then climb another two levels to the street.

For MTA to argue that a station on the Upper Level, as originally proposed by the Committee for Better Transit, is less safe than the Deep Cavern defies common sense. Pedestrians walking on cross streets on Manhattan's East Side can look down through grates and see the top of rail cars, no further than five or six feet below them. Numerous opportunities exist to develop additional regular and emergency exits within the buildings that are located along Vanderbilt Avenue directly over the loop track platforms. For all but a short segment of the loop track, access to adjacent tracks is available. If needed, additional emergency access to this short segment can be provided. **On the basis of security and fire safety concerns alone, MTA should scrap its proposed Deep Cavern Station and pursue the Upper Level Loop Alternative.**

The detailed review of the Delcan Report contained in the March 24 letter, the first since this report was sent to MTA some 18 months ago, provides MTA an important first step to refine the Upper Level Loop Alternative so that it fully meets LIRR and Metro-North operating requirements at Grand Central Terminal. For example, current transportation engineering practice suggests that the appropriate maximum speed to comfortably traverse the Upper Level Loop track is a little over 15mph, assuming a three inch unbalanced superelevation. It would be important for MTA to fully explore Metro-North's contention that due to limited side clearances, speeds should be limited to four miles per hour in anticipation of excessive lateral motion due to track or equipment defects. The location any such close side clearances should be identified and mitigation measures devised.

Metro-North's practice of keeping three tracks out of service at any one time for "maintenance or capital work" is a luxury few busy railroads can embrace. It is particularly painful in this case, since it forces LIRR commuters into a Deep Cavern station, adding three to four minutes per trip and greatly increasing risks in this age of concern about security. Metro-North should develop its own operating plan, building on the Delcan plan, to facilitate the release of Upper Level Loop tracks for LIRR use. MTA can refine the construction plan, based on its successful experience in constructing the local-express connection in Queens, to avoid the weekday Metro-North track outages discussed in the Delcan plan. By minimizing or eliminating these operating concerns MTA can avoid any significant environmental concerns and quickly move ahead the Upper Level Loop Alternative.

A more regional approach to dealing with Metro-North capacity issues is also warranted. Particularly, it would be important for MTA to revisit Alternative G described in the Major Investment Study Final Report of the MTA-NJ Transit-PANYNJ Access to the Region's Core (ARC) project. That alternative would connect the eight center-most platform tracks of the Lower Level of Grand Central Terminal with five existing platform tracks at Penn Station as part of the ARC plan for new Trans-Hudson tunnels. Alternative G was dismissed because it failed to provide adequate peak hour train capacity. This failure was due to the inability of NJ Transit and Metro-North to agree on an integrated operating plan that made full use of the through-running capability possible using this connection. Instead, NJ Transit and MTA are now advancing another Deep Cavern station, under 34th Street and under Macy's. This station will have the inconvenience and risks associated with this type of facility, while increasing the cost of this project. Alternative G would have greatly improved the operating performance of Metro-North at Grand Central Terminal converting this "stub" terminal into a "through" station and making it much easier to bring LIRR trains to the Upper Level Loop platforms. Passengers on both sides of the Hudson River would enjoy many new travel options, by advancing both proposals concurrently.

Other proposals to increase Metro-North capacity should be advanced. In the near term, operation of Metro-North trains on Amtrak's West Side and Hell Gate Lines to Penn Station would quickly allow major increases in service. A more advanced signal system on the four-track Park Avenue mainline could increase capacity to thirty trains per hour, per track. A grade separation at Mott Haven Junction in the Bronx would eliminate conflicts at this critical location. Finally, with MTA now considering options for improving LIRR service to Lower Manhattan, a similar planning effort for direct train service from the Northern Suburbs, dropped a month before 9/11, could be revisited.

With the region's three commuter rail operators collaborating, rather than going their separate ways, the Manhattan business district -- the region's economic engine – will be better served, commuters will save travel time, taxpayers will benefit and **the frightening risks of two Deep Cavern *terminal* stations can be avoided.**

Sincerely,

George Haikalis
President

SPEED AND CAPACITY AT THE GCT LOOP

The spreadsheet attached shows data for speeds from 3 to 15 MPH. The capacity of trains to traverse the loop is a function of many factors, including the speed assumed.

The spreadsheet details these calculations.

Constants

Various constants are given in rows 21-27. These include:

- 21-Train length = 1020 feet (12 cars at 85 feet per car)
- 22-Brake rate = 1.713 feet/sec (standard signal design rate for NEC region as per Amtrak braking curve S603)
- 23-Seconds in cruise before responding to brake application = 8
- 24-Signal Block Length = 200 feet. This is a short block- high density situation.
- 25-Conversion factor 1 MPH = x feet/sec = 5280/3600 = 1.467 fps
- 26-Minimum radius curve in the loop = 333 feet
- 27-Degrees of curvature for the minimum radius = 5730 / radius
  Radius standard for 1 degree curve = 5730 approx)

Distances

Row 5:

Braking distance = seconds to come to a stop at braking rate and speed
= Speed in mph converted to fps, divided by twice the brake rate.
Standard Newtonian math of V squared / (2 * brake rate).

