

Central Area Loop Study Technology Presentations: Question Responses

Automated Guideway Transit

Question 1 - How large are the support columns for the track and how far are the columns from the face of private property line buildings?

Column width for AGT and Monorail systems will vary with column spacing and the type of structural support system. Widths might typically range between 3 and 5 feet. Column setbacks from buildings will depend on the sidewalk widths.

Question 2 - How would you place columns where cornices of historic buildings extend over sidewalk?

This will have to be looked at on a case-by-case basis, historic architectural treatment of columns is possible.

Question 3 - How would a third level of pedestrian movement help to activate the urban/city fabric (create vitality)?

System could be at the 2nd or 3rd level. The improved mobility, safety, climate-control, and fast transport offered by AGT and Monorail systems can encourage activity (business/entertainment/shopping) along all the areas served by the AGT Loop.

Question 4 - Explain what would be involved with moving or relocating a station? (i.e. emergency stairs/escalators, elevators)

Moving or relocating stations rarely if ever occur.

Question 5- One of the big selling points of this system is its convenience and time savings, assuming that a user is at street level and will move (climb stairs) or be transported (escalator/elevator) to the third level and when exiting the system wishes to move back to street level, isn't this a real effort for the user, and may involve a great deal of time and inconvenience.

Vertical transport to a 2nd or 3rd level via escalator/elevator is both fast and easy. The travel time saving once aboard the AGT train will make it well worthwhile.

Question 6 - Wouldn't large structure, columns and beam systems affect future development or cause building owners to work around structure and compromise on an effective development for the private property owner?

AGT facilities would not impact property lots or the constructability of a property site. The increased access/mobility provided by the AGT and Monorail systems has been shown in fact to increase property values (commercial and residential).

Question 7 - What is the relative capital cost to the taxpayer to install?

Relative costs will be determined in next phase of the Study. The cost to taxpayer depends on the local/federal and public/private funding splits.

Question 8 - What is the relative annual cost to the taxpayer to operate?

Relative costs will be determined in next phase of the Study. The cost to taxpayer depends on the local/federal and public/private funding splits.

Question 9 - After installation & setup, is it self-sustaining and/or profitable?

Profitability would depend on cost estimate and fare estimate to be performed in next phase of the study.

Personal Rapid Transit/Taxi 2000

Question 1 - Who will inspect and certify that the system meets public safety standards? Are there such standards? If not, how long will it take to develop such standards? Does going over a river require special standards, inspection and certification?

First, here is what we said in our response to the Measures of Performance:

- Because Taxi 2000 is a form of public transit that has been fully designed, but not yet built, and because Taxi 2000 and other PRT designs are totally different from other technologies, existing fire codes and regulations will have to be applied to the Sky Loop in a way that is reasonable.
- There is currently under way creation of a new ASCE Standard for Automated People Movers, which will include standards for PRT. The CALSC's PRT consultant, Sam Lott, is on the committee writing this new standard, and Sam and Ed Anderson of Taxi 2000 are consulting on how Taxi 2000 solves all the various fire and safety issues. Hopefully this new ASCE standard will incorporate the Taxi 2000 solutions, so that we can refer to this new standard when dealing with local fire codes and regulations.
- Sky Loop stations are designed to go inside buildings, or outside. Guideway may also be attached to buildings.
- This unique technology will thus involve compliance with local building codes. Until presented to local authorities, we cannot know what they will require.

As to who will inspect and certify the system meets "public safety standards," this will likely be the city fire and public safety officials from the three cities. The local building codes of all three cities will have to be reviewed in context of this new technology. Assuming the new ASCE national standard is adopted by the time we are ready to build the Sky Loop, we would ask these local officials to look to this standard for engineering and safety recommendations, to be adopted in the local building codes, where local codes would be at variance with the ASCE standard. It is also assumed that the ASCE standard would incorporate national fire safety codes in its new standard.

How long will this take? Sam Lott stated that the ASCE standard has been under way for several years now. While no timetable is known to us, Taxi 2000 plans to work with this ASCE committee to get these standards finished and adopted during its three year prototype development phase.

Going over a river might require special considerations. Certainly walkway access would be required. The KYTC would have to approve the method of attachment of the guideway and supports to its bridges. We are not aware of any other special requirements, but this would need to be researched further in a later phase of the CALS.

