



Georgetown Corridor Airport Rail Link



Forecasting Update 2011/12



FINAL Report
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Professional practices and procedures have been applied in the development of the analysis, findings and conclusions reported herein. The base case projections contained within this document represent SDG’s estimates. While they are not precise forecasts, they do represent, in our view, a reasonable expectation for the future, based on the most credible information available as of the date of this Report.

The views expressed within this Report are based upon:

- Information collected by us up to July 2011
- Information provided to us up to July 2011;
- Review of written information supplied by Metrolinx

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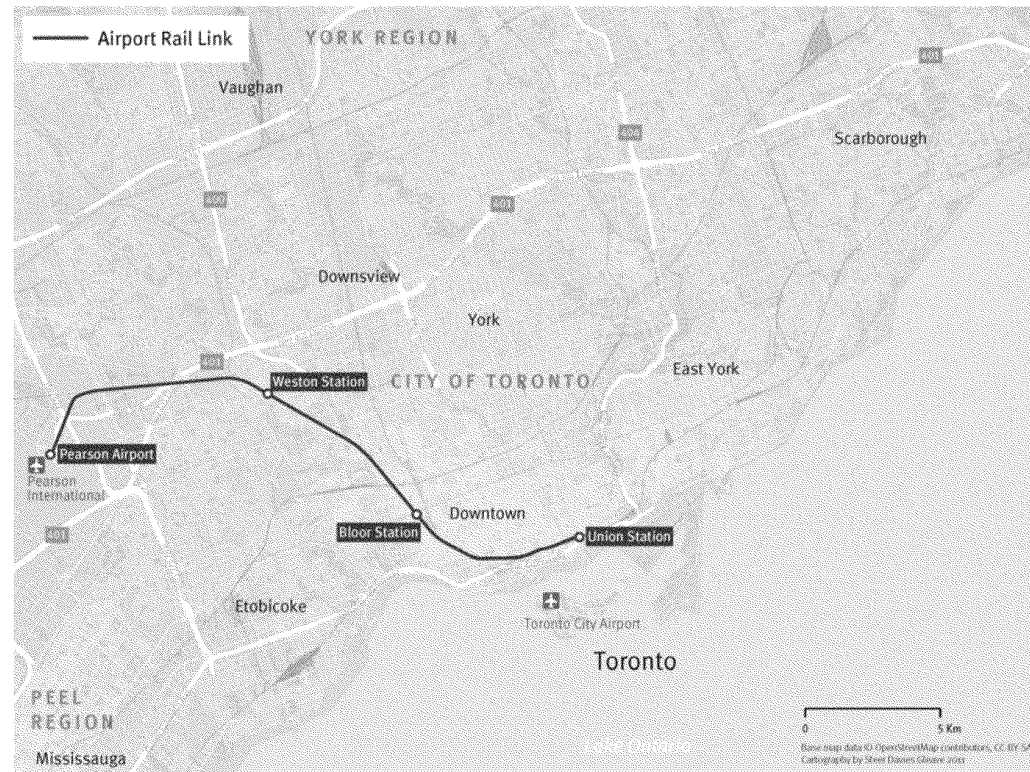
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Glossary

ARL	Airport Rail Link
Avg	Average
Aug	August
CAD	Canadian Dollar
CAGR	Compound Annual Growth Rate
GDP	Gross Domestic Product
GTAA	Greater Toronto Airport Authority
GTHA	Greater Toronto and Hamilton Area
Km	Kilometre
LBPIA	Lester B. Pearson International Airport
LRT	Light Rail Transit
Pax	Passengers
SNC	SNC Lavalin
SP	Stated Preference
TTC	Toronto Transit Commission
UPAG	Union Pearson Air-Link Group

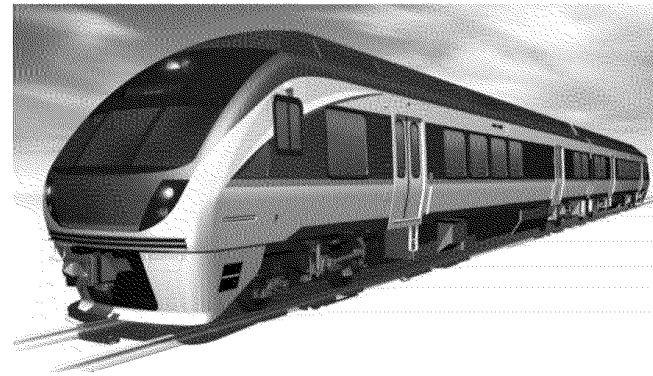
Introduction and background

- I Lester B. Pearson International Airport (LBPIA) is located in the City of Mississauga and serves the population of Toronto and the Greater Toronto and Hamilton Area (GTHA). In 2010 33 million passengers travelled through LBPIA. By 2031 this is forecast to reach 52 million.
- I These high volumes of passengers puts pressure on the existing modes of surface access serving the airport where passengers currently have the choice between taxis, driving and parking or being dropped off, the airport express bus or a number of local bus services operated by Toronto Transit Commission (TTC).
- I Since 2001 however, there have been plans to develop a new Airport Rail Link (ARL) which would provide a new direct and rapid passenger rail service between Union Station in downtown Toronto and LBPIA some 22.5km away. The service is planned to open in 2015, in time for the Pan American Games which will be held in Toronto in the summer of 2015.
- I The ARL will use the existing Georgetown alignment from Union Station passing through Bloor and Weston before travelling along a new dedicated spur to LBPIA.



Scope of Work

- I In July 2010, the Ontario Government asked Metrolinx to build, own and operate the ARL from Union Station to LBPIA. From this date Metrolinx assumed responsibility for the project including design, construction and operations, building on the work that had been undertaken in the past. The project had previously been led by Union Pearson Air-Link Group (UPAG), a subsidiary of SNC Lavalin.
- I In 2009 Steer Davies Gleave undertook an Investment Grade Ridership and Revenue study for SNC Lavalin for the ARL service. Having taken over as sponsors of the scheme Metrolinx commissioned a new study to update these forecasts under a number of new operating assumptions both for the ARL and for a number of the competing modes, as well as taking into account the latest passenger growth at LBPIA.
- I The broad scope of work for this new set of forecasts has therefore been to:
 - Carry out a comprehensive update of the forecasting model and update structure as necessary
 - Review underlying assumptions and refine model inputs
 - Review and update potential demand for the ARL taking into account changes in the air market and in Toronto's demographic make-up
 - Update travel time and cost assumptions for ARL and competing modes
 - **Exclusion per Committee Direction**
 - Provide advice on operational design related to demand profiles and rolling stock capacity
 - Analysis of market shares both with and without the ARL



Overall Approach

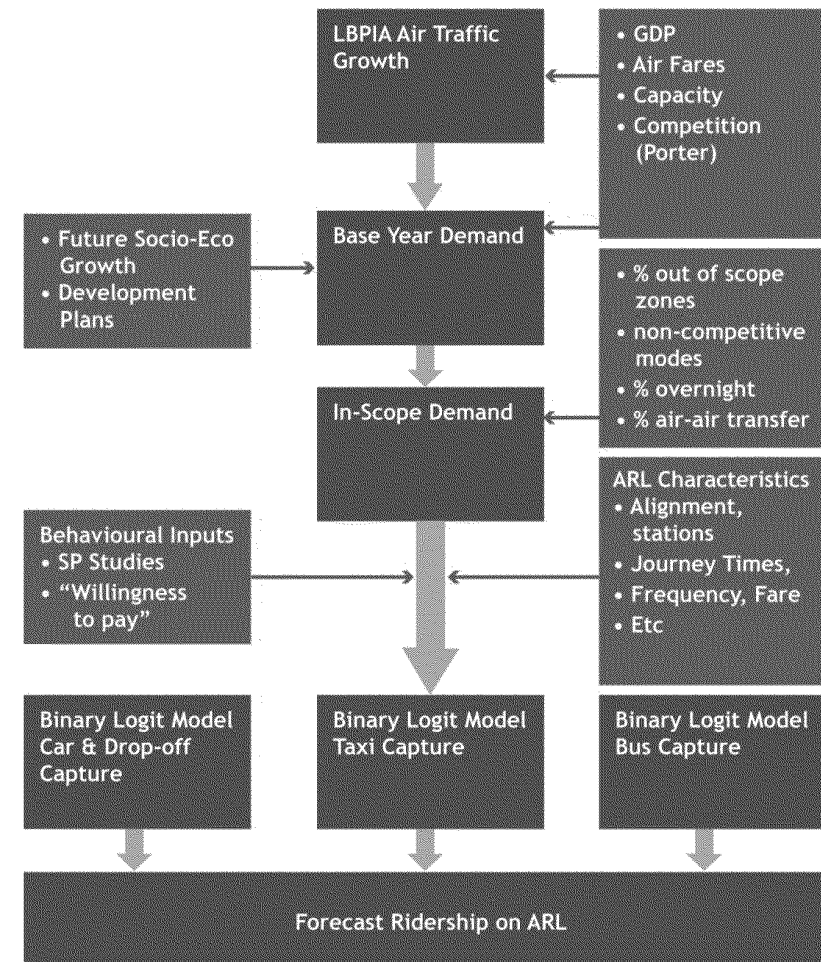
I Our forecasting approach is based on a framework widely accepted throughout the transportation industry and commonly used to estimate potential demand for toll roads, urban transit systems and rail networks.

