

File Note

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Project title	Union Station Pedestrian Flow Study	Job number
		96142
cc	Tim Laspa, Becky Upfold, Michael O'Neill	File reference
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Subject	Airport Rail Link (ARL) Pedestrian Access Journey Times	

1 Introduction

The City of Toronto have commissioned Arup to complete pedestrian movement studies at Union Station since 2003. This work has been completed in connection with the station revitalization project and has utilized bespoke and class-leading pedestrian micro-simulation software developed in-house by Arup. During these studies, a significant body of knowledge regarding pedestrian movement within the facility has been created.

In March 2012, further work was initiated jointly by the City of Toronto and Metrolinx to incorporate updated GO Transit/Metrolinx future year am peak train service patterns and passenger demand forecasts. The update to the pedestrian simulation models will incorporate ARL activity. A timeline of 10 weeks is expected for this work following receipt of all relevant data.

As Metrolinx have identified an urgent need to understand the pedestrian access experience for passengers travelling to the Airport Rail Link, existing knowledge has been used to create an understanding of the passenger experience for ARL passengers as they move through the Union Station complex. This note sets out that understanding and will be updated once the simulation runs incorporating ARL passengers have been completed.

The journey experience for ARL passengers is described within this note as follows:

- Where are passengers coming from?
- What is the most likely route that they will take through the station?
- Will that route be step free? And if not, what is the step free alternative?
- What is the journey time for each route in off peak (uncongested) conditions?
- How is the station forecast to operate during the am peak period and how will the additional commuter passengers present during that time affect the ARL passenger experience?

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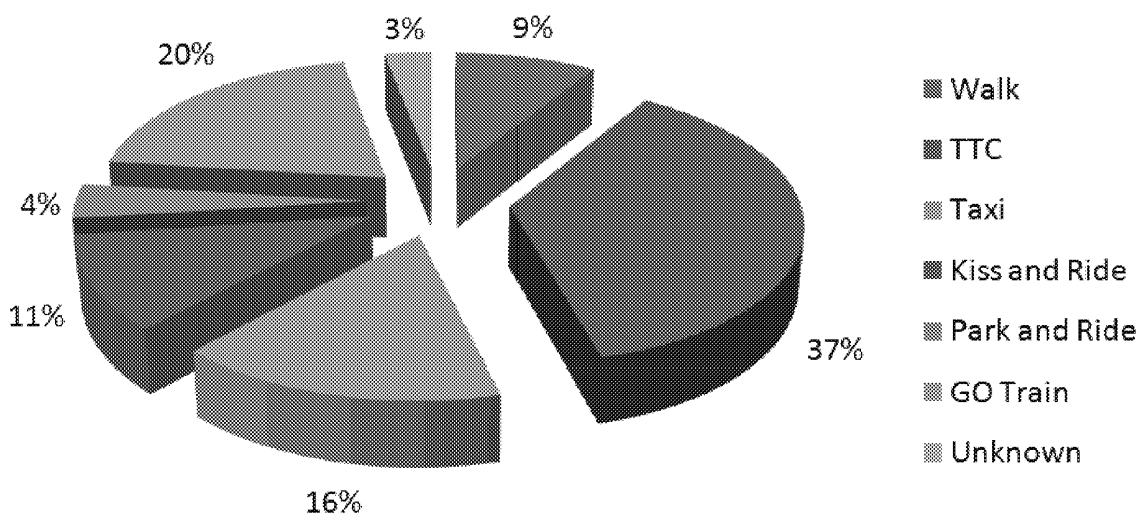
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2 Where are Passengers Coming From?

A variety of surveys have been completed to understand the likely mode of access for ARL passengers. These surveys are broadly consistent and suggest a mode share of access as described in figure 1.

Figure 1: Mode Share of Access – Union Station ARL Passengers (Source: SDG Presentation Nov 11, 2011)



2.1 Walk Access

Passengers walking from downtown residences and hotels to access the ARL will approach the station from multiple directions. The walk experience from the 4 corners of the building have been reviewed.

