Taxi Research Partners

TORONTO Taxi Research
Market | Infrastructure | GIS | Fares

# Determining the Appropriate Number of Taxicabs and its Impacts for the City of Toronto



Final Report

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# Acknowledgements

Taxi Research Partners (TRP) acknowledge the kind input from the many contributors to this study. We acknowledge and thank the City of Toronto for its commission and significant support in the delivery of the work. We would also underline the significance of input from the Toronto Taxicab industry for which we are grateful and appreciative.

# 1. Executive Summary

This report sets out the analysis, findings and conclusions of our review to determine the Appropriate Number of Taxicabs and its Impacts for the City of Toronto. Our work was undertaken in the period January - March 2013 on behalf of Municipal Licensing and Standards (MLS) of the City of Toronto, and completed by the Taxi Research Partners (TRP), an independent specialist consultant. Our work addressed the demand for taxi services, based on a measured baseline, reflecting current use at the time of study, predicted demand and taxi use over a ten year time horizon, industry structure and potential development.

It is our conclusion that, based on current passenger service levels, current numbers of taxis are appropriate to meet current demand. We have defined a service level baseline that reflect this, against which future service levels can be measured. We recommend that future service levels should meet or improve on current availability.

In our conclusions we recommend that the supply of taxis can be enhanced through a change in licensing structure, measured changes in the numbers of licenses by type, and the adoption of a proportional approach to accessible vehicles.

We recommend that the taxi licensing structure be updated to harmonize license types, and conclude the greatest benefit is achieved where licenses are updated to a modified transferable Ambassador license as described in detail below. We recommend the introduction of license transferability for Ambassador licenses; the conversion of current "Standard" plates to double shifted transferable Ambassador plates on renewal (abbreviated as AM2 in the body of this text), and the conversion of existing Ambassador plates to single shifted transferable Ambassador plates (AM1) with immediate effect.

Allied to the adoption of AM1 and AM2 plates, we recommend that measured increases in demand be met by an increase in capacity, described as Cab Shift Availability (CSA) in the text, to be achieved through the conversion of single shifted AM1s to double shifted AM2s on a measured basis. We recommend that the measurement taxi license numbers be renewed every two years, with the measured increase required to maintain CSA to be applied annually. In our measurements

this requires the conversion of 90 AM1 to AM2 licenses in 2013, with an additional 90 conversions in 2014.

In line with the desire to ensure measurements are correct and account for changes in the market, we recommend that the base calculation, as set out in the Taxi Market Model, be re-calculated in 2015, with further transfers applied on a measured basis thereafter. We recommend that new license issues, rather than transfers and conversions, be considered only upon exhaustion of current AM1 - AM2 conversions.

We have also concluded that it would be beneficial to update some elements of the taxi meter rate measurement. Taxi meter rates have a direct impact on the choice of mode, with some elements impacting significantly on distinct population groups. In order to stimulate demand and to ensure more equitable access to taxis, we recommend that the taxi flag be reduced from $4.25 to $3.25. Reduction in flag rate should not result, however, in a loss of income to the driver. We therefore recommend that the flag reduction be offset by an increase in distance based income. We recommend that this is achieved by reducing the incremental distance to 129 meters, described in our combined recommended scenario. Changes in the taxi meter rate measurements are intended to be cost neutral when measured over all trips and predicted demand. This is summarized as:

Recommended action

| Measure | Action | Comment |
|---|---|---|
| Ambassador licenses | Immediate conversion of existing AMB to AM1 licenses | |
| Standard licenses | Immediate conversion of existing STD capacity to (legacy) licenses | Re-issue to AM2 on transfer |
| Market Growth | Conversion of AM1 to AM2 licenses to meet market demand | 90 AM1 to AM2 license conversions in 2013, 90 AM1 to AM2 license conversions in 2014 |

| | | |
|---|---|---|
| Accessibility | Adoption of proportional model of accessibility at 6% of fleet, to be subject to review | Review at 2015 in light of vehicle type availability |
| Taxi fares | Adoption of a lower flag charge offset by a reduced incremental distance | Flag charge to be set at $3.25 |
| Taxi fares | Increasing distance based income to ensure a zero sum cost | Distance increments to be set at 129 m |
| Review | Undertake reviews of baseline and prediction | Toronto taxi market model to be reviews and rerun at 2 yearly intervals. Next review at 2015 |