Row 6:

Assumes 2 blocks clear for the braking interval behind the first train. Assumes a three aspect system in this slow speed territory. These are:

1. Stop
2. Braking required
3. Next block is clear and no immediate stop is needed.

The result is a 2 block clear distance behind train 1 of 400 feet.

Row 7:

Train length is the standard 12 car train length of 1020 feet.

Row 8:

Cruise distance before braking.
The seconds of row 23 times the velocity in fps from row 3.

Answers

Row 10 Total Headway distance

The sum of rows 5-8. This is the total of the minimal train headway separation factors for the speed indicated. It includes (for train 2) all the distance factors to catch up to the position of train 1. This includes train 1 length, braking distances etc.

Row 12 Headway Seconds

Headway distance row 10 divided by feet/sec of the column. It gives the seconds by which the trains are separated in a headway sense (head to head or tail to tail). This is one of the key answers of the entire exercise.

Row 14 Max Trains per hour

This is the seconds per interval divided into the seconds per hour (3600). This is the repeatable events per hour if no problems intervened. For 12 MPH it is 38 Trains per hour (TPH) and 45 TPH at 15 MPH.

Row 16 TPH at 75 % Load Factor

Assuming time losses, the rate of production (TPH) is reduced from the above. The most common signal design assumption is 75% of the theoretical. This row shows the net result in TPH.

Row 17

Assuming a 50% load factor, the output is further reduced. This is a much more conservative criteria. At NJT we were advised by signal engineers to use 75% for the new system on the NEC (HDIS).

Row 18

Unbalanced super-elevation in inches (top rail over low rail)

Solved by the standard equation of V squared = K * (E+U) / D where:

- V = mph
- E = inches super-elevated
- U = inches unbalanced (a net inch deficit re a balanced velocity on a banked curve)
- D degrees of curvature
- K = constant 1500. (LIRR criteria 1970's). The derivation of K shows a "sticky" variable – a function of the cross elevation angle – but always close to 1500.

Note that the values computed are less than the typical rail stresses and no threat to passenger safety.

Conclusion

Capacity on the GCT loop is a function of speed. The speeds are well within normal railroad tolerances for safety on the curvature involved.

The GCT loops (upper or lower) can provide the needed capacity for the ESA project.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	**SPEED AROUND THE LOOP**																		
2	MPH	3	4	5	6	7	8	9	10	11	12	13	14	15					
3	Feet per second	4.400	5.866	7.333	8.800	10.266	11.733	13.199	14.666	16.133	17.599	19.066	20.532	21.999					
4	**DISTANCES**																		
5	Braking Distance	5.650	10.045	15.696	22.602	30.763	40.181	50.854	62.782	75.966	90.406	106.102	123.053	141.260					
6	Signal Interval @ 2 Blocks	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000	400.000					
7	Train Length	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000					
8	Cruise Distance beore braking	35.198	46.931	58.664	70.397	82.130	93.862	105.595	117.328	129.061	140.794	152.526	164.259	175.992					
9	**ANSWERS**																		
10	Total Headway Distance (Feet)	1460.849	1476.976	1494.360	1512.998	1532.893	1554.043	1576.449	1600.110	1625.027	1651.200	1678.628	1707.312	1737.252					
11																			
12	Headway (Seconds)	332.026	251.769	203.786	171.939	149.315	132.453	119.433	109.103	100.729	93.822	88.044	83.152	78.970					
13																			
14	Max Trains Per Hour (TPH)	10.843	14.299	17.666	20.938	24.110	27.179	30.142	32.996	35.739	38.370	40.889	43.294	45.587					
15																			
16	TPH @75% Load Factor	8.1	10.7	13.2	15.7	18.1	20.4	22.6	24.7	26.8	28.8	30.7	32.5	34.2					
17																			
18	Unbalanced SuperElevation	0.103	0.184	0.287	0.413	0.562	0.734	0.929	1.147	1.388	1.652	1.939	2.248	2.581					
19																			
20	**CONSTANTS**																		
21	Train Length (Feet)	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000	1020.000					
22	Braking Rate (Feet Per Sec)	1.713	1.713	1.713	1.713	1.713	1.713	1.713	1.713	1.713	1.713	1.713	1.713	1.713					
23	Time before automatic braking (Seconds)	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000					
24	Signal Block Length (Feet)	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000	200.000					
25	FPS at 1 MPH = 5280/3600	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.467	1.467					
26	Minimum Radius (Feet)	333.000	333.000	333.000	333.000	333.000	333.000	333.000	333.000	333.000	333.000	333.000	333.000	333.000					
27	Degrees of Curvature	17.207	17.207	17.207	17.207	17.207	17.207	17.207	17.207	17.207	17.207	17.207	17.207	17.207					

Evaluation of GCT Loop Track for Revenue Service Operation

1. Loop Track Safe Operating Speed

A loop track speed of not less than 15 mph is feasible and within acceptable safety and comfort limits, as detailed below.