Question 2 - PRT proposes vehicles that can be programmed and sent to a destination without an operator. Some proposed PRT routes pass federal buildings in Cincinnati and Covington. Will federal authorities, while reviewing safety from terrorist acts, allow an unmanned vehicle to approach and stop at or in or near federal buildings? Has there been such a federal review, or discussions of such a review? This kind of terrorist/safety concern will probably also affect private building owners.

We don't know what federal authorities would say about PRT, nor have they been asked. However, terrorist acts are extremely rare in the U.S. Would a PRT vehicle with a capacity of three or four people, or 650 lbs, be more tempting to a terrorist than a bus with 46 people or a light rail vehicle with 200 people? We doubt the presence of a driver would be any deterrence to a terrorist. Station cameras would increase chances of being caught. The 650 lb maximum load and distance of the PRT guideway from a federal building makes significant damage to the building unlikely. Private building owners who consider stations will have to make their own safety plans, but again, terrorist activity is very rare.

Question 3 - How large are the support columns for the track and how far are the columns from the face of private property line buildings?

Taxi 2000 support columns are 20" diameter at the base and 12" at the top. Typically they would be located over the edge of a sidewalk a foot from the curb, or in a median strip between sidewalk and curb.

Question 4 - How would you place columns where cornices of historic buildings extend over sidewalks?

Our route avoids most historic areas. As most downtown sidewalks are 8' wide, it isn't likely a cornice would hang over the entire sidewalk. Further, such cornices are likely to be well above the 24' height of the PRT guideway and vehicle.

Question 5 - How would a third level of pedestrian movement help to activate the urban/city fabric (create vitality)?

Our SLC paper, " Sky Loop-Effect on Downtown Retail," distributed to all earlier, answers this in some detail. Generally, we believe that making it much easier for people to get around the downtown area will enhance the vitality of the area. Many

believe the Skywalk enhances downtown retail now by making it easier for office workers to get to the retail area during lunchtime. The Sky Loop would simply widen the area served. However, because the guideway would be outside, where all street activity would be observed while riding, it would be less isolated from such activity than the Skywalk. Further, we think station advertising of special events and individual stores would help.

Question 6 - Explain what would be involved with moving or relocating a station? (i.e. emergency stairs/escalators, elevators)

Exterior stations are pre-fabricated and erected in sections. They can be disassembled easily and moved to a new location. Stations inside buildings would be specially designed, and normally not moved. This would be a decision for the building's architect.

Question 7 - There is a concern that the ability of this system to handle large crowds efficiently. What would be your estimate of length of time it would take to load a crowd for use after a large event such as a Red's Game?

With four 14-berth stations around the stadium, the Sky Loop system could take away 10,000 to 12,000 people each hour. This is equal to 200-250 busses, and more than double that of a single LRT line operating a 200 person capacity train every 2.8 minutes, as proposed by the I-71 Study.

Question 8 - One of the big selling points of this system is its convenience and timesavings. Assuming that a user is at street level and will move (climb stairs) or be transported (escalator/elevator) to the third level and when exiting the system wishes to move back to street level, isn't this a real effort for the user, and may involve a great deal of time and inconvenience.

The typical station will be 20' above street level, or two flights of stairs. Climbing or descending would take under 30 seconds for most people. If you need the elevator, it will be waiting for you. The car will likely be there when you get up to the station. This compares with waits of up to 20 minutes for a bus or light rail car. Which is more convenient?

Question 9 - Wouldn't large structure, columns and beam systems affect future development or cause building owners to work around structure and compromise on an effective development for the private property owner?

See answers to Qs 3 and 6. Also, posts and guideways are pre-fabricated, and can be moved easily. PRT is much smaller than the AGT systems being considered, of course.

Question 10 - What is the relative capital cost to the taxpayer to install?

See the Sky Loop Financial Plan.

Question 11 - What is the relative annual cost to the taxpayer to operate?

See the Sky Loop Financial Plan.

Question 12 - After installation and setup, is it self-sustaining and/or profitable?

Yes. If our projected capital and operating costs are “in the ballpark”, then the key question is whether the revenue we project will be too high-or too low! This will require a serious market study, sometimes called a mode split analysis. Prior such studies, while few, indicate a 25-35% split for PRT. We assumed 20% in Plan D of the Sky Loop Financial Plan. We have said all along that such a study will have to be done by the CALSC, either now or in a later phase.

Question 13 - How does one access a station located inside a building after office hours and the building is closed?

This will be up to the building owner. If he wants station access after hours for employees, this could be built into the Sky Loop computer with a special station access code on such employees’ Sky Loop Cards.