### 1.1 Numbers of licenses

The concept of a "sufficient" number of licenses for a city has been discussed in a number of taxi reviews in Canada and more widely, and follows the logic that a defined number should provide sufficient levels of supply to satisfy demand. Historically many cities have linked numbers of licenses to the population size, an increase in population requiring an increase in taxi license numbers to serve the growing city. The approach allows for both historical observation (backcasting) and prediction (forecasting) of population to predicate a change in license numbers. More recent studies have developed from this using a wider number of "demand indicators" in addition to population size alone, identifying a series of measures, also called demand surrogates, that in combination predict potential demand for taxis. The latter recognising the potential of differing factors to influence taxi use over population size alone.

In our study we have been asked to consider both license numbers and potential changes in the structure of the industry, including the adoption of new license types that will in turn alter the effective levels of supply. This introduces a further level of complexity as it becomes possible that changes in the structure of licenses will impact on the level of service (satisfying demand) in addition to total number of licenses issued. Furthermore, as the market for taxis actually splits

across differing demands (trip types), by location and time, the concept of a single measurement of demand becomes more difficult to justify on its own.

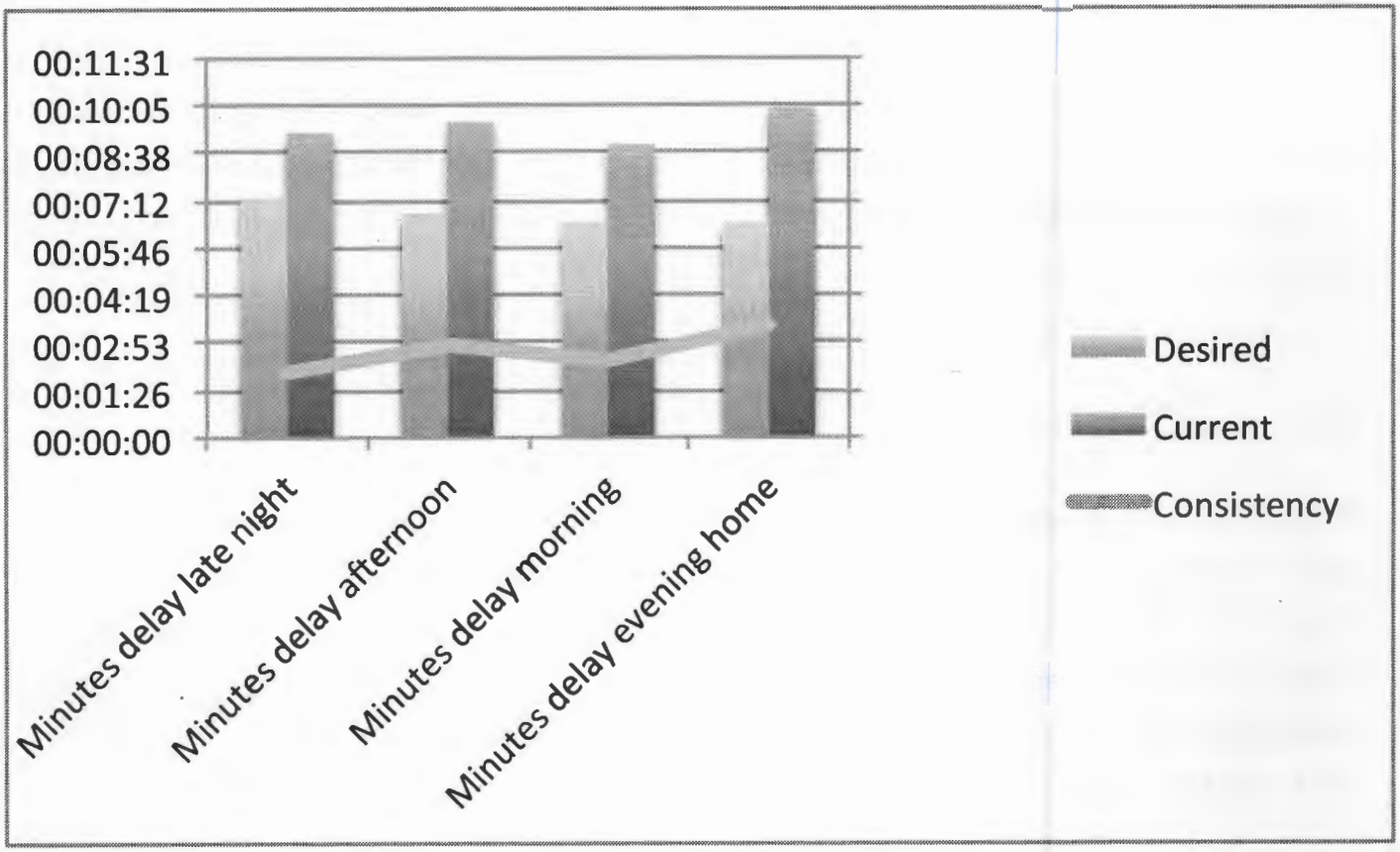
In addressing the issues of license numbers we have developed a Toronto Taxi Market Model that allows for changes in license type to be tested, and includes service level indicators to illustrate the impact of changes arising from the issuance of new licenses and/or changes to the types of licenses issued. A baseline indicator has been set using current service levels against which changes in numbers can be compared. Current license numbers appear appropriate to current demand, see below, allowing the team to set a baseline against which future service levels can be measured. It is our conclusion that changes to the numbers of licenses or license structure should maintain or improve upon current availability.