I It relies on answering two significant questions:

- In-scope market: how much of the total travel between LBPIA and GTHA could reasonably be attracted to the ARL?
- Traffic capture: how much of this in-scope travel can actually be captured?

I In the following slides we focus on each of the key building blocks of the forecasting process, as illustrated in the figure to the right:

- The LBPIA air traffic: volumes and trends
- Determining the size of the in-scope demand
- Assessing the level of capture, both for different market segments and taking into account decision drivers
- The key characteristics and assumptions that affect the ARL service and its operations



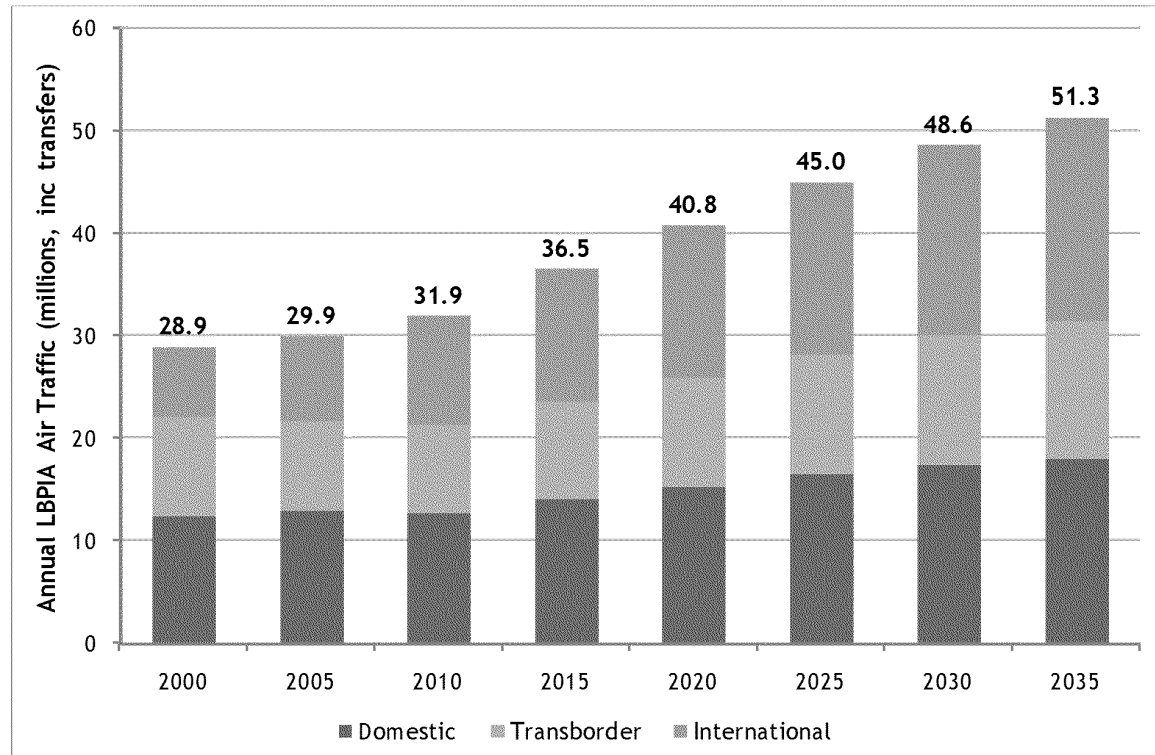
Approach: LBPIA air traffic

I Independent air traffic forecasts for LBPIA have been developed by Steer Davies Gleave by first forecasting for the three main passenger airports in the GTHA (LBPIA, Billy Bishop City and Hamilton International) and then separating out LBPIA passengers. The forecasts for all passengers at LBPIA (including those in transit between flights) are shown in the figure below. These are generally lower than those developed by GTAA.

I The forecasts have been developed using a series of drivers including:

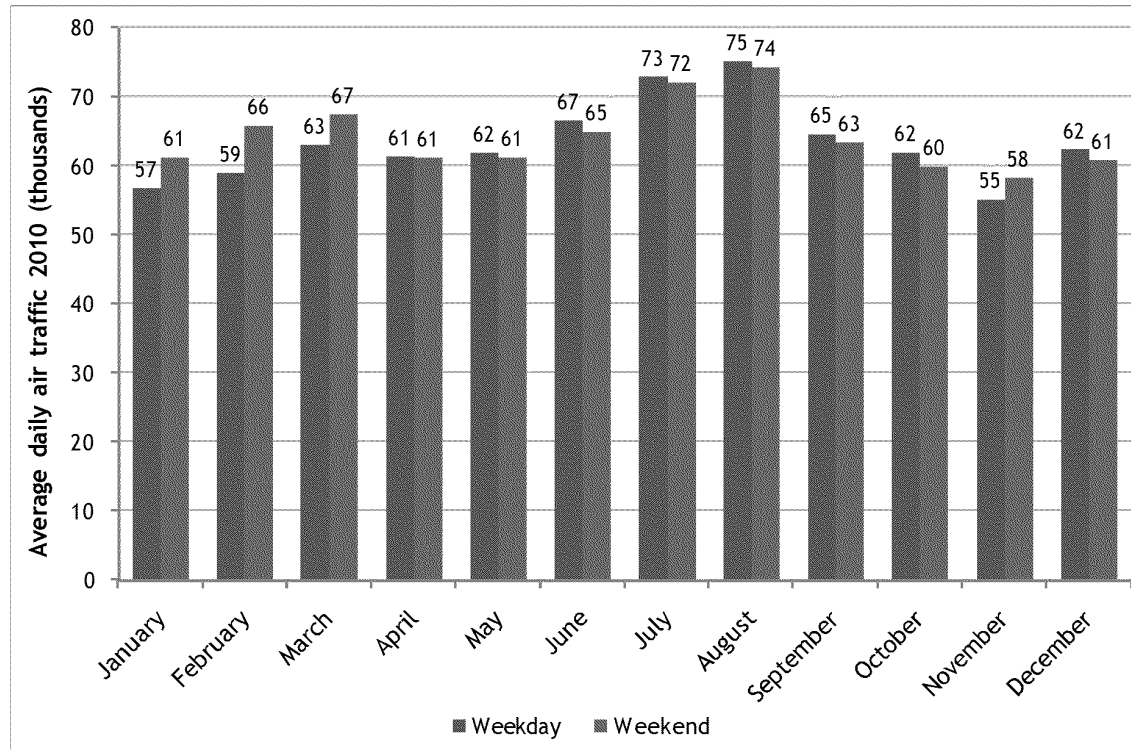
- Information at a flight sector level (the type of flight): trans-border, domestic and international
- Historical trends in air traffic
- GDP forecasts
- Cost of air travel
- Likely changes in airline strategy, particularly reflecting the activities of Porter Airlines
- Capacity constraints at each airport

I Between 2011 and 2031, total air traffic at LBPIA is forecast to increase at an average rate of 2% per annum.