Cant deficiencies of 3 inches are commonly used in traversing curves in revenue service. This limit is allowed by the FRA for operation at speeds up to 90 mph (see 49CFR213). For the loop track, with a 333 ft. radius curve without superelevation, this cant deficiency is reached at a speed of 15.8 mph.

A maximum speed of 18 mph – the estimated upper limit tolerance for an automatic speed control system enforcement at no code in the track on LIRR (check with LIRR for exact data) would result in a cant deficiency of 3.9 inches. For a loop track enforcement speed of no greater than 18 mph, the cant deficiency could be limited to no greater than 3 inches by installing 0.9 inches superelevation on the curve. Civil speed restriction at maximum speed no greater than 15.8 mph, under operator control, would achieve the same result.

There is no safety impediment associated with operating at a 3.9 inch cant deficiency. (The FRA allows operation at up to 4 inch cant deficiency provided qualification testing is done. See 49CFR213.57(c).) However track and wheel wear will increase somewhat and passenger lateral accelerations will increase as cant deficiency is increased.

Wayside clearances would need to be confirmed for the outside of the curve for operation at 3 or 3.9 inch cant deficiency, and also for the inside of the curve if superelevation were introduced.

LIRR prefers to operate at no more than 1.5 inches of cant deficiency, although there are curves in the East River tunnels which are traversed at 3 inch cant deficiency by LIRR and Amtrak trains on a regular basis.

The use of the loop track at 3 or 3.9 inch cant deficiency should be discussed with LIRR. Superelevation could be considered on the loop track to reduce the cant deficiency at operating speeds which provide the desired capacity; see Section 2. below.

2. Loop Track Capacity

The calculated theoretical capacity of 43 trains per hour is believed to be a realistic estimate, as detailed below. This theoretical capacity is based on our knowledge of the current LIRR EMU performance and should be confirmed or corrected with input from LIRR. This theoretical capacity is estimated to support a reliable operation at a capacity of 30 trains per hour, also detailed below.

In order to obtain a loop track track capacity of 30 trains per hour or greater assume a loop track minimum traverse speed of 15 mph; this is acceptable per Section 1. above. A minimum traverse speed of 15 mph would be associated with a maximum speed of approximately 18 mph with tolerances accounted for (should be confirmed with LIRR). This would allow use of LIRR's existing no code automatic speed control enforcement at a nominal 15 mph.

Assume a worst-case distance to stop based on a free run time of 5 seconds and a safety brake rate of 1.2 mph per sec. (1.76 ft per sec^2) (confirm with LIRR). The worst-case distance to stop from 18 mph (26.4 fps) is $5x26.4 + (26.4)^2/(2x1.76) = 132 + 198 = 330$ ft. Therefore the minimum block length is estimated as 330 ft. For two blocks separating the trailing end of a consist from the leading end of the consist behind, the leading ends of two consecutive consists would be 2x330 + consist length apart. Using a twelve car consist this distance is 2x330 + 12x85 = 1680 ft. At a speed of 15 mph (22 fps) the time for successive trains to pass a fixed location is 1680/22 = 76 sec. This is equivalent to a theoretical capacity of 47 trains per hour, but is limited to slightly less than this by the need to accelerate when leaving the station platforms, as explained in the next paragraph.

As a consist leaves the platform it will accelerate at about 1 mph per sec (1.47 ft per sec^2) (confirm with LIRR). It must reach at least 15 mph (in order to ensure adequate capacity) and then continue at speed until it has traversed at least 1680 ft from the platform before the next train can depart, assuming the most conservative case of a 12 car train leading. (A method for controlling the speed of the train under manual control is needed since the Engineer will not be able to accurately ascertain the speed from the speedometer in this speed range. A system of flashing lights with the pattern traveling at 15 mph is one means of providing this.) The time for the leading train to travel 1680 ft is composed of 15 sec to reach 15 mph (22 fps), with a distance traveled of $(22)^2/2x1.47 = 165$ ft, and with the remaining distance of 1680 – 165 = 1515 ft traversed in 1515/22 = 69 sec, for a total of 15 + 69 = 84 sec. Therefore, the next train is cleared to leave the station at 84 sec after the leading train departs, and no delay in headway or constraint on capacity will occur. Consecutive trains at 84 sec intervals results in a theoretical capacity of 43 trains per hour.

The theoretical capacity of 43 trains per hour provides margin for recovery from unforeseen events which might occur during loading at the platform. For example, at an actual capacity of 30 trains per hour (at departure time intervals of 120 sec) the actual departure of each train is later than that established by the average time interval between trains which is available (84 sec) by 120 – 84 = 36 sec. This time is available to react to passengetrs holding doors, failure to get a door closed and locked indication etc.