### 1.2 Service Level Indicators

Critical to determining appropriate license number and structure is the ability to measure impacts of changes in supply on the level of service received by passengers. In section three we set out current passenger delay, including indicators of a level felt "desirable" in public surveys and that typically achieved. Verifiable operational statistics are regularly measured in trips hired through brokerages, see figure 1, allowing a comparison between a stated "desirable" and measured "achieved" level of service. Differences between "desirable" and achieved levels are noted with an additional indicator showing consistency between four indicative time periods: from entertainment home late at night; from shopping home in the afternoon; travel to work in the morning commute; and evening travel from home to entertainment. Service levels for Hailed and cabstand journeys are less readily measured as these would not typically be captured in electronic data, but an indication of service levels can be identified using stated "experiential" data.

As some journeys will necessarily include delays in drivers accessing a pick up point, resulting from congestion or physical location, not all desirable service times will prove achievable; however, consistent and relatively low levels of delay should be possible, the greater the level of consistency, the more balanced the market.

Figure 1: Baseline service levels for broker dispatched trips, showing public desired level, current performance, and consistency measure




Current supply in Toronto serves most trips with only small variation between desired levels of service and actual service delivery, ranging between additional delays of 1 minute 59 seconds for late night taxi use; to 3 minutes 28 seconds for evening travel from home to entertainment. Consistent and low levels of variation are felt to be positive, while peaking and high levels of variation may indicate a less balanced market. The Toronto market appears well served with low levels of variation in supply.

### 1.3 Future demand and market development

A measure of demand has been determined using a mix of observation (Baseline) and prediction (future) demand for taxi services. It is noted that the current supply of taxis is appropriate to the level of demands currently observed, allowing for the team to develop baseline measures against which future demand can be tested. In addition to maintaining and improving on baseline service

levels, we feel it to be appropriate that the markets develop to accommodate additional demands the taxi services, including the need for accessibility within the fleet see section 1.4.

Given that demand predictions are subject to volatility, reflecting the nature of the measurements, we recommend that the review be updated every two years. We recommend the use of a rolling 10 year horizon, to provide the industry and the travelling public with a medium to long term review of the taxi industry.

