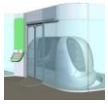
Station Management

Using Ultra

The on-demand nature of Ultra - vehicles wait for you, rather than you waiting for a vehicle - ensures that passenger waiting time is very low. Ultra provides an easy-to-use system which is accessible to all. Once your journey has begun, you can sit back and relax - the vehicle takes you straight to your chosen destination. Below is a step-by-step guide to using the current Ultra system, around which the specific details for future systems would be based.

Go to nearest Ultra station: The individual or group wishing to use the system enters their closest station on the network.

Purchase ticket: using one of the available fare collection methods described below.



Go to berth or waiting area: At each station there are a series of berths and a passenger waiting area. Display screens would indicate the appropriate berth for the passengers, or direct them to the waiting area. Premium ticket holders would bypass the regular queue and proceed straight to the vehicle boarding area.

Destination confirmation: The passenger destination selection is passed to central control which provides movement instructions to the vehicle assigned to the berth. The destination is displayed to passengers for their confirmation.

Enter the vehicle: Once the vehicle arrives (if it is not already waiting), the doors will open and the passengers enter. Once seated, they press the close doors button followed by the start button, and can sit back and relax; from this point on the vehicle will automatically take them to their destination by the best available route

Arrive at destination: At the destination, the passenger leaves the vehicle, which may either wait there for the next fare or, alternatively, be redirected by central control to places with known demand.

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Fare collection systems

There are a number of fare collection options that could be employed in future systems:

- Automatic Ticketing machines
- Manned Ticket offices
- Paid Turnstile systems
- Smartcard systems

The Ultra system user interface software (both the user-facing Destination Selection Panel as well as the back end) was designed to accommodate whichever fare collection mechanism is most appropriate for the location.

Transport for London's Oyster Card is an example of an effective smart card system:

Figure 1: Oyster Card being read at a fare gate with a touch to the "yellow card reader".

Queue management

As with the fare collection mechanism, there are different options for queue management depending on the station requirements and expected demand. A simple system that would be appropriate for Amritsar is one similar to the "Disney" fast pass system, which makes provision for premium ticket holders. The premium ticket holders have their own entrance or aisle which allows them to go straight to the vehicle boarding area, whereas the regular ticket holders are directed through a separate entrance/aisle and must queue.

This would allow the premium passengers to arrive at the front of the queue to either a dedicated bay on the station or to a member of staff who will give them priority when boarding. This system would require a ticket reader to verify the premium ticket or a member of staff to do the same function.

Premium ticket holders, in addition to being able to bypass the standard queue will have the ability to ride in a vehicle with only their own party. Standard ticket holders, in contrast, upon reaching the front of the queue, will be directed by either the ticket / smart card readers or the station staff to board a particular vehicle, which they may or may not share with other passengers going to the same destination.

Safety Certification

Worldwide, there are 144 automated fixed guideway transit systems operating. These carry more than 4.6 million passengers per day (source: Planners Guide to Automated People Movers, 2006/7), operating at an exceptionally high level of safety compared to both (a) non-grade separated transit such as Commuter Rail and LRT and (b) private automobile travel.

Interestingly, legacy transportation systems such as “automobiles traveling on roads” and non-grade-separated rail transit could NOT achieve safety certification under the spirit of the current automated transit safety law. Under this spirit, fatalities are not allowed. In contrast, there were 118,000 Indian highway fatalities in 2008. No authoritative nationwide numbers exist for the safety of non-grade-separated trains colliding with pedestrians and other vehicles, however in Mumbai alone over 4,000 people are killed by trains each year.

Safety in all aspects of the design, construction and operation of PRT is Ultra PRT’s (the company’s) first priority, as is evident in the process by which UK Ultra safety approvals were obtained. A Preliminary Hazard Analysis (PHA) was undertaken and mitigating features identified. The residual risks were classified in terms of frequency with which an accident may occur and the worst case harm that could be caused by the accident. A frequency and severity score, agreed with the UK Regulator, was applied to each possible accident. A risk ranking score was then obtained by multiplying the frequency and severity scores. These risk ranking scores were then applied to a risk classification matrix that identifies a set of risk acceptability criteria, again agreed by the UK Regulator. The residual risks from the PHA were deemed by the Regulator to be acceptable.

Ultra is also compatible with the US federal and state PRT safety standards as well as the US National Fire Protection Association (NFPA) fire escape codes. In the U.S., Code of Federal Regulations (CFR) 659 delegates fixed guideway (PRT, APM, monorail, LRT, heavy rail, cable car, and heritage trolley) public transit safety certification to the states, with a series of minimum requirements placed on each state’s regulatory agency. There are 44 regulated fixed guideway systems in 27 states. CFR 659 provides four important definitions which can be applied to PRT:

- **Safety** means freedom from harm resulting from unintentional acts or circumstances.
- **Security** means freedom from harm resulting from intentional acts or circumstances.
- **System Safety Program Plan (or SSPP)** means a document developed and adopted by the transit agency, describing its safety policies, objectives, responsibilities, and procedures.
- **System Security Plan (or SSP)** means a document developed and adopted by the transit agency describing its security policies, objectives, responsibilities, and procedures.

Under both CFR 659 and the UK Regulator’s safety verification for PRT systems, the Operator is required to appoint a competent, independent safety team. This safety team is referred to as the Safety Verification Team (SVT) and must be approved by the appropriate Regulator – further details are given below.