Consideration should be given to installing a preparatory signal at the platforms advising Engineers that the trailing end of a train on the loop track is 660 ft from the platform and that the next train should prepare to depart within the next 36 sec.

The switches used in merging tracks 38 through 42 cover a total length around the outer loop of approximately 500 ft. from the south end of the platform. So a recognition that the trailing end of a train is approximately 660 ft. from the platform could be installed approximately 160 ft. beyond the last of these switches, and used to provide a clear or preparatory signal at the platforms.

3. Single Point Failure

A review of the impact of a disabled train on the loop track indicates that:

1. **the risk of such a failure is no greater than, and may be less than, the risk of such an event in other typically encountered revenue service operations**
2. **contingency service at a reduced level is possible, as it also is in existing operations**
3. **the capability for clearing a disabled train is equal to or better than in other typical revenue service operations**

as detailed below.

The distance over which a disabled train would force a contingency plan for continued operation is relatively small in the loop track operation; less than 500 ft plus train length where the single track area would be fouled with no run-around capability. Continued service following such an event would require revenue and deadhead trains to reverse run out of the station on the west side during removal of the disabled train. This appears to be no more onerous than when a disabled train near the station platform(s) in an existing operation or for the current ESA planned operation would require contingency rub-around service to be instituted. In such cases run-around could, if in close proximity to station platforms and during peak service hours, require back-up moves and through a crossover to return and exit the station on another track. Access in and out of the station would be reduced in either existing facilities where run around is feasible, or in a LIRR facility in GCT that normally used the loop track.

Removal of the disabled train on the loop track could be had by moving it Southeast into the storage area on the East side of the station. This is a relatively short distance.

There are many locations where a single point failure can cause significant disruption of service. The loop track would be subjected to a relatively high density of use, and therefore should be subjected to frequent inspection and scheduled maintenance as required. Maintenance of cross level and gage would be especially important, in order to avoid excessive wheel unloading due to cross level deviation and to thus minimize derailment risk.

The third rail supply should be considered a critical component of the loop track. The possibility of two or more trains calling for maximum current simultaneously must be accounted for.

Upgrading the loop track itself should be considered – hardened rail and subgrade improvements might be appropriate.

EMU consists are relatively reliable due to redundancy of traction and other systems. However, use of a standby protect unit in close proximity to the loop track, possibly in the storage area on the East side of the station, should be considered. This unit might carry on-board rerailing equipment.

Estimate of Headway Leaving Station for Proposed LIRR East Side Access to Grand Central Terminal

Introduction

The single loop track track available at the South end of the upper level of GCT was analyzed to determine theoretical capacity based on using a nominal speed on the small radius loop track of 15 mph. This speed was chosen as it yields a cant deficiency of 2.7 inches (Cant deficiency is a measure of the centrifugal force felt by occupants of the cars when traversing the curve.); a 3 inch cant deficiency is accepted by the Federal Railroad Administration as the upper limit without special qualification, is typically used in revenue service and provides acceptable passenger comfort. Note that the curves in the East River tunnels are traversed at 3 inch cant deficiency when traveling at 60 mph.

Assume leaving on a single track with sufficient station platform tracks switching into the leaving track to not result in delay associated with passenger loading.

Methodology

The "lead" train leaves the station at time, t=0. The next train out – the "following train" – is assumed to leave the station as soon as sufficient distance is covered by the lead train to create twice the safe stopping distance between the trailing end of the lead train and the front end of the following train.

The safe stopping distance, B, is calculated as

1.) $B = V^2/2(BR) + t_{fr}V$

where V = limiting speed after accelerating out of station, fps
BR = brake rate, ft./sec.^{2}
t_{fr} = effective free run time before brakes are fully applied, sec.

A safe separation of the two trains is assumed to be a distance of 2B.

The total time, t = T, to traverse a distance which places the front end of the following train at the location that was occupied by the lead train when the following train left the station is the time to accelerate plus the time to run at the limiting speed (assumed constant).

2.) $T = t_a + [2B + l - d_a]/V$

where d_a = distance to accelerate from stopped to speed = V
l = lead train length,
t_a = time to accelerate

3.) $d_a = V^2/2(AR)$

where AR = acceleration rate, ft./sec.^{2}

4.) $t_a = V/AR$

Substituting equs.' 1.), 3.) and 4.) into equ. 2.) and simplifying

5.) $T = V[1/BR + 1/2AR] + l/V + 2t_{fr}$

In order to ensure that the above operating scenario is feasible it is necessary that the lead train will have traveled a distance greater than or equal to 2B + l in time = T, to provide a safe distance between it and the following train at time = T. In time = T the lead train will have traveled a distance, D with

6.) $D = TV = V^2[1/BR + 1/2AR] + l + 2t_{fr}V$
$= 2B + l + V^2/2AR > 2B + l$

The maximum headway is achieved at dT/dV = 0. Assuming that BR = AR (an approximation to simplify the calculations below) then