## 1.4 Accessibility

It is our view that accessibility should be promoted as a right to all transport users, regardless of ability or circumstance. This effectively requires the provision of accessible vehicles within the Toronto taxi fleet. As the market for purpose built accessible taxi vehicles is in flux and subject to rapid development, many of the variables on which accessible vehicle costs are measured are subject to change. We have recommended the use of a proportional number of accessible vehicles as a short term approach, and recommend that this element in particular be reviewed in 2015.

## 1.5 Review frequency and application

The study team recommend that the taxi review of the appropriate number of taxicabs be undertaken on a regular basis, and no less frequently than every two years. On this basis we recommend that the City of Toronto undertake a top up review in 2015. It is also noted that ongoing and regular reviews should avoid the need for specific 'triggers' to be identified in so far as the regular measurement will ensure that service levels keep track with changes in demand.

# 2. Introduction

Taxi Research Partners (TRP) are pleased to have been commissioned by the City of Toronto Municipal Licensing and Standards to undertake an independent economic review of the taxi industry, as part of Toronto's comprehensive Taxicab Industry Review begun in 2011. Our brief required us to develop and apply a standard methodology for determining the appropriate number of taxicabs and to develop scenarios for future changes to the licensing system that would address major issues identified in earlier phases of the Taxicab Industry Review, namely the existing two-tier licensing system and options for ensuring the availability of on-demand accessible taxicabs.

TRP performed an economic analysis of Toronto's taxicab industry that was designed to expand beyond the models already explored in the Taxicab Industry Review Preliminary Report. The work was based on a series of steps providing progressive analysis and review, addressing: (1) the prediction of demand for taxi services in the city (a taxi demand model); (2) a review of the differing approaches to licensing and supply of taxis; and (3) application of a Toronto Taxi Market model, illustrating the impacts of changes to supply, including taxi license numbers and industry structure, based on the development of differing licensing scenarios for testing.

The analysis of a taxi market, both in terms of the supply of taxis and determinants of demand, requires the measurement of quantity and quality factors. In order for TRP to perform an in-depth analysis of the industry, we engaged both the taxicab industry and the riding public, to understand the use of taxis under the current licensing structure; and the factors that would develop if the structure itself was changed. Given the nature of taxi licensing, reflecting a series of linkages between regulatory decisions and economic viability, the team undertook a detailed review of the economic relationships apparent within the taxi industry, between the taxi industry and other forms of transportation, and between the industry and its regulators.

Given the implications of this reform initiative, care was taken to properly and formally engage all interested parties. The list of stakeholders included taxi driver groups, Ambassador Plate holders, standard plate holders, brokerages (including mobile app services new to the Toronto market),

fleet operators, accessibility groups, tourism and business representatives, transit operators, and city officials. A series of formal interview questions were consistently posed to groups of stakeholders. Key data sought included:

- Baseline information about each stakeholder's operation and relationship within the current industry structure,
- Current information about patterns of supply and demand, including demand for their taxi service, and
- Future demand for taxi in the context of various future scenarios.

In cases where specific solutions were proposed by a stakeholder group, that solution was incorporated as a part of the scenario testing, set out in detail in this document. Where stakeholders possessed actual data revealing patterns of supply and demand, specifically data from call centres and dispatch systems, requests were made for the data, with the assurance that confidentiality would be guaranteed.

In order to quantify the baseline demand for taxis, TRP developed a passenger survey (Appendix 2) that was available online on a study-specific website. The availability of the survey was advertised through media coverage of the study (radio and print), and by distribution of fliers at key locations such as Billy Bishop Airport Terminal, Liberty Village Shops, Union Station, Variety Village, Dufferin Mall, Scarborough Town Centre, and Yorkdale Mall. Survey information was also provided to a network of community associations, some of whom were able to include details of the study in their newsletters, if their distribution deadlines met the tight timelines of this study. As a primary research exercise, the survey was designed to relate to the respondent's most recent taxi journey. It also posed a series of questions designed to investigate factors that affect the prediction of demand – factors such as relative cost and expectations of service availability.