Question 14 - What about patron security at remote stations?

During peak hours other passengers will be on the station platform. During off peak hours empty cars will be waiting, so passengers won’t wait at all on the platform. Stations are designed with no place to hide; they will be lit at night; and closed circuit TV cameras will monitor all platforms continuously. Stations will also have motion sensors, so when someone enters a station at night, central control will be alerted to watch. These stations will be far safer at night than most parking garages, lots, or bus or light rail stops.

Question 15 - What would be the hours of operation?

24/7.

Question 16 - Once a destination is purchased from a station, can that destination be revised or altered once inside the vehicle?

A passenger can always select the next available station. He can't select any other station. He would have to get out and buy a new ticket (or use his Sky Loop Card) to select the correct station.

Question 17 - Can parking meters, signs and/or streetlights be attached to the support columns?

Yes.

Light Rail Transit

Question 1 - What is the relative capital cost to the taxpayer to install?

Relative capital cost – Light rail systems typically cost between \$15-50 million per mile of double track to construct. The cost is dependent on many variables including system size, track location (in-street vs. open trackway), the need for bridges or other structures, ect.

Question 2 - What is the relative annual cost to the taxpayer to operate?

Relative operating cost – As with capital costs, operating costs are dependent on system size, frequency of service, length of run, ect. Annual operating costs for complex light rail systems can be on the order of \$1 million/mile of double track with service frequencies of 10-20 minutes.

Question 3 - After installation and setup, is it self-sustaining and/or profitable?

Self sustaining – Light rail systems, like other modes of public transit service, are subsidized. Fare box recoveries (the percentage of operating costs recovered by fares) can be in the range of 30-40%.

Question 4 - Will tracks for LRT or streetcars be located in curbside lanes? If so, won't this eliminate parking spaces important now for retailers and others? Won't this also make truck delivery and pickup more difficult?

I could answer this explicitly as "yes." In downtown Cincinnati, light rail running on Main and Walnut would eliminate 60, or about 3%, of our total downtown metered parking spaces. An acceptable loss, given the benefit.

However, like the other questions, this is really a policy issue. These spaces could easily be replaced in off-street lots or structures. But I don't think that's for me to answer.

Hope you understand.

Question 5 - What are the figures for the maximum capacity for LRT for the CAL and how are they derived? (Are they just being carried over from the I-71 Corridor Study?)

In the consultant's Specification of Alternative Transit Technologies (SATT), maximum frequency peak direction is stated to be 40 trains per hour and peak capacity is stated to be 6,000 to 20,000 passengers. How are these figures derived? (The derivations should be made available to anyone who asks for them).

40 trains per hour could only be achieved at headways of 1.5 minutes. Using figures (total vehicles: 44; stations: 17; total miles of rail line: 36.4; and, average speed: 28 mph) presented by the consultants in the I-71 Corridor Study, the maximum headway achievable for this corridor is 2.8 minutes. (OKI's conceptual operating plan proposed 10 minute headways).

At headways of 2.8 minutes, the peak capacity of LRT for the I-71 Corridor would be 2464 passengers per hour. (Note: it is very likely that no LRT system in this country operates at headways under 3.0 minutes).

Peak capacity for LRT is a function of train consist (number of vehicles per train), service frequency or headway, and vehicle capacity. A typical light rail system may operate with 10-15 minute frequencies throughout the day and with frequencies as low as 3 minutes during the peak period. A modern low-floor light rail vehicle can carry approximately 73 seated passengers plus an additional 188 standees for a total of 261 passengers per vehicle. A three car train would hold 783 passengers, and at 3 minute headways (20 trains/hour) would have a capacity of 15660 passengers per hour in the peak direction.

Question 6 - The SATT refers to the capacity of LRT as "maximum frequency peak direction". Will the Central Area Loop for LRT consist of a one-way single-track loop or a two-tracks two-way loop, with one set of tracks in each direction?

Is the maximum capacity figure based on a one-way or two-way loop? Are projected capital costs for the LRT CAL for a one-way or a two-way loop? What are the wait times for a one-way loop vs. a two-way loop? If the loop is two-way, will both tracks be located on the same city streets? What impact will locating one-way tracks on city streets have on (increasing?) traffic congestion (relative to the shuttle buses baseline)? Note: PRT should have a negative effect on congestion relative to the shuttle bus baseline, since it does not run on the streets. If the LRT CAL is two-way, what effect will two tracks (one each way) on the same streets have on traffic congestion?