7.) $T = 3V/2BR + l/V + 2t_{fr}$

8.) $dT/dV = 3/2BR - l/V^2 = 0$ at $V = V_0 = [(2/3)(BR)l]^{1/2}$

Numerical example # 1

Assume BR = 1.47 ft./sec.^{2} (1 mph/sec.) and l = 1020 ft. (twelve 85 ft. long cars)
Then V_0 = 31.6 fps (21.6 mph)
$T = T_0$ = 80.5 sec.
Headway = $3600/T_0$ = 45 trains per hour (tph)

Numerical example # 2

For 15 mph speed with BR = 1.47 ft./sec.^{2} (1 mph/sec.) and l = 1020 ft.
T = 84.8 sec.
Headway = 3600/T = 42 tph

Numerical example # 3

For 7.5 mph speed with BR = 1.47 ft./sec.^{2} (1 mph/sec.) and l = 1020 ft.
T = 120 sec.
Headway = 3600/T = 30 tph

Numerical example # 4

Speed tolerances should be used to establish minimum block length. For a nominal limiting speed of 15 mph use 18 mph as the upper limit speed with tolerances, for establishing minimum block length, B. Then B = 448 ft., and the distance and time to accelerate are d_a = 105.4 ft. and t_a = 12 sec.

Assume a speed of 12 mph as the lower limit of the nominal speed of 15 mph for establishing a conservative upper bound on the time, T in equ. 2.)

T = 114.9 sec.
Headway = 3600/T = 31 tph

Phil Strong

Rolling Stock Dynamic Envelope on the MNR Loop Tracks

In summary, rolling stock dynamic envelopes is a complex subject. It depends on suspension system design and track geometry perturbations, in addition to obviously depending on car static envelope. Of all the cars operated by MNR and LIRR, the M-7 would almost certainly have the smallest dynamic clearance envelope, for any given track conditions. Also consider that track maintenance standards, regulated by FRA, are very loose for speeds less than or equal to 15 mph. So MNR's concern about clearance on the loop may be more based on operating experience than on objective assessment of changes to better control the vehicle clearance envelope. Discussing this with capital construction people could result in being classified as a certifiable nut. Even with rolling stock technical "specialists" this has been known to happen. Not too many people realize that there are a wide variety of passenger rolling stock suspensions in service. These are not 3 piece freight car trucks that are almost all in accordance with AAR standards, or locomotives that are typically very similar to each other as regards suspension design. Although the vertical suspensions of most passenger cars have almost the same static deflections under carbody weight they differ in spring lateral spacing, lateral characteristics and air spring height control methods.

I estimate that at about 3" cant deficiency on a 330 ft. radius curve without superelevation (Herb, note that cant deficiency is typically using a 60" lateral distance between wheel-rail contact patches, not 56.5") the M-7 would be expected to have no more than 2" of lateral motion at 13 ft. ATORR (I don't have an M-7 cross-section drawing), with no more than 1" being due to quasi-static roll and the other 1" being due to lateral deflection at the primary suspension. There might also be up to about a 0.5" lateral shift of the wheelsets on the track. The above values are under ideal conditions and will get larger with cross-level, gage and alignment deviations in the track and dynamic excursions due to track irregularities. For example, a 1" cross level error on both trucks, or 2" on one truck, will add approximately another 2.6" to the lateral motion at 13 ft. ATORR. Alignment and cross-level deviations on curves will typically be in the direction to increase lateral deflection to the outside of the curve, due to operation at cant deficiency. So careful track maintenance and investment in quality trackbed is warranted if clearances are tight.

The earlier LIRR and MNR EMUs', and the MNR coaches, are quite soft in roll and are likely to exceed the 2" lateral motion in ideal conditions estimated for the M-7 at 13 ft. ATORR. by at least 1". This is because they are inboard bearing trucks, which puts the primary suspension spring spacing at 46" rather than at about 80" for the M-7. Also all but the M-1 uses 3 leveling vales per car whereas the M-7 uses 4. The M-1 uses only 2, but this loss of roll control on the double-convoluted air springs does have some time delay built in due to the roll orifices. The M-1s' also have a very stiff primary suspension.

The above are estimates. A well planned test should satisfy all, including me, since this is not a simple situation to analyze. For example the results would depend partially on time dependent phenomena. For example, an M-2 car might fare poorly in a static lean test but do better in operating at 3" cant deficiency for a short period of time.

Phil Strong, 5/12/06

New Jersey Association of Railroad Passengers
Empire State Passengers Association
Lackawanna Coalition
Straphangers Campaign
Institute for Rational Urban Mobility, Inc.