A taxi driver survey (appendix 3) was also included on the study website and was publicized through the trade press and trade websites. Information gathered from the Taxicab industry Survey, supplemented by dispatch records, provide a detailed review of the supply of taxi services across the city. In addition to the industry-specific issues identified by the Taxicab Industry Review, compliance with the Accessibility for Ontarians with Disabilities Act (AODA) and the Integrated

Accessibility Standards Regulation (IASR) is required. As of January 1, 2013, every municipality in Ontario is required to identify progress made toward meeting the need for on-demand accessible taxicabs. TRP has reviewed the relationships in Toronto between municipal licensing, TTC Wheeltrans, and the industry that are investing in wheelchair accessible taxis.

In this document we set out the methodologies we applied in the stages of the study, the development of the Toronto Taxi Market Model, and its application. In section six we draw these elements together to describe the likely outcomes arising from changes in the industry structure and draw conclusions and recommendations for future change. The conclusion also underlines some of the issues that are inherent in predictive models both in terms of sourcing data, its accuracy, and methods by which this might be updated. Our recommendations include our view that the underlying modeling exercise need be repeated to maintain accuracy and accommodate any errors arising in third party predictions of growth. The team recognize the significance of impacts arising from application of new licensing practice and outline, in the conclusion, methods for updating the base analysis and data.

# 3. Demand for Taxi Services

Demand for taxi services relates to the numbers of passengers, and potential passengers, seeking to use taxi services. The demand for taxis can be measured both in terms of existing use, sometimes referred to as observable demand; and potential new demand. Potential new demand can arise from changes in external factors, such as the growth of a city, but can also relate to hidden demand, sometimes called latent or suppressed demand, from individuals currently choosing not to travel by taxi for a variety of reasons. Trip suppression is often reported in the case of wheelchair dependent passengers, but can extend beyond this to a range of other potential passenger trips.

In the first part of our review we estimated the numbers of trips being made and potential change in the level of demand over the next ten years. The study identified a baseline level of demand reflecting the numbers of passengers using taxis in 2012, against which we predicted demand over the next ten years. Existing use of taxis was estimated using recorded and reported statistics, both those collected by brokerages as a part of the electronic dispatch process; and those reported by members of the public through surveys. Changes in demand to 2022 were predicted using a series of indicators, described below. It is important to note that predictions of demand are subject to variation as the factors influencing future use of taxis can change over time. For this reason the team have looked closely at the choices made and reasons for taxi use, as well as broader measures of demand, discussed below.