Approach: seasonal trends in air traffic

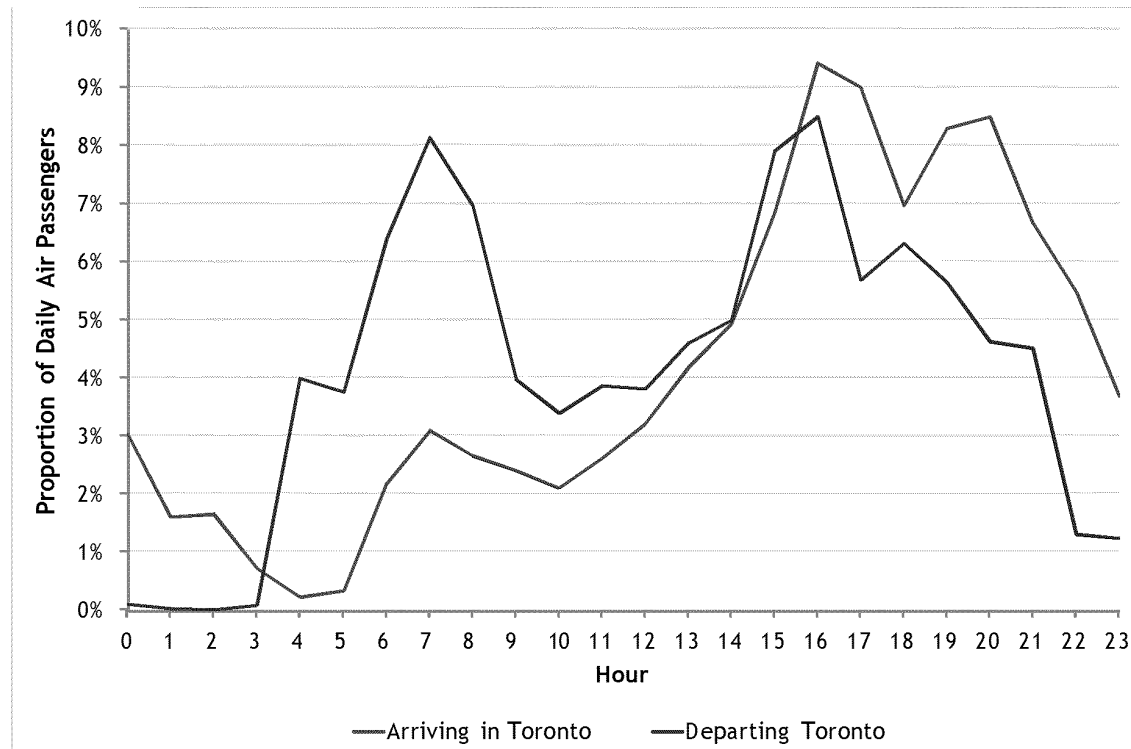
- Our forecasts reflect both seasonal variation across an average year and diurnal trends across an average day. These trends have been established using detailed flight profile information provided by GTAA.
- The figure below illustrates the seasonal variation from month to month and by day of week. Each bar corresponds to the average number of total passengers either enplaning or deplaning at LBPIA, excluding those transferring, on weekdays and weekend days in each month of the year (2010).



- This information is used specifically for the identification of potential peak flows on the ARL.
- Weekdays and weekends show a similar overall level of air traffic, though there are more domestic, trans-border and business passengers on weekdays and more international and leisure passengers on the weekend.
- The summer months are the busiest period across the year with August the busiest month overall, where all days of the week are above the average for the year.
- This seasonal variation does not reflect the peak periods for specific groups of passengers, and in particular business travellers, for whom quarter 3 (July to September) is 25% below the average for the rest of the year.

Approach: daily trends in air traffic

- I The figure below illustrates the daily variation in air traffic, separately for arriving and departing passengers (excluding those transferring) for an average day (includes weekends and weekdays).
- I On average, arriving passengers peak in the afternoon between 16:00 and 17:00, but remain at a relatively high level until 20:00. The period between 16:00 and 20:00 accounts for just over 40% of the arriving daily passengers.

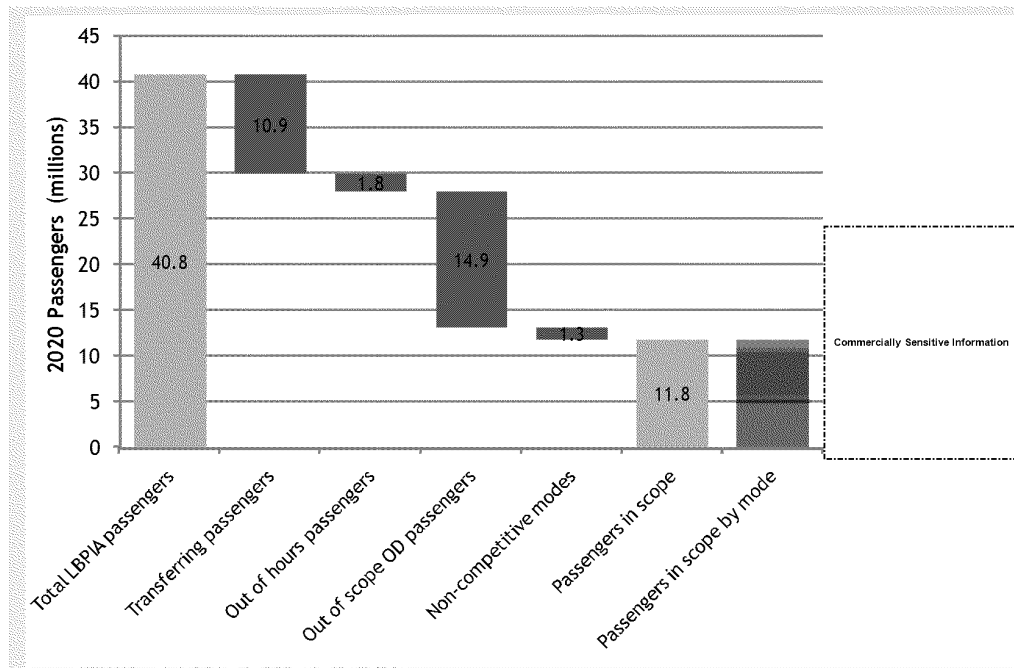


- I The profile for departing passengers shows two peaks: one in the morning between 06:00 and 09:00, accounting for 21.5% of the daily departing passengers, and a second in the afternoon between 15:00 and 17:00 accounting for a further 16.4%.
- I The quietest times across the day for both arriving and departing passengers occur in the early morning:
 - Between 04:00 and 05:00 for those arriving;
 - Between midnight and 03:00 for departures.
- I Variations in air traffic across the day are an important component in determining what the hours of operation should be for the ARL.

Approach: in-scope demand

The size of the in-scope market has been established through examination of the air traffic at LBPIA, both in the ARL opening year and into the future. Some groups of passengers are removed from the total air traffic, what remains is termed the in-scope demand. Those discounted for the purposes of assessing in-scope demand are:

- Transferring passengers who are changing planes and therefore do not leave the airport
- Those travelling at times outside of the proposed hours of operation for the ARL
- Passengers travelling currently using modes of transport from which it would not be logical to switch such as dedicated hotel shuttles or hire cars
- Those travelling from areas outside of the ARL corridor such as from Mississauga or Brampton where the current mode of travel would remain advantageous



The figure to the left illustrates this process for a single forecast year, 2020.

40.80 million passengers are forecast to use LBPIA, including those transferring to other aircraft who do not have an origin or destination in the GTHA.

After removing those passengers who could not or logically would not use the ARL, 11.81 million passengers remain in-scope.

Approach: traffic capture

I To address traffic capture, we have considered the following issues:

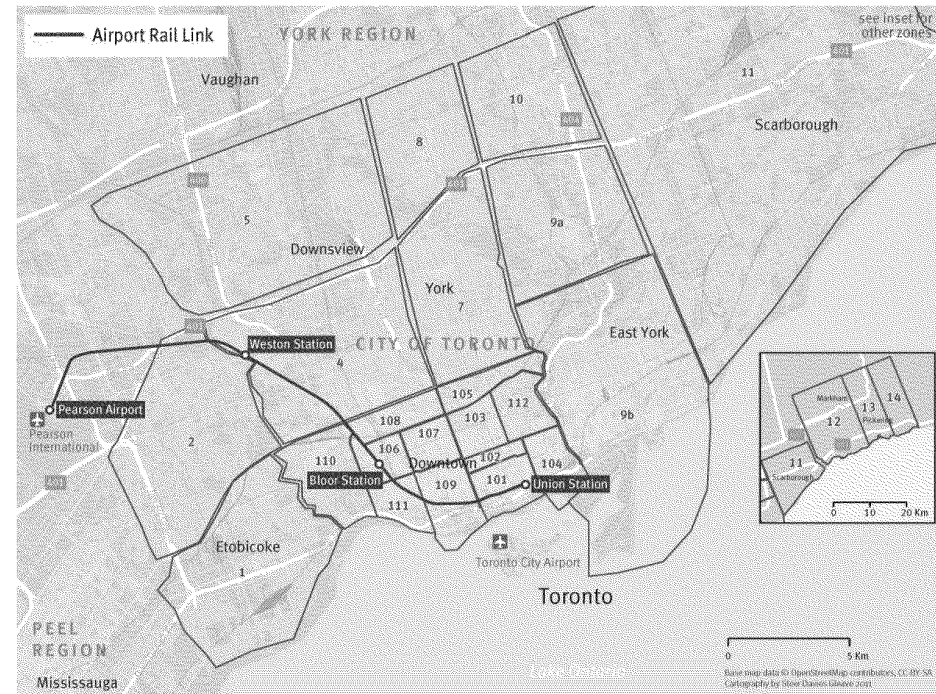
- What are relative costs and benefits of each mode of travel?
- How will each traveller choose between options?