May 2, 2006

Commissioner Raymond W. Kelly, New York Police Department
One Police Plaza, New York, NY 10038

Nicholas Scopetta, Commissioner of New York Fire Department
9 Metrotech Plaza, Brooklyn, NY 11201

Joseph F. Bruno, Commissioner of the Office of Emergency Management
11 Water Street, Brooklyn, NY 11201

Secretary Michael Chertoff, U.S. Department of Homeland Security
Washington, DC 20528

Commissioners Kelly, Scopetta, and Bruno and Secretary Chertoff:

Transit advocates in the New York/New Jersey metropolitan area are seriously concerned about the fire safety egress and security implications of two new "Deep Cavern" railway terminals being proposed by the New York Metropolitan Transportation Authority and New Jersey Transit. The MTA terminal, some 150 feet below Park Avenue and Grand Central Terminal in Manhattan, is for the LIRR East Side Access Project. The NJ Transit terminal is some 100 feet below 34th Street and Macy's Department Store, also in Manhattan. Each of these terminals would consist of two four-track caverns, with a mezzanine between the upper and lower levels. Access to the street would be from the mezzanines, using long escalators. As many as 8,000 passengers could be trapped in these terminals in the event of an emergency.

Many transit advocates have proposed alternatives to both Deep Cavern stations that would use existing platforms at Penn Station and Grand Central because they would require less travel time to reach and would cost far less to construct.

In this age of concern about terrorism, we respectfully request that you do a careful risk assessment of these deep cavern stations, and compare them with the risks of the alternatives proposed by transit advocates, before construction proceeds. If such assessments have already been done, we ask that we either be briefed on these reviews or given your assessment of the security. In the case of at least one of the projects — East Side Access — the Final Environmental Assessment and Record of Decision were finished prior to the events of September 11, 2001.

For more information please contact George Haikalis at 212-475-3394. We hope to hear from you at your earliest convenience.

Sincerely,

Bruce Becker, President, Empire State Passengers Association
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Clarence, NY 14031

Douglas John Bowen, President, NJ Association of Railroad Passengers
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David Peter Allen, President, Lackawanna Coalition
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cc: elected officials and interested parties

SAFE EGRESS FROM DEEP STATIONS
Flawed Criteria in NFPA 130

Herbert T. Landow
Member, NYC TRF

Abstract

The design of railway stations includes the consideration of emergency evacuation requirements. These are written in NFPA 130, a standard of the National Fire Protection Association. If a standard is faulty or inappropriate in any way, the flaw has far reaching consequences. The Code 130 is an example of a flawed code. As such it deserves our immediate attention and improvement. The code fails to properly measure egress rates from deep stations. The paper reviews the reasons for this and indicates corrective action.

SCOPE

The design of railway stations includes the consideration of emergency evacuation requirements. These are written in NFPA 130, a standard of the National Fire Protection Association. The NFPA is a body designed to create such standards. It works with experts who develop a consensus view of the appropriate guidelines. The NFPA is not a governmental organization and has no rule making authority. Any authority it has is created by governmental units that may adopt it as a requirement for construction within the jurisdiction of that governmental unit.

Despite this indirect authority, the NFPA standards have a major influence in construction and design. If a standard is faulty or inappropriate in any way, the flaw has far reaching consequences.

The Code 130 is an example of a flawed code. As such it deserves our immediate attention and improvement.

EXAMPLE OF THE PROBLEM

In New York City, the MTA is planning the East Side Access Project. This will create a deep underground terminal. As many as 5000 persons will be in the terminal at one time during the evening rush period. Safe emergency egress is a major problem. However, using the NFPA 130 criteria, it appears solvable. This is an illusion, however. The following discussion will make that clear and propose constructive action.

CONTEXT

The code is entitled *Standard for Fixed Guideway Transit and Passenger Rail Systems*.[1] References to it will be detailed in the end notes of this paper. The code content is indexed by a number and sub-number system. Thus Chapter 5 may have subparts 5.4, then 5.4.2, then 5.4.2.1, etc.

The Code 130 covers many design elements including Stations, Trainways, Emergency Ventilation, and Vehicles. Our immediate concern is with station evacuation.

EVACUATION REQUIREMENTS

For a transit or railway station, the code assumes a track and platform system. The need for evacuation is premised on a fire or the presence of toxic matter in the air. The platforms may be on an elevated structure, at grade or underground.

The maximum time allowed for clearing the platform of all riders is 4 minutes.[2] The maximum time to clear the entire system (including platforms) is 6 minutes.[3]

Such evacuation is conducted from the platforms to a "point of safety". This is defined as "an enclosed fire exit that leads to a public way or safe location outside the structure, or an at grade point beyond any enclosing structure, or another area that affords adequate protection for passengers." [4]

This definition has three alternatives. The first two are physical: "outside the structure," "beyond any enclosing structure." The third is ambiguous and uses the vague term "adequate".

PHYSICAL DESIGN REQUIREMENTS

Egress paths include stairs, escalators and elevators. Elevators are not normally considered in egress computations due to their inherently low capacity.