2.2 TTC

Passengers using TTC services will primarily access the ARL facility from the TTC Subway/Streetcar concourse. Although some passengers may arrive at Union Station by bus, it is assumed that the volume of such passengers will be very small and individual assessment of journey experience from local bus stops has not been completed.

2.3 Taxi and Kiss and Ride

It is assumed that passengers arriving by these modes will be dropped off on the north side of Front Street adjacent to the western entrance to the Great Hall.

2.4 Park and Ride

No station parking facilities will be provided. Passengers who park and ride will be assumed to use existing downtown lots which are available on all sides of the station. Review of access for walk-in pedestrians will therefore also reflect the experience of park and ride passengers.

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2.5 GO Train

Passengers making their way from the GO Train will be assumed to come from either the York Street GO Concourse or the Bay Street GO Concourse.

3 Which Routes Will ARL Passengers Use Through The Station?

Union Station is a porous facility with multiple available entrances and exits and alternative routes to get from one part of the facility to another. ARL passengers may be expected to utilize a variety of routes in, out and through the facility.

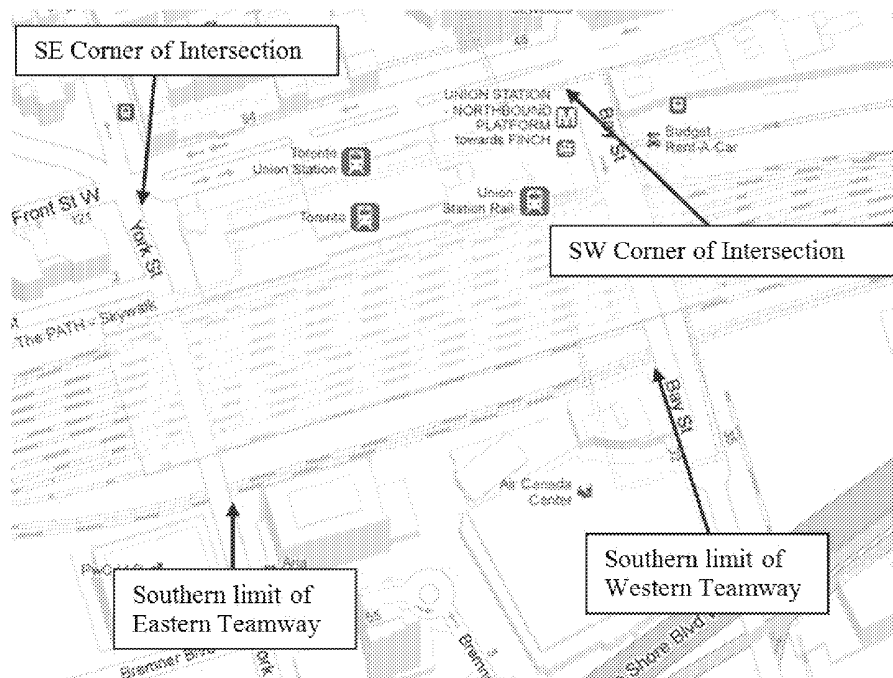
The following sections describe key routes for all passenger groups and reflect the most direct pedestrian routes through the station.

3.1 Walk-in from the Downtown

For passengers walking in from the downtown core, four locations have been selected for the purpose of describing access routes and generating journey times.

The four locations are described in Figure 2.

Figure 2: Point Locations for Measurement of Walk-in Journey Times



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3.1.1 Walk-in From NW Corner (Front and York Intersection)

From the south west corner of the intersection, passengers would make their way through the western entrance to the West Wing and proceed direct via the Skywalk. There are no level changes on this route.