At present, the concept for the Loop Circulator using light rail vehicles includes bi-directional tracks. The tracks would be installed in existing streets. In some cases, both tracks may occupy a single street, and in some cases (typically with one-way streets) a single track will occupy a street. The effect on traffic capacity depends on whether the light rail vehicles occupy exclusive rights-of-way or share lanes with roadway traffic. Light rail travel times and capacity will be adversely affected in a shared traffic environment.

Question 7 - The SATT states that the average speed for LRT for the CAL will be 12-28 mph. How are these numbers derived? How many stations will be included in the LRT CAL? What is the maximum wait time at a

station? What is the longest estimated travel time from any one station to any other station on the LRT CAL?

Average Speed – Because the alignment for the Loop Circulator light rail option has not been finalized, no run time simulations have been performed. Normal practice is to operate light rail vehicles in a street running environment at the maximum speed of adjacent road traffic. In a downtown environment, typical speed limits are 25 mph. Station dwell times for light rail vehicles generally average 20 seconds. Average wait times will depend on the frequency of operation, which may vary by time of day.

Question 8 - How many stations will be included in the LRT CAL? Where will these stations be located? Has the cost for land (and acquisition and demolition of existing buildings?) been factored into the capital cost figures for the CAL LRT? Should it be necessary to demolish buildings for station locations, what will be the environment impact of such action relative to that for the Sky Loop? All stations for the CAL LRT will have to be similar in size because all have to accommodate the LRT vehicles, regardless of the passenger volume at each station. Has this fact been factored into the capital cost estimate for the CAL LRT? Will the stations have to accommodate single LRT vehicles, or dual LRT vehicles?

Number of stations – The preliminary plan shows a total of eleven stations, three each in Covington and Newport, and five in Cincinnati. The stations have not been sized relative to the number of light rail vehicles because ridership estimates are not complete. Stations typically consist of a shelter, ticket vending machine, and appropriate signage. The current plan does not anticipate building demolition to accommodate stations. All environmental impacts would be considered in evaluating station locations.

Question 9 - How many LRT vehicles are being included in the capital cost for the CAL LRT? Where will these vehicles be stored and maintained? Might they share maintenance facilities with the proposed I-71 LRT and, if so, won't this proposed facility have to be larger and cost more, and is this possible additional cost being included in the capital costs estimate for the CAL LRT?

A fleet size has not yet been established for the light rail option. If the I-71 light rail system is constructed, vehicles would likely be maintained in that facility. The incremental cost of any additions would be included in the capital cost estimate. If I-71 were not constructed, a separate facility would be required.

Question 10 - The LRT vehicles proposed for the I-71 Corridor each have room for 65 seated and 50 standing passengers. During peak periods will almost half of the passengers on the CAL LRT be standing? On the CAL

PRT they will all be seated. What impact will this fact (standing vs. seated) have on ridership on LRT relative to PRT?

The Portland low-floor vehicle accommodates 73 seated passengers and 188 standees. This is a fairly typical configuration. Crowding typically occurs only during the peak and does not seem to have a significant adverse impact on ridership.

Question 11 - Will the CAL LRT and the I-71 LRT (should the latter be built) share track in common? If so, will there be any stations located along the sections of track shared in common? If so, will there be an impact on capacity and ridership as a result of the sharing of these stations during peak periods.

It is possible that the I-71 LRT could share track with the Loop Circulator LRT. It is unlikely that joint stations would impact ridership unless the system is operating very near capacity and conflicts occur between the two schedules. Proper planning should minimize this possibility.

Question 12 - Should it be proposed that the CAL LRT and the I-71 LRT share some track in common (particularly for a bridge from Cincinnati to Covington), will two separate cost figures for the CAL LRT be provided, one for sharing tracks (and bridge) with the I-71 LRT, the other to include the cost of a Cincinnati-to-Covington bridge (as well as a maintenance facility), in the event the I-71 LRT is not built?

The costing methodologies have not been developed for the various modes. Appropriate assumptions will be developed to account for issues such as shared structures.

Question 13 - Will one or two bridges be required for the CAL LRT to cross the Licking River? If only one, what will be the design of this crossing and what effect will this crossing have on traffic congestion at each end of the bridge?

Unless the LRT CAL is one-way one track only, the other track will have to cross city streets/intersections near each end of the bridge.

The LRT crossing for the Licking River has not been designed. In a shared traffic environment, LRT could be placed in two of the traffic lanes on the existing bridge.