Escalators are limited in quantity to one half of the exit paths at any one level.[5] Of these, one is assumed to be out of service.[6] Furthermore, the out of service escalator must be the one most critical to evacuation.[7]

Escalators running in the direction of emergency egress are permitted to keep running.[8] When running toward the emergency, they must be capable of being stopped.[9] No suggestion is made that such escalators once stopped can be restarted. This is very sensible in that safety requires very cautious assumptions as to what will work when needed.

No assumption is made that the capacity of escalators should be considered when operating in the egress direction. Such capacity may be higher than that of a stair, but it is not considered. This is wise in that the emergency may include power losses which stop such an escalator despite the operational advisory that it can remain running if already doing so.

STAIR/ESCALATOR EQUIVALENCY

For a particular station layout, computations are required to test evacuation timing. For this purpose, stairs and escalators are treated as equivalents. They are both vertical paths. That is, escalators have the same capacity and velocity numbers as do stairs of similar width. This is entirely appropriate in the emergency context.

Major issues arise, however, when we examine the computations required and the factors specified in the code.

TESTING FOR SAFE EGRESS

The code demonstrates an arithmetic routine for computing the egress time. Linear factors are multiplied and added. Passengers are assumed to distribute themselves to stairs in proportion to the capacity of the stairs, thereby maximizing the system egress performance. All queues are assumed to be used so that they all clear at the same moment. This is reasonable only where the exits are well distributed along the platform.

A contrary example of the problem is from my experience at Penn Station NY. A full train arriving in the morning rush hour on track 2 took 9.5 minutes to clear the platform. I took these stopwatch measures in 1986. The time matched the predicted values based on a computer simulation which predicted 9 minutes. The passenger load was about 800. Three exit stairs were available for egress. The problem was that the passenger load was well distributed along the length of an 8 car train – but the three exits were all located at the west end of the platform. A large queue developed for the most easterly exit. The queue size was such that it filled the full width of the platform. No one could get around that queue.

Persons near the base of the crowded stair were just a few seconds from flowing up the stair. They would not move to the two open west stairs as this would have delayed their personal exit. Yet, by standing where they were, they blocked any possible flow around the queue to available and unused exits.

In other words, the passengers were optimizing their personal well being, and could not or would not move to other locations for system optimization.

Passengers do not behave so as to optimize the **system** egress time. They optimize their **personal** egress time. The arithmetic procedure used in the code should be replaced by a more subtle calculation. A simulation is needed, not a static arithmetic calculation.

CAPACITY AND SPEED

The code specifies both capacity and travel speed factors. The capacity is related to vertical path obstacles (like stair/escalators) which can only handle so many persons per minute. This may develop a queue and a waiting time to enter the path. Such waiting time is part of the overall timing analysis.

For movement in the upward direction, a capacity is given as 1.31 persons per minute per inch of width.[10] Thus, a 36 inch wide vertical path has a capacity of 47.16 persons per minute. When combined with the passenger load to be handled, it helps to define a queue time.

Additionally, there is travel time for the egress. Time is allowed for walking to exits as well as time on a vertical path. The latter is specified as 40 vertical rise feet per minute in the upward direction.[11] Thus, a vertical path climb of 10 feet, uses 1/4 of a minute or 15 seconds.

Separate factors are given for downward movement. These give higher capacity and speed values to reflect the easier motion in the downward direction.

CODE SCOPE AND INAPPROPRIATE USAGE

The factors give in the code are presented as constants. There are no variations that reflect the **amount** of motion in the vertical direction. Thus to climb 70 feet uses the same capacity and speed rates as for 10 feet. *This is clearly not correct. Everyone knows from personal experience that one slows down during a long climb*. The slower rate of climb also reduces the vertical path capacity.

The code, therefore, is written in the context of **limited amounts** of vertical movement. When applied outside of that context, it gives a distorted view of egress reality.

Many new projects are built with the intent to provide deep stations far from the point of safety. Great depth facilitates the use of tunnel boring machines and the avoidance of surface level costs. However, it greatly enlarges the safe egress problem.

To use the existing code to evaluate egress for a **deep** station is entirely inappropriate. Indeed it is dangerous to future generations. The code should be revised to make the capacity and speed factors variables (not constants). They should vary as a function of the vertical distance itself. The new function can be empirically determined and implemented very quickly.

Studies of the rate of climb should include the effects of blockage of the stairs by persons who are forced to stop due to lack of stamina. These random stoppages are critical to blocking the flow, reducing the egress rate and, more critically, expanding the queue at the base of the path. The wait time in the queue expands rapidly as the system egress performance deteriorates.

CONCLUSION

For project managers, their staffs and consultants to ignore this issue is typical but not tolerable. When it comes to safety, we tend to minimize today's cost rather than invest in a long term risk avoidance. Only after the catastrophe do we commit ourselves to wiser actions. The 130 code was written to deal with emergencies caused by accident or hidden design flaws. Since 9/11, of course, risk is expanded as we must now include malevolence as a cause.