## 3.1 Baseline Demand

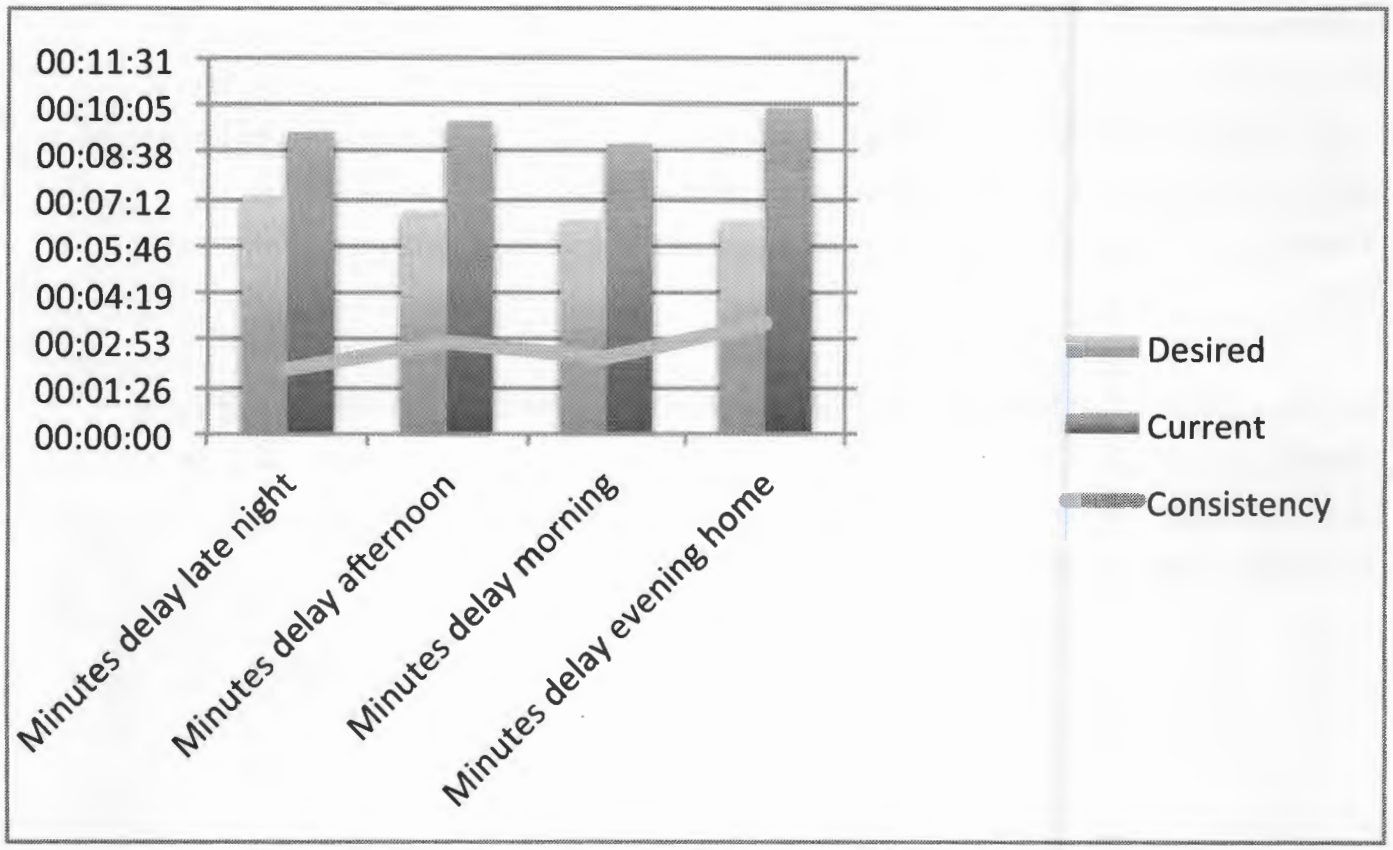
Baseline demand relates to the current use of taxis in Toronto. The team undertook a series of surveys in January and February 2013 including Public Surveys, Taxicab industry Surveys and Stakeholder Analysis, to understand current use of taxis in the city. We also used electronic data provided by taxi brokers relating to dispatched taxi trips.

### 3.1.1 Public Survey

A public survey was undertaken using tablet computers and online survey techniques. The survey was designed to relate to the respondents most recent taxi journey. A total of 1200 surveys were completed across the city, identifying use of taxis, pick up locations, methods of engagement and experiences. The survey also included questions related to cost sensitivities and use of alternative services, wait times experienced, and those considered desirable (see Appendix 4).

Results from the public survey are set out in more detail in subsequent sections, but can be seen to highlight the currently good level of service across the city. Four journey types are highlighted, demonstrating desired service levels and actual delivery for taxis travelling home at night, for travel from shopping in the afternoon, for commuting journeys in the morning, and evening travel from home, see figure 2.

Fig 2: Baseline Taxi fleet delay, desire and performance



In each of the four time periods levels of service felt desirable by survey respondents are compared with the actual delivery times observed amongst the fleet. Thus the public stated desire for services to be provided within 7 minutes 17 seconds for late night travel is typically served within 9 minutes and 16 seconds, ie: an additional waiting time of 2 minutes. A slightly higher delay is experienced for afternoon shopping trips (desired: 06:49, current: 09:35). Morning commuting trips and evening trips from home to entertainment are delivered with similar levels of wait time (Morning commute, desired: 06:32, current: 08:53; Evening trip from home, desired: 06:30, current: 10:00).