3.1.2 Walk-in From SW Corner (Southern limit of York Street East Teamway)

From the eastern sidewalk, passengers would proceed north through the teamway, entering the station halfway along the teamway and proceeding via a bank of stairs to the retail level. Heading west and north and returning to the promenade area below the West Wing, an elevator would take passengers to the West Wing and onward to the Skywalk Bridge and ARL.

A step free route avoiding the stair from the teamway to the retail level is available by continuing through the teamway to the north west promenade level station entrance .

This route is complex and could create some wayfinding challenges.

3.1.3 Walk-in From SE Corner (Southern limit of Bay Street West Teamway)

Passengers would proceed north via the teamway to the Bay Promenade entrance and proceed due west via the Front Street Promenade and the Great Hall, reaching the ARL via the West Wing and Skywalk Bridge. There are stair, escalator and elevator transitions on this route.

3.1.4 Walk-in From NE Corner (Front and Bay Intersection)

Passengers would proceed directly via the Front Street sidewalk, entering the station at the Great Hall and proceeding via the West Wing and Skywalk Bridge to the ARL. There are no level changes on this route. Passengers to and from the taxi and Kiss and Ride drop off areas on Front Street would also use this route.

3.2 TTC Concourse

Passengers would proceed south through the Moat to the Bay Street Promenade then westward via the Front Street Promenade, Great Hall, West Wing and Skywalk Bridge to the ARL. There are stair, escalator and elevator transitions on this route.

Journey times presented in section 4 are measured from the TTC Fareline.

3.3 Taxi and Kiss and Ride

Passengers would proceed direct through the Great Hall Front Street entrances, the West Wing and the Skywalk Bridge to the ARL. There are no level changes on this route.

Journey times presented in section 4 are measured from the Front Street curblin at a central point between the two Great Hall doorlines.

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3.4 Go Transit Bay Street Concourse

Passengers would proceed directly to the Great Hall via the north west corner of the concourse where there is a level change serviced by a stair, escalator and elevator. Onward route is through the West Wing to the Skywalk.

Journey times presented in section 4 are measured from a central point within the concourse.

3.5 Go Transit York Street Concourse

Passengers would proceed directly to the Great Hall via the north east corner of the concourse where there is a level change serviced by a stair, escalator and elevator. Onward route is through the West Wing to the Skywalk.

Journey time presented in section 4 are measured from a central point within the concourse.

3.6 VIA Rail Concourse

Passengers would proceed directly to the Great Hall via the central ramp leading from the northern end of the concourse to the Great Hall. Onward route is through the West Wing to the Skywalk.

Journey time presented in section 4 are measured from a central point within the concourse.

4 The Pedestrian Experience

During previous phases of study, the pedestrian performance of the Union Station complex has been assessed in detail for the following scenarios:

- Existing Conditions
- Construction Staging Conditions (including ACC special event scenarios)
- Future Year (2021) Conditions

The performance of the station will evolve from the current day situation. It will be affected by revitalization construction work which, once complete, will enhance the passenger experience significantly. It will also be affected by passenger demand growth.

The ARL is expected to open in 2015, concurrent with the completion of revitalization works. Our assessment reflects a 2021 operating condition which will be operationally similar to that on opening day. As described in the introduction, we will be updating this memo to reflect the results of a 2031 operating condition but do not anticipate significant changes to the pedestrian environment for ARL passengers to be uncovered by that work.