I Capture is estimated for different mini-segments of the in-scope market. Mini-segments are defined to reflect different times and costs, and underlying behaviours and preferences across the total in-scope market. We use the following segments:

- Current mode of travel: airport express bus, taxi, drive and park (terminal parking or remote lots), drop off
- Residency: resident of the GTHA or not
- Purpose of journey: travel for business or not
- Type of flight: domestic, transborder, international
- Time of day when travel to/from the airport would occur: morning peak, afternoon peak, other off peak times
- Travelling party: travelling alone or in a group
- Area in GTHA travelled to/from:
25 areas (termed zones) in GTHA

I A zoning system covering 25 different areas in the GTHA has been chosen to reflect different propensities to use the ARL which will be driven by:

- Demographics of those travelling to or from the airport, for example downtown areas logically have a higher number of business non residents
- Times and costs on the current modes of travel
- Access to the proposed ARL stations, in terms of times, costs and ease of interchange



Approach: relative costs of travel

I The relative cost of travel for each competing mode has been established using a combination of publically available data sources and new data collected specifically for the work carried out for SNC in 2009.

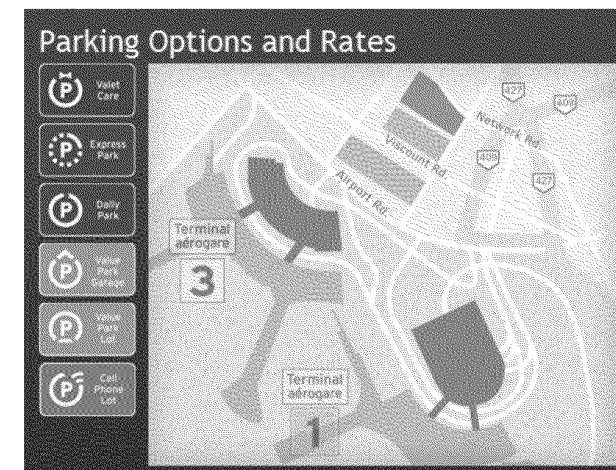
I For each current mode of travel, and for each of the 25 areas in GTHA we established:

- **Exclusion per Committee Direction**
 - * For travel by private car this includes parking charges only, fuel and tolls are not taken into account
- The time spent in the vehicle travel to the airport, both in peak and off peak periods
- The time to travel from an origin in the GTHA to the main mode of travel (access time)
 - * For travel by private car or taxi this is zero minutes
 - * For travel by transit this is the time to the transit station or stop
- Any time spent waiting for the current mode of travel to arrive at the station or stop (transit and taxi only)
- Time between the drop off point at the airport and the main terminal (egress time)
 - * For travel by private car this is the time between the car park and the terminal, separately for the terminal and reduced rate lots which tend to be in remote locations
 - * For travel by transit or taxi this is assumed to be zero minutes

I We have developed a set of cost assumptions for travel by ARL in a similar fashion, using:

- Assumptions about which station passengers will use from the different areas in GTHA and how they will travel to this station
- Run times between ARL stations and the planned number of trains that will run each hour

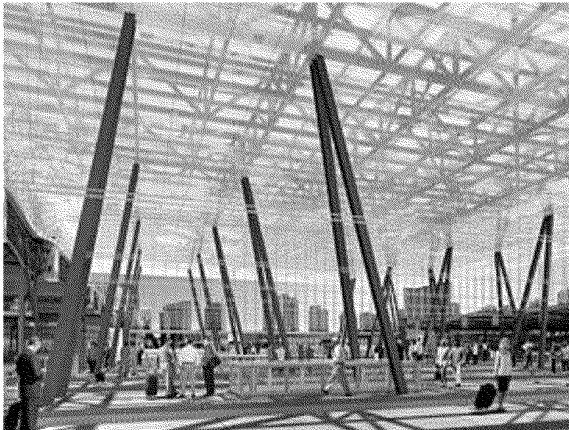
■ **Exclusion per Committee Direction**



Approach: ARL characteristics and key assumptions

I In developing this set of forecasts for Metrolinx we have assumed the following ARL service characteristics:

- The ARL will open for service on 5th April 2015
- That trains will run every day, 365 days a year
- Hours of operation will be from 5am to 1am the following day
- That there will be four trains an hour all day in each direction
- That each service will call at Union Station, Bloor, Weston and LBPIA
- Interchanges at each of the station will be clearly marked and easy to navigate
- The service will have a premium look and feel and be clearly branded as different from other rail services operating in Toronto
- That the journey time between Union Station and LBPIA would be 25 minutes, in each direction.
- **Exclusion per Committee Direction**
- And that planned station improvements will be completed at Union Station and that the ARL will have its own dedicated platform both at Union and at the airport station



I In addition we have assumed that:

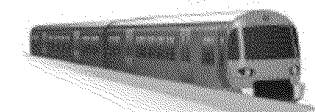
- During the first three years of operation, passenger numbers will “ramp-up”:
Year One: 65% , Year Two: 80%, Year Three: 90%
(The ramp-up assumptions have been estimated based on other international rail services)
- And that Metrolinx have procured a 2-car fleet of trainsets, but are looking to expand the service to a 3-car service in the future.

Approach: behaviours and decision drivers

- Passenger behaviours and their decision drivers are a key input to the forecasting framework. They are used to reflect how the different segments of the market will react to the ARL. In simple terms we believe that all passengers will respond logically to time savings and cost differences. If one mode of travel is cheaper and faster than another, it would be perceived as more attractive.
- However there are other factors that are not related to time and cost which can have a bearing. These are more difficult to measure and are typically reflecting in a mode constant which reflects all other underlying preferences for one mode of travel compared to another.
- In 2009 we undertook a program of behavioural research with airport users in the terminal in order to estimate these modal preferences as well as sensitivities to time and cost. The survey was carried out as part of the wider study for SNC, with 1,260 passengers who had travelled to the airport from the in-scope area by either car, airport express bus or taxi.

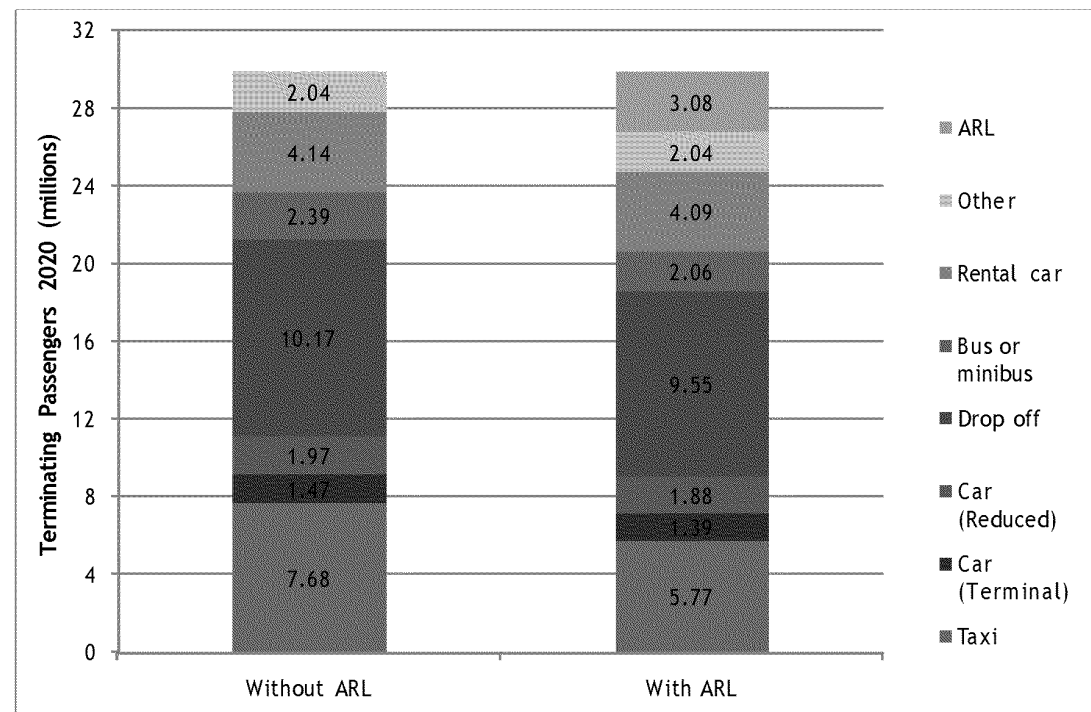
- The data from this research was used to estimate behavioural choice models which allow us to quantify the modal preferences and sensitivities using a well established mathematical framework
- The full details of this research and the results obtained are contained in the appendix to this document.