While it is important to underline that mean delay does not equate an individual experience, but rather the average delay across all respondents and across all reported journeys, the current levels of delay can be considered good when compared with other locations. Moreover variation of delay, indicated by the consistency line, suggests that the extent of delays do not peak significantly in any one period of time, but rather indicate a consistently low level of delay ranging from 8 - 10 minutes, against a stated desired level of 6 - 8 minutes. Measured delay in other cities using the same electronic datasets compare less well, Atlanta, GA - mean delay: 12 minutes 46 seconds; Nashville, TN- mean delay: 15 minutes, 9 seconds[1]. It is noted that the measurement of delay is subject to city specific conditions, including traffic, demand location, highway design and distances to access pick up locations, and is not constant. Indeed some delay is a necessary element of taxi use as taxis respond and will often need to drive some distance to the start of a trip.

It is our suggestion that the current level of delay represents a relatively good service in the city, allowing us to use the current baseline as an indicator of appropriate future supply levels. Changes in the market, both in terms of demand for taxis and their supply should seek to ensure that the same level of service is maintained or improved upon.

[1] Delay times for Atlanta and Nashville are taken from live taxi dispatch data in the period 2011 - 2012, and is subject to change.

### 3.1.2 Taxicab industry Survey

Members of the Taxicab industry were approached through representative groups, and individually, to identify a full range of operating experiences, as identified by the trade themselves. A series of meetings were undertaken across the city with the kind assistance of taxi representative groups (see appendix 5), with individual members of the Taxicab industry also able to present their views and express their concerns using an online survey included on the study website. Awareness of the survey and our aims in seeking trade opinions, were forwarded via the trade press and in individual contacts made by the study team. A full list of all trade respondent bodies is included in the appendices of this document. We also included an online version of the Taxicab industry survey using a study website advertised in local media.

### 3.1.3 Stakeholder Review

In addition to the views of the public, and to those of the Taxicab industry, the study team undertook a review of wider stakeholders across the city (see appendix 5). A stakeholder can apply to any person or group with an interest in the development of the Taxicab industry, and included brokers, user groups and groups with an interest in specialist transport. The most visible 'specialist' use of taxis was felt to be the availability of the mode to accessible users which, by extension, includes the use of taxis as a part of the TTC Wheel Trans service, though a variety of further specialist uses may also be considered including on-demand accessible transport, distributor transport, and the role of the taxi alongside fixed route transit. The stakeholder review also extended to include city officials and official bodies with a role in transportation.

## 3.2 Developing Demand Indicators

Engagement with public, trade and stakeholders allow the team to develop specific demand indicators for use as a part of our demand model. A Demand Model provides a structured assessment of current, and future, use of taxis that can be measured against supply. Demand indicators highlight the effectiveness of the market in meeting demand, and can be extended to license numbers, where their measurement allows a city to define how many licenses should be issued.

Historically many cities, including Toronto prior to 1982, have linked a change in population to the demand the taxis, sometimes expressed as a population to license ratio. In its simplest form the population to license ratio provides a basic indicator of the number of taxis that may be appropriate to serve a city of a given size. As the population increases, it can be argued, so does the demand for taxis. The indicator suggesting a simple positive correlation, ie: a 10% increase in population might be argued to justify a 10% increase in the number of taxis licensed.

More complex demand indicators have followed, in Toronto as a result of the 1982 Curry, Coopers and Lybrand report, introducing additional 'factors', demand surrogates, including: population across the wider greater Toronto area (GTA), airline deplanements, as well as the addition of some forms of transit as additional demand indicators. The use of a wider series of demand 'factors' acknowledges that the link between population and taxi use may be somewhat more complex than a linear relationship to population alone; ie: at the actual use of taxis reflect a wider range of demand 'drivers' that may include use of transit, numbers of incoming tourists, population densities etc. A review of the principles of surrogates demand as applies in the USA can be found in Schaller (2005) '*A regression model of the number of taxicabs in US cities*'.