Question 14 –

- **CALS Spec sheet specifies LRT vehicles weighs 79,000 lbs. empty (Tare)**
- **100 Passenger capacity with standees**

- **LRT Vehicle would weigh 91,000 lbs. Fully loaded (79,000 + (100 psg X 120 lbs./psg.)**

Stopping Distance: What is the stopping distance of a 79 klb – 91 klb LRT vehicle traveling at:

- **10 mph?**
- **20 mph?**
- **30 mph?**

A typical light rail vehicle stopping rate is 3 mph per second. In an emergency, the vehicles can stop at 4.5 mph per second. Normal stopping distance at 30 mph is 220 feet; emergency stopping distance at 30 mph is 150 feet. This is comparable to the stopping distance of a bus.

Question 15 - Passenger safety in Emergency Stop: What measures are in place to protect seated, standing, and wheel-chaired passengers if LRT vehicle has to make an abrupt stop?

Passengers riding in a LRV are protected by the vehicle structure and interior design. Seatbelts are not provided. Securements for mobility devices are typically provided. Passenger safety is a consideration in determining safe deceleration rates.

Question 16 - Collisions with Automobiles and Pedestrians. What measures would be in place to prevent automobiles and pedestrians from crossing immediately in front of a LRT vehicle?

Pedestrians and drivers are expected to observe and obey traffic control devices. Light rail vehicles operating on city streets are controlled by an operator and normally follow traffic signals, although specific train signals may be provided.

Question 17 - Fire Separation:

- **What protects LRT passengers from electrical fires caused by high-voltage wiring between catenary to motors?**
- **What protects LRT passengers from motor fires?**

The car shell and chassis are designed to be fire resistant and protect passengers from fire and smoke. All wiring is properly insulated and grounded to protect against shock hazards.

Question 18 - One-Way Bridge Collisions: What measures would be in place to prevent head-on LRT vehicle collisions on a single track bridge in a dual track bi-directional system, such as would be on the L&N Bridge in a dual-track bi-directional system?

Bridge crossings have not yet been designed. If a single track section were used, rail switches, block signals, and operating rules would be used to prevent collisions.

Question 19 - LRT Stops/Stations: What security measures would be in place at LRT stops or stations for waiting passengers, particularly at night?

LRT stations would be designed with passenger security in mind. Typically, lighting is increased in waiting areas, transit security police may be provided, and closed circuit TV cameras may be used in station areas and on-board vehicles. Emergency call boxes may be installed on platform areas. Station design includes clear sight lines and open architecture.

Question 20 - Poles & Catenary: How do you prevent automobiles or trucks from knocking down a post and thus the high voltage catenary lines?

Catenary support poles are very robust in design. Because poles occur at regular distances, the energized wire would be supported by adjacent poles in the event one pole is knocked down.

Question 21 - Snow & Ice: How is acceleration, braking, and thus vehicle control maintained when the rails are covered in snow or ice?

Light rail vehicles use sand to enhance traction in low traction situations. Smooth power application is also used to minimize wheel spin. Typically light rail vehicles include systems to detect and correct wheel spin and slide.

Street Railway

Question 1 - What is the relative capital cost to the taxpayer to install?

Based on similar systems in Denver, Portland, Sacramento and Slat Lake City, the total cost per mile would average about 19 million dollars. This would include street trackage, overhead electric, cars and shops, but would assume joint use with the light rail system of the Western bridge over the Ohio. A turn around loop near the proposed bridge could return the cars to Newport, as an example, until the bridge is completed.

Question 2 - What is the relative annual cost to the taxpayer to operate?

The annual operating cost would average 1.6 million dollars based on an average of 5 cars in continuous operation. With other public systems including METRO, the fares account for about a third or more of revenues. The balance is funded by public money, supplemented by advertising. METRO, for example, is supported largely by the City's earnings tax.

Question 3 - After installation and setup, is it self-sustaining and/or profitable?

No response.

Question 4 - Would the stops be the same as LRT, or is there an opportunity for additional stops for more frequent use?

The streetcars could share stops with light rail, as well as servicing simple stops similar to buses, to provide maximum flexibility.

Question 5 - Would scheduling and/or travel speeds and times be compatible with LRT operational characteristics (safety and efficiency concerns).

The travel speeds on urban streets would be similar to light rail and the scheduling could be compatible where they share trackage. Signaling and operators in each car will assure safety.