4.1 Union Station Spatial Performance - AM Peak Period

Future year performance of the station is described in detail within the Union Station Pedestrian Planning Study – Phase 3 Final Report dated November 2011. The following figures are excerpted from that report and give a good overview of the spatial performance of the station during the busiest

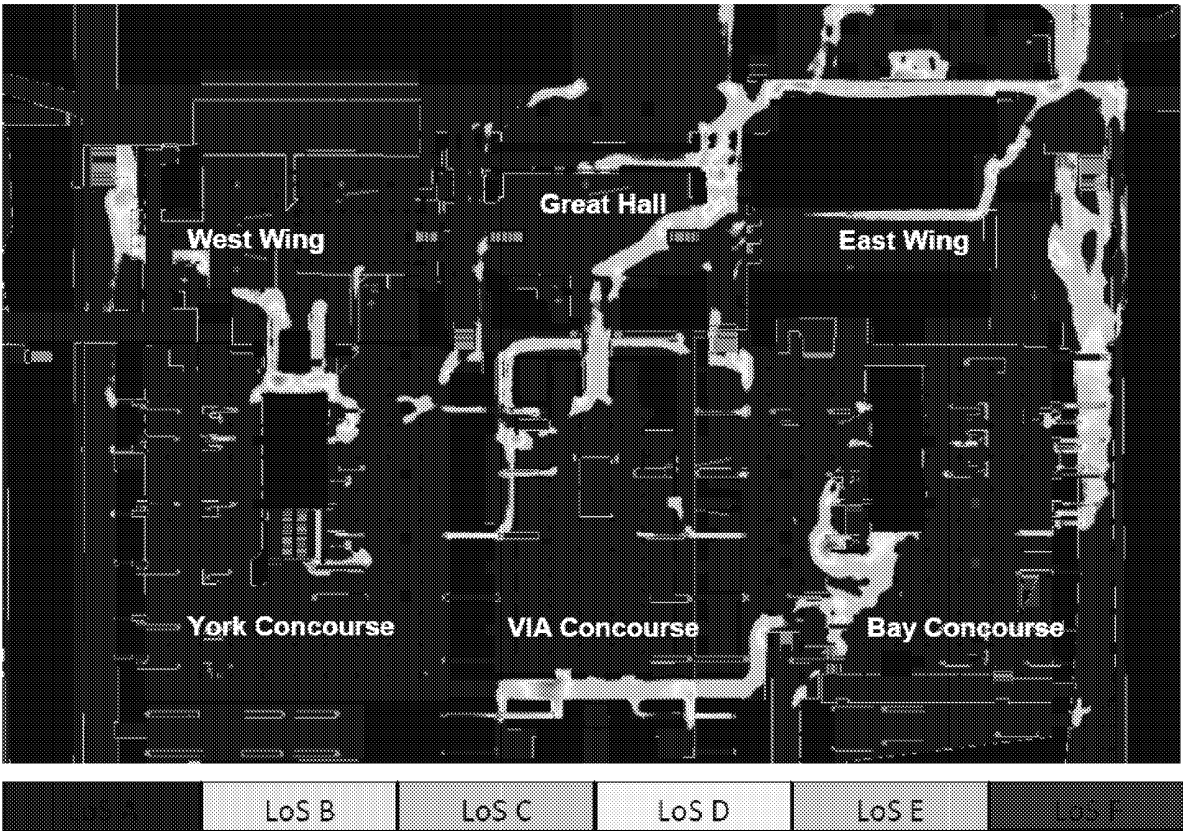
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15 minutes of the am peak period. The figures describe average Fruin Levels of Service (LoS) in all areas of the station. Fruin Levels of Service range from A to F, where the low end of LoS A represents empty space and the high end of LoS F represents dangerously crowded space. Further detail is available in “Pedestrian Planning and Design” by John J Fruin (Edition 1, 1971, Elevator World). Typically LoS C is used by transit agencies globally as a planning target, with pockets of higher density typically considered acceptable if crowd safety is not endangered.