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Option A Taxi or Limo, as today  \$50 one-way 45 minutes to Airport	Option B Express Train from Union Station  Exclusion per Committee Direction 20 minutes from Union Station to Airport Services every 15 minutes Access to Union Station as you described	
Which would you choose?		
Option A	Neither	Option B

Summary of results

- I We have developed a base case set of forecasts for the ARL between opening year in 2015 and 2031.
- I The forecasts suggest that the ARL will be well-used with 3.08 million passengers forecast by 2020.
- I For the total market of those travelling to or from the airport by all modes, at all times and from all directions, this is equivalent to 10.3%. This corresponds well with published statistics for other air-rail links both in North America and across the world.
- I The market share of those travelling to or from the airport both with and without the ARL in 2020 is shown to the right.
- I The forecasts suggest that by 2020 the market share of those passengers will change as follows:
 - Parking at the airport will fall from 11.6% to 11.0%
 - Using taxis will reduce from 25.7% to 19.8%
 - Being dropped off at the airport falls from 34.1% to 31.9%, and
 - Travelling by all bus services decreasing from 8.0% to 6.9%

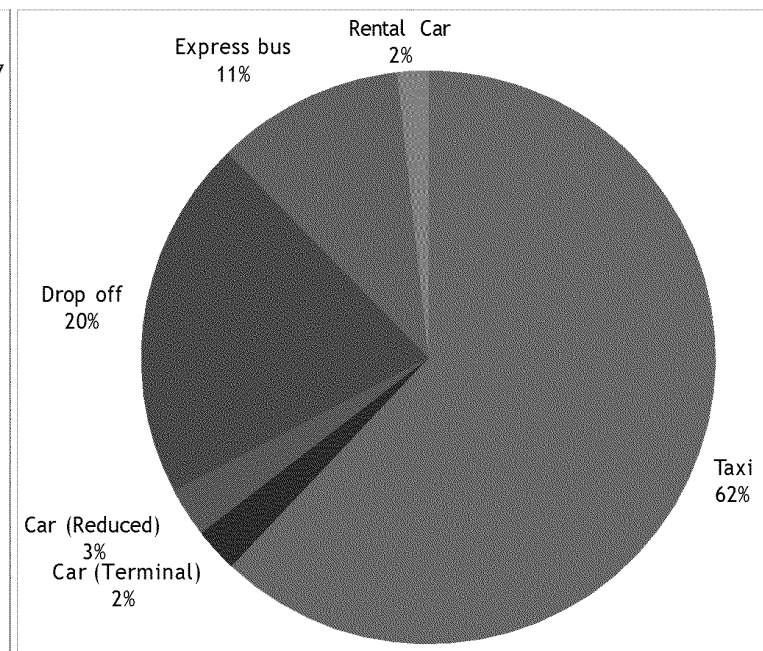
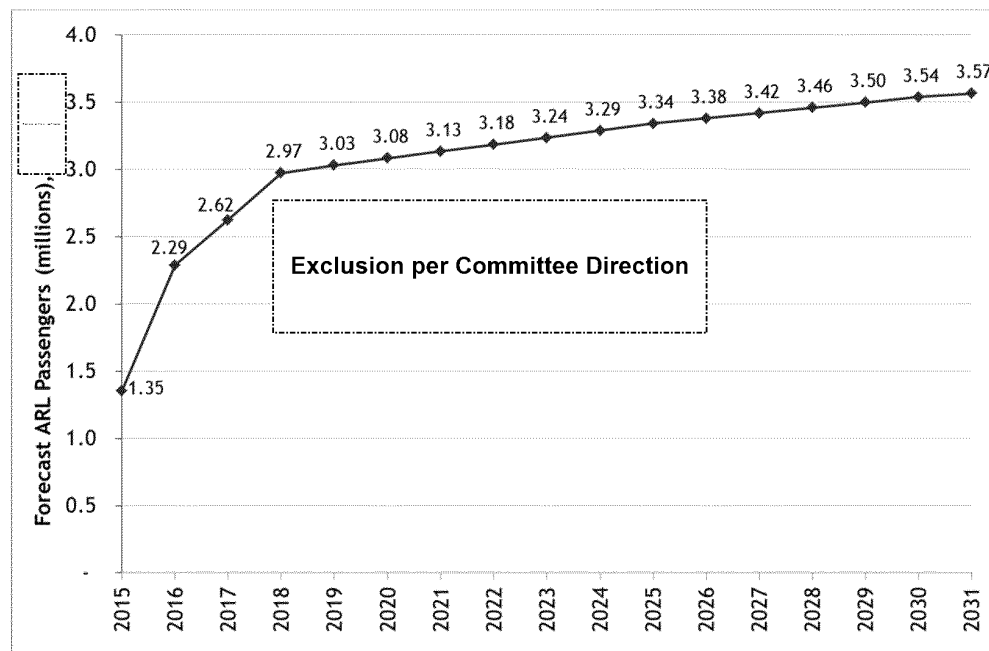


Composition of ARL passengers and forecast through time

Exclusion per Committee Direction

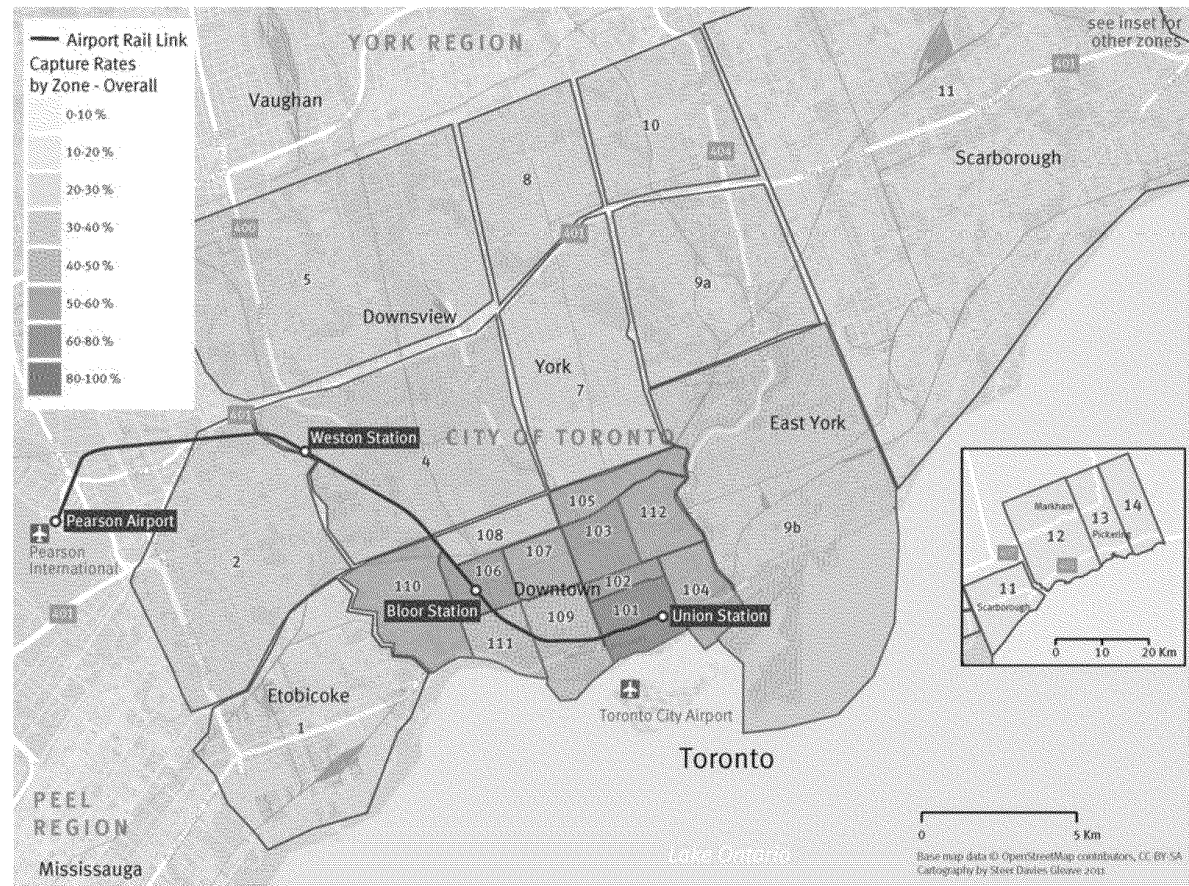
annual ARL passengers are initially forecast at 1.35 million (one way movements) in opening year (calendar year opening date 5th April), rising to 2.97 million in 2018 when the system reaches maturity.

- I Passengers numbers are then forecast to grow at an average annual rate of 1.4% per annum from 2018 until 2031 when volumes reach 3.57 million.
- I In 2020, 3.08 million passengers are forecast to use the ARL. This is forecast to comprise:
 - 62% of those who had previously used taxis,
 - 11% of those who had previously used the express bus and
 - 27% of those who had travelled to the airport by car, either parking or being dropped off.