In any case, we all know that a long climb to safety from a **deep** station is a slow process. We must deal with that reality. Critical variables cannot be treated as a constants.

Endnotes

1. National Fire Protection Association, *NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems*. Quincy, MA: National Fire Protection Association, 2003 including Tentative Interim Amendment (TIA 03-1)
2. Maximum platform clearing time 5.5.3.1
3. Maximum station clearing time 5.5.3.2
4. Point of Safety 3.3.35
5. Limit on escalator use at 50% versus stairs 5.5.3.3.2.5
6. Assume one escalator as out of service 5.5.3.3.2.6
7. Escalator out of service is the most critical one 5.5.3.3.2.7
8. Escalator in egress direction may continue to operate 5.5.4.1 (2)
9. Escalator running reverse of egress direction 5.5.4.1 (3)
10. Capacity of vertical path in the upward direction 5.5.3.3.2.4 (1a)
11. Speed in the upward direction 5.5.3.3.2.4 (1b)

Reference

National Fire Protection Association, *NFPA 130: Standard for Fixed Guideway Transit and Passenger Rail Systems*. Quincy, MA: National Fire Protection Association, 2003 as subject to Tentative Interim Amendment (TIA 03-1)

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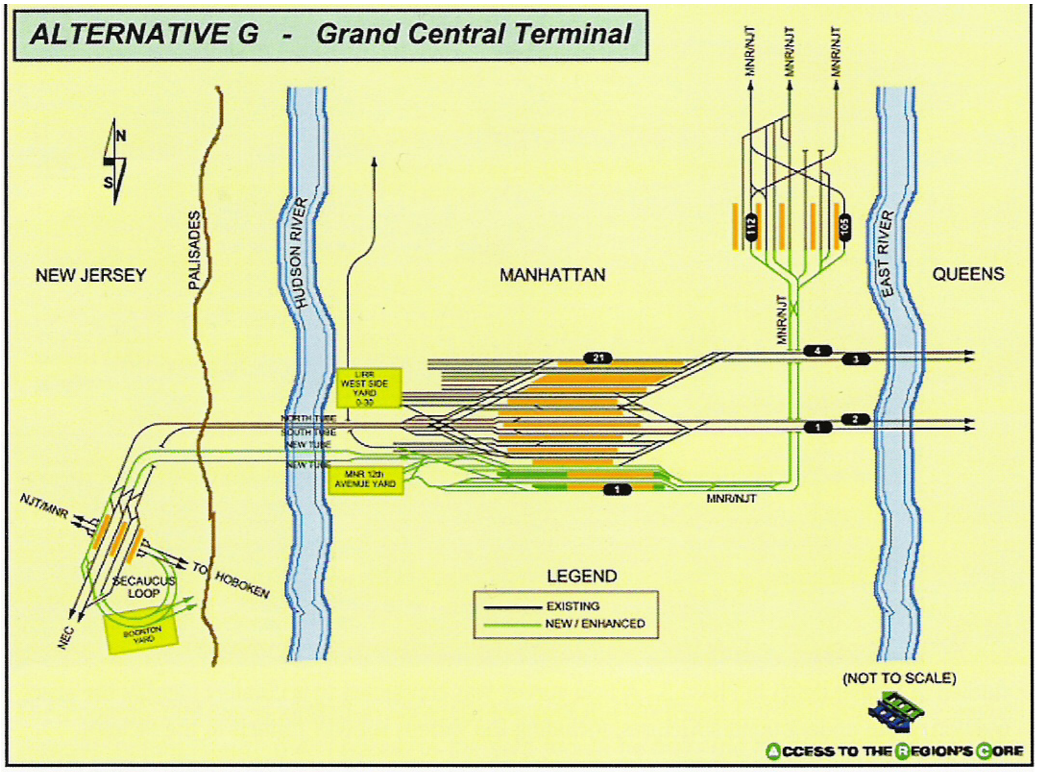

Penn Station - Grand Central Rail Connection

Connecting the New York City's metropolitan region's two key railway stations is an important step in establishing a regional rail system.

This plan evolved from a cooperative planning study for new Trans-Hudson rail capacity -- "Access to the Region's Core" -- a collaboration of NJT, MTA and the PANYNJ. With this connection, New Jersey rail passengers could more conveniently travel to and from Manhattan's East Side where 70% of them want to go. Likewise, Westchester, Mid-Hudson and Connecticut passengers could gain better access to the growing office concentrations in Manhattan's West Midtown and sites in New Jersey. However, NJT has endorsed a plan to build additional track capacity to a new deep level terminal below 34th Street adjacent to Penn Station -- but not to construct the fixed NYP-GCT rail link.

NJ-ARP thinks this is shortsighted, given the energy and environmental constraints facing the nation, region and states in the 21st century.

Regional transport problems demand regional solutions. The key to this plan's success is close cooperation between the MTA and NJT.