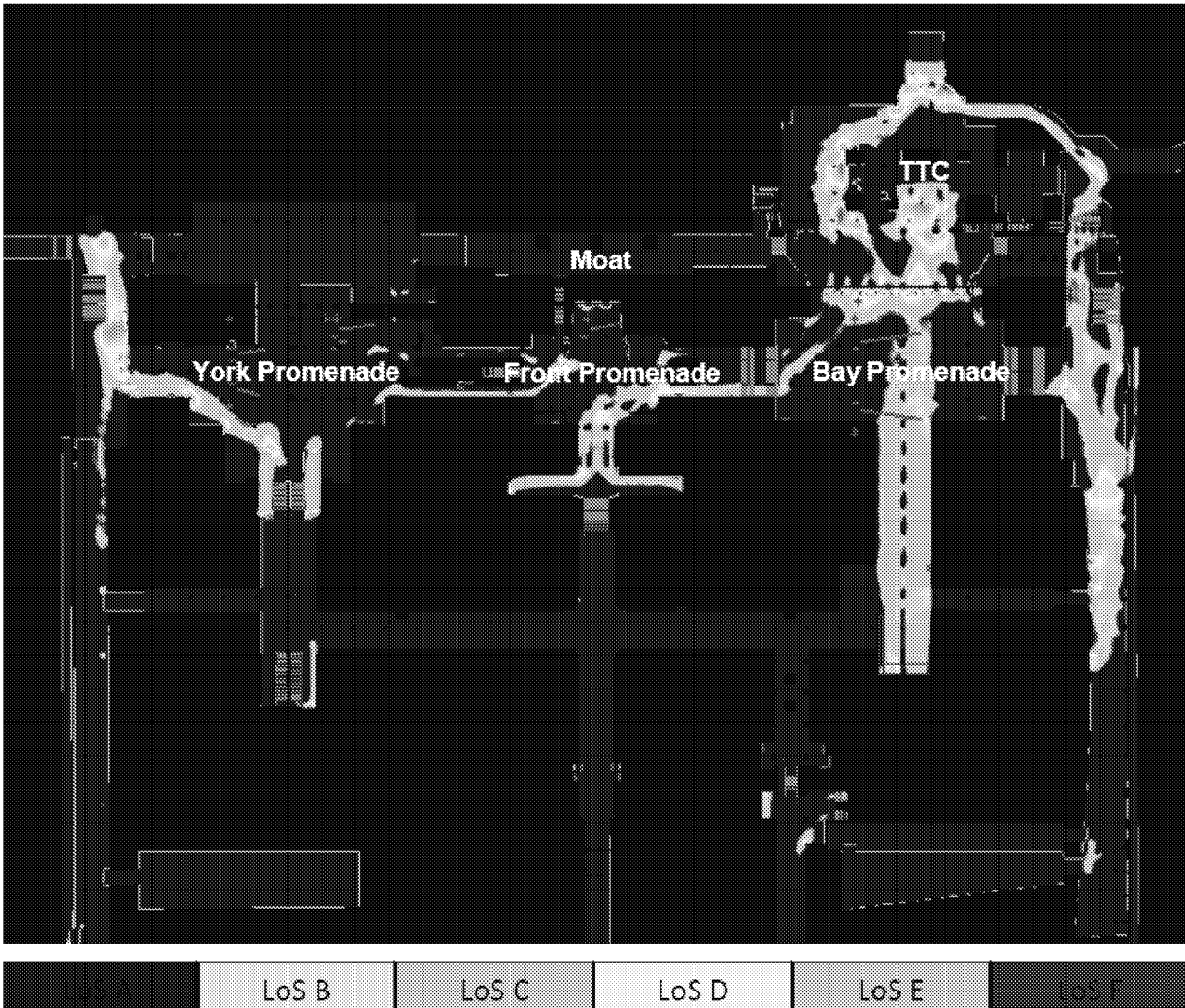
Figure 3: Fruin Average Levels of Service - Union Station Concourse Level (2021 Am Peak 15 minutes)



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Figure 4: Fruin Average Levels of Service - Union Station Promenade Level (2021 Am Peak 15 minutes)



The Fruin plots describe a generally free-flowing station with small areas of congestion, typically associated with doorlines and vertical transitions. Data referenced by Fruin suggests that the average pedestrian will not experience any significant congestion related walking speed reduction until density levels reach or exceeds LoS D.