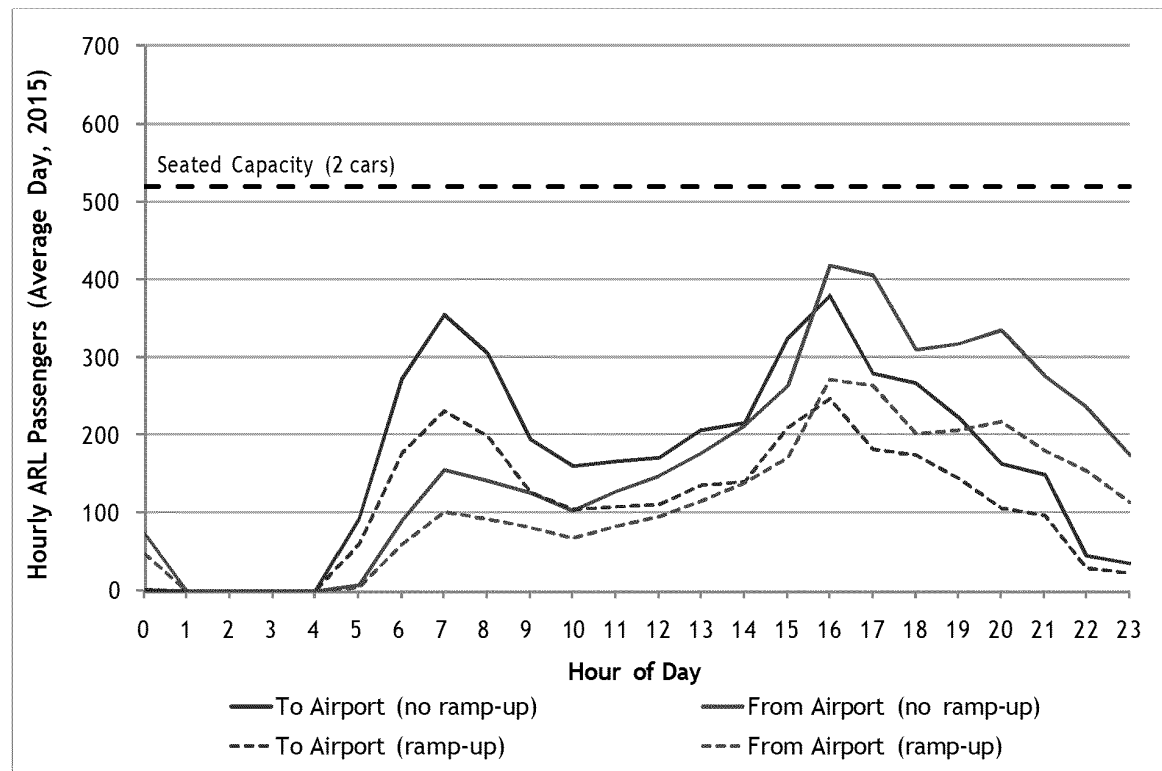
Capture rates by area of Toronto

- I The number of passengers attracted to the ARL varies across different areas in Toronto. The highest numbers are attracted from the downtown areas, and in particular the area closest to Union Station where the station can be accessed by foot.
- I This is reflected in the figure to the right which shows how much of the in-scope demand is forecast to be captured from each area, in percentage terms.
- I For the area immediately around Union Station in the downtown area 68% are captured from the overall in-scope market.
- I Similarly for the area in the immediate vicinity of Bloor Station (labelled 106) capture rates are high at 53% reflecting the highly competitive nature of the ARL compared to other competing modes for those travelling to or from this area.



ARL passengers on an average day, opening year 2015

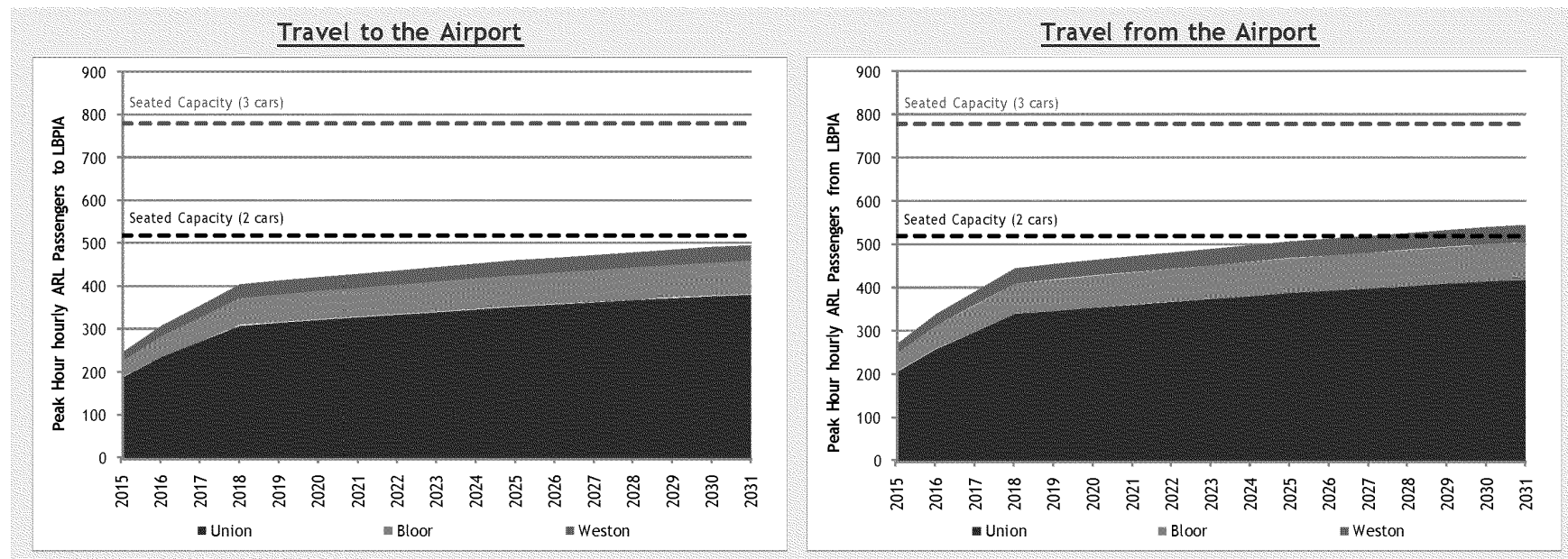
- I By adopting the GTAA hour of the day passenger profiles from 2010, we have developed forecasts for each hour of ARL service. The figure below shows the likely range of passenger volumes in 2015 in both directions of travel separately.
- I An allowance has been made for the amount of time that passengers typically need both to pass through the airport when:
 - arriving at LBPIA (45 minutes domestic/trans-border, 60 minutes international), and
 - check-in and security checks (60 /90/120 minutes for domestic, trans-border and international respectively).



- I In general the afternoon period is likely to be busier on the ARL compared to the morning due to the high volume of international flights taking off and landing in the afternoon. The peak hour for travel to and from the airport occurs in the afternoon between 16:00 and 17:00.
- I If the ARL service is configured as a 2-car train, the implied seated capacity is 520 passengers per hour.
- I On an average day across the year, including both weekends and weekdays, we forecast that the forecast passengers can be comfortably accommodated, even in the peak period.
- I The graph shows the profiles with and without ramp-up assumptions

Peak hour ARL passengers by station, average day 2015

- I On an average day across 2015, during the peak hour we have forecast the number of passengers at each station on the route; this is illustrated in the two figures below for each direction of travel: to the airport (left) and from the airport (right).
- I The vast majority of passengers are forecast to use Union Station in downtown Toronto (76% in opening year in each direction). Bloor station is forecast to be used by 16% of passengers and Weston 8%.
- I In reality Union Station may be more popular than forecast as we have assumed that:
 - Passengers starting their trip in areas to the north and west of Union Station such as at Koreatown, Swansea or Etobicoke would access the ARL at Bloor rather than effectively back-tracking towards the Downtown area and using Union Station
 - The ARL station at Bloor will be easy to access and have a good interchange with other transit modes