The wide range of experience held within the team at Ultra PRT, combined with the expertise of members of the SVT, means that a culture of positive but direct challenge to the detail of the proposal is embedded within the project team.

Safety References

- "FTA 49 CFR (Code of Federal Regulations) Part 659 Rail Fixed Guideway Systems; State Safety Oversight; Final Rule, " http://transit-safety.volpe.dot.gov/publications/sso/49CFRPart659_FinalRule/SSOFinalRule.pdf
- "San Francisco International Airport AirTrain System Safety Program Plan, Revision 1," August 25, 2005. 49 pages. http://www.Ultraprt.com/AirTrain_SSPP_Rev_1_-_Final.doc
- "On Site Safety Audit of San Francisco Airport Airtrain," California Public Utilities Commission (PUC), 2004. http://docs.cpuc.ca.gov/word_pdf/AGENDA_RESOLUTION/41123.doc
- ASCE Automated People Mover Standards Committee: http://www.apmstandards.org/
- "Safety Certification of MUNI's Advanced Train Control System: A View from the Trenches," http://www.tsd.org/papers/rv3018.pdf (San Francisco MUNI)
- NFPA 130: http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=130&cookie%5Ftest=1

System safety assessment

Hazards are assessed against the full list of 361 specific system hazards identified during the product development. These systematically consider possible hazards and have been assessed for causal factor and consequence as described above. From this analysis mitigations have been implemented. The consequential hazard ranking is refreshed as new data is obtained. The hazards can be summarized in twelve categories, as shown the Table below

Hazard Ref	Ultra Hazard	Definition	Notes
H1	Obstruction on Guideway	Any hazard relating to a "foreign object" on the Guideway (or more generally within the "structure gauge") and station movement area.	Obstructions may be natural, (e.g. snow); accidental (e.g. debris/road vehicle incursion/material left following maintenance/etc.); or deliberate (e.g. vandalism or trespassers). The analysis differentiates between relatively harmless, low-mass obstructions and high mass objects likely to stop a vehicle violently.
H2	Loss of Vehicle Guidance	Any hazard or failure of the vehicle control leading to the possibility of the vehicle hitting the infrastructure (e.g. sidewalls; central divides; and station infrastructure).	Includes vehicle faults such as steering, brakes or on-board control system and external faults with the Guideway or central control system.

Hazard Ref	Ultra Hazard	Definition	Notes
H3	Loss of Separation between Vehicles	Any hazard leading to a potential collision between Ultra vehicles. Excludes collision with “foreign” vehicles such as road vehicles intruding onto the Guideway.	A large range of causal factors identified, including vehicle faults and external factors relating to the control systems and infrastructure. Covers vehicles slowing gradually, stopping suddenly or being directed onto a collision course with others.
H4	Ultra Guideway fails to contain vehicle.	Any hazard leading to the possibility of a vehicle leaving the Guideway. Includes collapse of the Guideway, vehicle crashing through the Guideway wall or “jumping” the wall (e.g. after collision with an object).	The most likely causes of this situation relate to damage to the Guideway itself either deliberate (vandalism/terrorism) or accidental (collision with heavy-goods road vehicle or structural failure of the Guideway itself).
H5	People on the Guideway	Any hazard arising from the presence of people on the Guideway.	This covers passengers either accessing from stations or leaving a stationary vehicle on the Guideway (by accident or deliberately) as well as staff (e.g. maintenance) and trespassers. Includes passengers or station users on the Guideway following a fall from a vehicle or platform.
H6	Unintended passenger-vehicle interaction.	Any hazard leading to a passenger falling (or being ejected) from the vehicle. Includes many hazards associated with the doors together with vehicle structural failure.	Covers vehicle faults such as door operations and structural failure and station management such as vehicle to station door alignment.
H7	Loss of System Control.	Any hazard arising from the failure of the system that prevents the Network Controller and/or Security Controller from performing their tasks as intended.	The primary reasons for loss of overall system control relate either to issues within the central control system, including controller error or to communications issues and failures (voice or data).
H8	Fire	Any hazards directly related to fire, explosion, etc.	The various causes of a fire cover vehicle failure and external factors such as environmental conditions and malicious acts.
H9	Electric Shock	Any hazard leading to a risk of electrocution.	Covers vehicle failures, other system components such as cabling and environmental factors such as lightning or flooding.

Hazard Ref	Ultra Hazard	Definition	Notes
H10	Slips/Falls or struck by flying objects.	Any hazard relating to people falling, tripping, etc. Any hazard relating to flying objects and debris. Includes luggage, etc. within the vehicle as well as flying debris arising from a collision.	Covers people slipping/falling on or near the system. The flying objects may be accidentally caused or malicious acts.
H11	Health and Safety	Any hazard to health not covered in the above hazards. Includes chemical/material hazards (e.g. COSHH), vehicle ventilation problems, fumes from burning or overheating equipment.	Includes assault, action by emergency services, crowding and environmental factors.
H12	Environmental Hazards	Any environment-related hazards not covered by the above.	Covers excess noise, EMI (emissive and susceptibility) and end-of-life equipment disposal.

Ultra PRT will, in conjunction with any nominated representatives and local emergency service organizations, undertake specific assessments of the hazards and risks associated with this application of PRT. This ensures that any concerns are identified at an early stage and can be managed to their lowest level of risk. Ultra PRT has found that engagement with the relevant safety authorities at an early stage provides the surest route to successful approval.