The following table describes the proportion of passengers moving between the ARL and the points described in section 3.0 to access their onward mode of travel.

It describes estimated free flow journey time for the average passenger and the anticipated conditions during the am peak period which may affect the journey experience and increase the speed of movement. Elevators are not modeled within Mass Motion. Mobility elevators generally operate at a slow speed (typically 0.5 m/s vertical speed or less) and we have assumed a journey time penalty of 60 seconds per elevator for step free routes which require their use. This is a reasonable reflection of waiting, boarding, movement and alighting times and assumes passengers may board the first available elevator “arrival”.

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Access Location	ARL Volume # (%)	Free-Flow Journey Time ## (Mins:Secs)	AM Peak 15 Minute Conditions
NW Corner	3.25%	2:15	Free-flow conditions anticipated throughout.
SW Corner	3.25%	4:00	Isolated pockets of LoS D in the York Promenade. This will feel noticeably busier for passengers but journey time impact of under 5 seconds anticipated.
SW Corner Elevator Rte		5:20	
SE Corner	3.25%	6:05	Isolated pockets of LoS D will be experienced on this route, in particular at the northern end of the Bay Street Teamway which will feel noticeably busier for passengers. Journey time impact of under 20 seconds anticipated.
SE Corner Elevator Rte		8:05	
NE Corner	3.25%	4:15	Pockets of LoS E/F are evident on the Front Street sidewalk. It is anticipated that the Front Street EA will address this by the time ARL opens. Some queueing may occur at the eastern entrance to the Great Hall. We anticipate a journey time impact of less than 15 seconds (and none if the western Great Hall entrance is used).
TTC Concourse	37%	4:30	Some pockets of LoS D exist on this route at the TTC fareline, the Moat doorline and within the Front Street Promenade and this route will feel noticeably busier than in the off peak. However, we anticipate a journey time impact of less than 20 seconds.
TTC Concourse Elevator Rte		5:30	
Front Street Taxi and Kiss & Ride	27%	3:15	Free-flow conditions anticipated throughout.
GO Bay Concourse	10%	4:15	Some limited queueing may occur on the approach to the stair/elevator transition from the Concourse to the Great Hall but generally free flowing conditions are anticipated. A journey time impact of less than 10 seconds is anticipated.
GO Bay Concourse Elevator Rte		5:15	
GO York Concourse	10%	3:45	Free flow conditions anticipated throughout.
GO York Concourse Elevator Rte		4:45	
VIA Concourse	3%	3:45	Freeflow conditions anticipated throughout.

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- Walk in trips are assumed to be equally distributed to the four corners of the building. GO Transit passengers are assumed to be equally distributed to both GO Rail concourses. The 3% of passengers assigned to the "unknown mode" group are assigned to VIA Rail as it is likely that the ARL will compliment VIA service and some interchange will occur between these services.

- Free-flow journey conditions are expected throughout the Union Station facility at all times outside of the GO Commuter peak periods. The volume of ARL passengers who will travel through the station during peak periods is expected to be relatively low, with ARL peak flow occurring during Airport peak periods which may not coincide with GO Transit peak periods.

5 Conclusions

Our initial review suggests that walk times for key interchange modes are acceptable for ARL passengers. The impact of AM Peak Commuter crowds on journey times and the passenger experience is expected to be limited.

Anecdotal evidence suggests that the performance of the terminal facility will bear favorable comparison internationally with other airport express rail operations. For example, passengers using the London Gatwick Express service routinely face safety related subway station closures associated with overcrowding of the Victoria Line platforms at London Victoria station, delaying their transfer movement by up to 15 minutes and forcing extended waits in very crowded (LoS E conditions).

By comparison, even during peak periods, a relaxed stroll through Union Great Hall will be offered, and will represent an attractive introduction for visitors to Toronto.