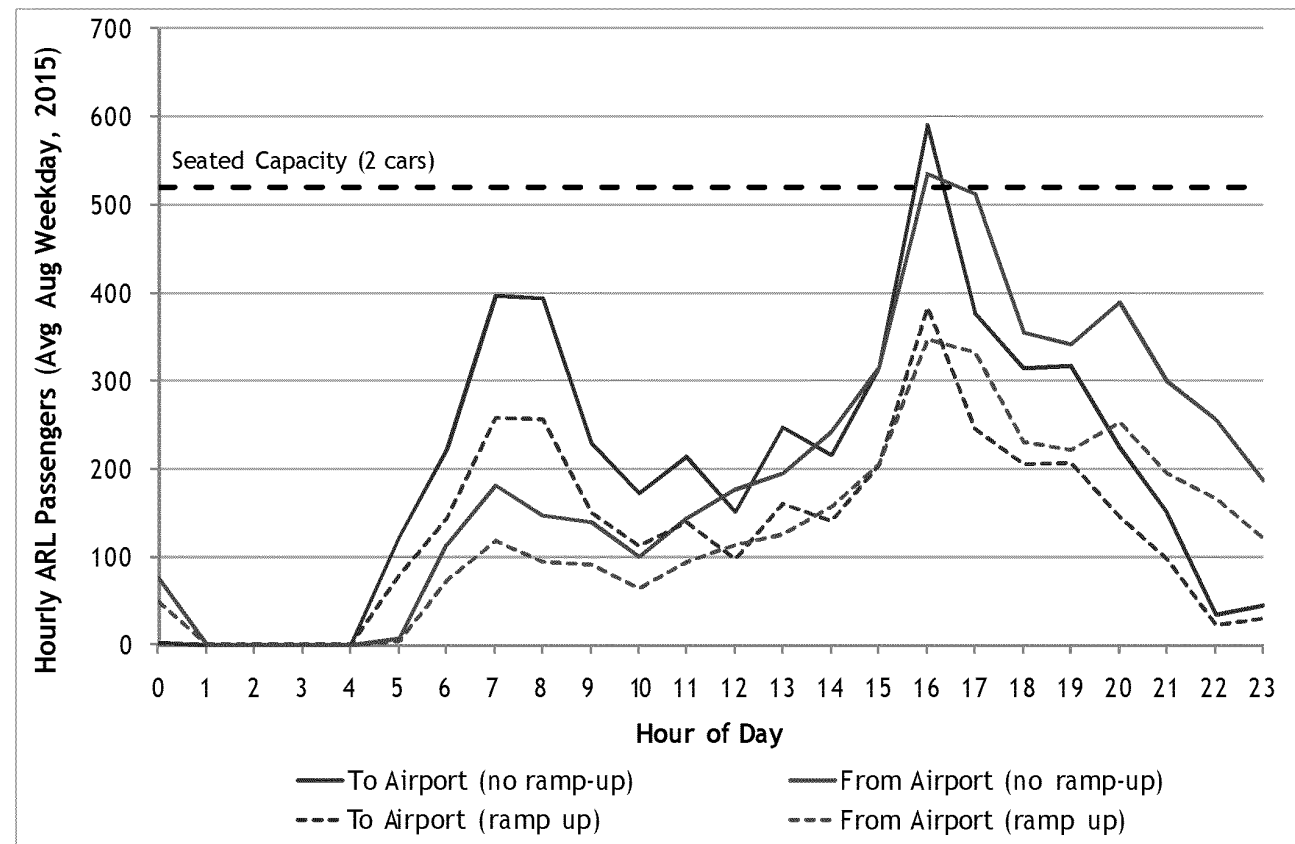


ARL Passenger on an average August weekday, opening year 2015

I According to GTAA statistics the busiest month at LBPIA is August, coinciding with the holiday season.

I Looking just at weekdays in August, when the number of forecast ARL passengers are at their highest, we forecast that the ARL could carry close to 400 passengers during the peak hour, in each direction in opening year, assuming four services an hour. There will of course be variations in the load factors on specific trains across each hour.

I If there were no ramp-up, the demand for the ARL could reach nearly 600 passengers in the peak hour. With in-hour variation, this would lead to significant carrying capacity pressures in the afternoon peak hour.



ARL Passenger on an average August weekday

I Focussing on the peak hour on an average August weekday between 16:00 and 17:00:

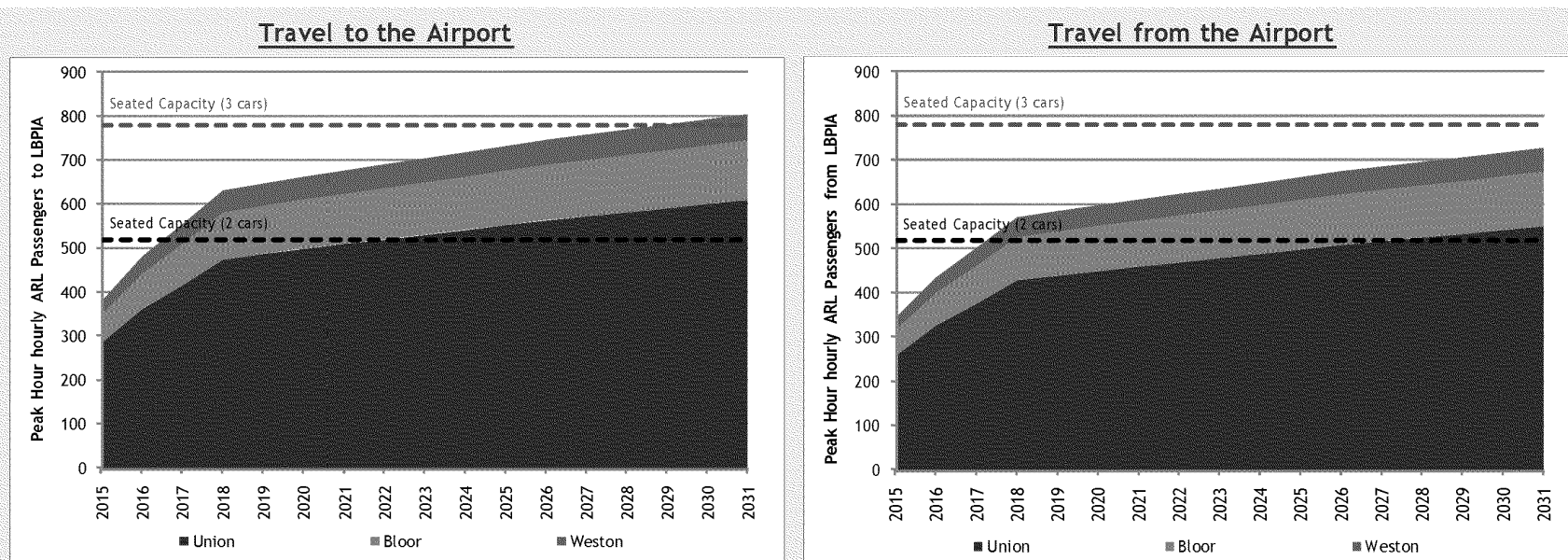
- The number of ARL passengers forecast to travel exceeds the available seating capacity within 3 years if the train is configured as a two car service. This is true in both directions of travel, to the airport (left figure) and from the airport (right figure)

I Again, if the service ramps-up faster than expected then there is a high risk of significant over crowding in August from opening year.

- Passengers boarding and alighting at stations other than Union are likely to be impeded or even crowded off the service altogether

I A number of options exist to manage high levels of demand, including but not limited to:

- **Exclusion per Committee Direction**
- Configuring services to respond to peaks in demand - running 3 car trains during these periods



Exclusion per Committee Direction

Sensitivity tests, robustness to other assumptions

I As well as changes to the proposed ARL fare we have also undertaken a number of other sensitivity tests, focussed on four key areas:

- Use of the GTAA air traffic forecasts, affecting the size of the overall in-scope market
- Adoption of different market characteristics including alternative market shares and levels of demand in different markets using independent data provided by GTAA
- Change in the competitive position of other modes, particularly on the biggest market segment, car parking at the airport
- Different ARL service characteristics including service frequency and run times

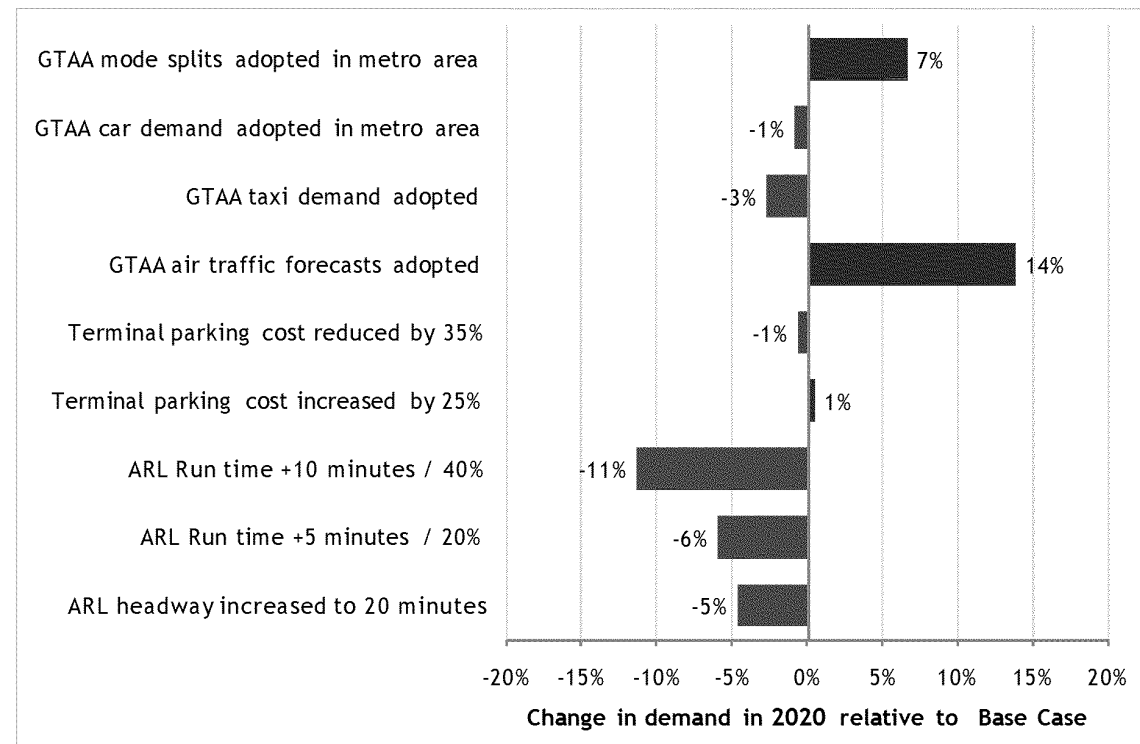
I The figure to the right shows the impact of these relative to the forecast demand in the base case for 2020.

I Adopting the GTAA air traffic forecasts leads to a 14% increase in the forecast ridership of the ARL. This is directly related to the fact that the GTAA air traffic forecasts are greater than the ones that have been developed by us for this study.

I Use of other GTAA data to change the demand composition of the in-scope market has a number of small impacts, the biggest being the impact of the GTAA mode shares for the downtown metro area of Toronto which increases ridership forecasts by 7%.

I Changes to the terminal parking costs has a negligible impact on the forecasts whereas,

I Negative changes to the ARL service characteristics have a small impact, reflecting the change in competitive position of the ARL.



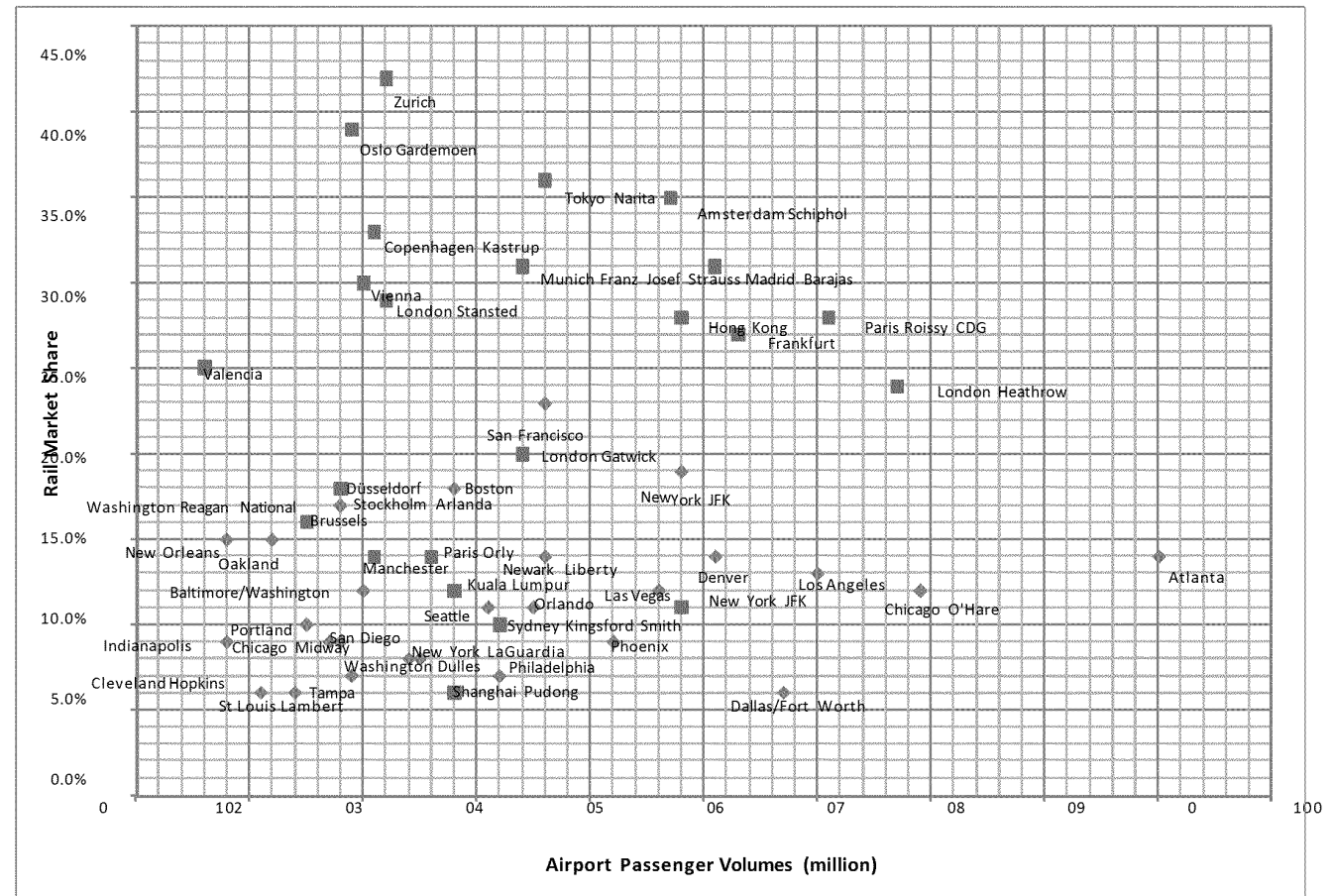
Comparison with other International Airports

The figure below shows the rail market share for a number of world airports against the airport passenger volumes in millions.

- For North America we show total transit share (rail + bus)

With a forecast market share of 10.3% and passenger volumes of 3.1 million in 2020, the ARL in Toronto is comparable with other North American cities such as:

- Vancouver served by the Canada Line rapid transit service: 10% rail market share
- Chicago Midway, served by Chicago Transit Authority "L" trains: 6% rail and 9% transit overall
- Seattle served by the Link light rail service: overall transit market share of 11%
- Baltimore Washington served by a large number of rail services (Amtrak, MARC and a light rail system): 12% transit market share



Summary of conclusions

- I 40.8 million passengers are forecast to use LBPIA in 2020. Removing those transferring between planes leaves close to 30 million surface access passengers.
 - The ARL is forecast to carry 10.3% of the surface access market. This corresponds well with other airports in the world, and in particular North American rail links such as Vancouver and Baltimore Washington.
- I In opening year we forecast that the ARL will carry 1.35 million passengers, with 2.97 million by 2018 when the system reaches maturity. This is assuming a 65% ramp-up in the first year, which may be conservative given the Pan-Am Games in July 2015, just three months after opening. By 2020 passenger numbers are forecast to reach 3.08 million with:
 - 62% of passengers previously using taxis,
 - 11% previously using the express bus and
 - 27% previously travelling to the airport by car, parking or being dropped off.
- I Capture rates vary depending on the area of Toronto that passengers are travelling from.
 - For the area immediately around Union Station in the downtown area, 68% are captured from the overall in-scope market.
 - And the area around Bloor Station is 53%.
- I Peaks in passengers are forecast to occur in August on weekdays, which are the busiest days in general at LBPIA.
 - The afternoon period is forecast to be busier on the ARL compared to the morning due to the high volume of international flights taking off and landing. The peak hour for travel to and from the airport occurs in the afternoon between 16:00 and 17:00.
 - During the peak hour on an August weekday in opening year, passenger volumes are forecast to be between 350 and 400 passengers per hour in each direction. This compares with a planned 2-car seated capacity of 520 passengers an hour.
 - If passenger demand ramps-up faster than anticipated there could well be issues with over crowding from opening year during peak August periods, assuming a 2-car service is operated at all times.
 - The risk of over-crowding might be mitigated by running longer trains (3-cars) during peaks, **Exclusion per Committee Direction**
- I Union Station is forecast to carry the most passengers with at least 75% boarding or alighting at this location. This has implications for operational plans given the time it will take for passengers to board and alight with luggage at the Union Station end of the trip where platform space is more restricted.

Sensitivity test summary

Exclusion per Committee Direction

Sensitivity test summary: comparison through time

Exclusion per Committee Direction

Exclusion per Committee Direction

Exclusion per Committee Direction

Control Sheet

Project/Proposal Name:	Georgetown Corridor Airport Rail Link
Document Title:	FINAL Report
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ISSUE HISTORY

Issue No: 3	Date: 22 March 2012	Details: Updated with Appendix
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