The use of demand indicators, or surrogates, from measured demand, allows the assessment of change on a measured basis, using verifiable third-party statistics. Schaller's work, along with that of the City of Toronto, supports this use by seeking to validate the accuracy of any change in the indicator against actual changes in the use of taxis. Closeness of fit, strength or weakness of the indicator, allows for the update of the measurement over time. The approach has been limited, however, by the ability of an authority to fully identify the use of taxis, and thus the accuracy of the measurement of 'fit'; ie: the validation of appropriateness of surrogates, and thus any measurement of 'causality' is restricted.

Further issues may relate to potential barriers to measurement, noted historically, including: reluctance to report actual patterns of supply, inaccuracies in reported data, different data disaggregation – including different zonal structures or methods of identifying pick up and drop-off locations. The extent to which these barriers remaining is questionable, as many, if not all, electronic systems record copious amounts of data by default, and should allow for a more

accurate use of real data than possible in the past. This is explored in more detail in subsequent sections of this document.

A further level of complexity exists in Toronto as a result of the ongoing review of license structure as well as the absolute numbers of licenses issued. Effectively potential shortfall in supply, where higher demand results in falling service levels, can be addressed using a mix of changes in numbers and changes in license structure. Any structured approach to testing impacts need to account for changes in demand, including changes arising from latent demand, and changes in structure. We have addressed this by developing a more detailed assessment of the Toronto taxi market, including the measurement of demand and market linkages, described below.

### 3.2.1 Measured Demand

A number of alternative approaches to the predictive or surrogate method of demand analysis exist, based on the measurement of actual demand. Any fundamental difficulty arises from the accuracy of predictions of surrogates, as well as there causality in taxi use. Measured demand, on the other hand, provides an accurate reflection of current use to date and may, in combination with predictive modelling, provide a more accurate alternative than surrogate assessment alone. It is appropriate to note that the two approaches, predictive and measured demands, are not mutually exclusive. Indeed, in many of the discussions undertaken in our work stakeholders have underlined the need to account for actual use (measured demand) in determining which factors affect the prediction of demand.

Measured demand is based on the ability to observe into account the actual use the taxi services, and this in itself places an emphasis on the ability to source accurate information. The accuracy of data and the ability to collect it has been questioned in previous reviews (EPG 1997), though it is our opinion that this argument is no longer valid as a result of the routine use of automated electronic processes, discussed in more detail below.

In our review we have identified linkages between trip origins, reported in public surveys; operating patterns apparent from electronic data; and observed trade operating practice; to determine composite demand indicators, patterns of demand associated with specific taxi use,

that provide a more accurate causality in predicting taxi use than may be achieved by the use of surrogate indicators alone.

### 3.2.2 Composite Demand Indicators

In preceding sections we have suggested that differing demand indicators were not mutually exclusive. The development of a composite demand indicator based on operational statistics and demand surrogates, provides a sound base for demand prediction and license issuance. We have identified composite demand indicators on the basis of:

- Measurement of a baseline of existing service levels,
- Measurement of spatial disaggregation of demand,
- Measurement of temporal disaggregation of demand,
- Measurement of demand by trip purpose,
- Identification of indicators of demand in light of the above,
- Identification of patents and latent demand,
- Prediction of change in demand using indicators as identified, and
- Methodology for validation and update in light of changes in the factors identified.

The composite demand indicator provides a basis of demand prediction by identifying specific trip origins by purpose, and as distributed by time and space across the city. The first of these, trip purpose, allows for the correlation of specific growth factors (surrogates) to an identifiable trip production rate; the latter, spatial and temporal disaggregation, to a definable service level indicator. In our analysis we have identified four time based service level indicators across the city, further disaggregation is possible.

### 3.2.3 Trip Production Rate

The third element in updating demand indicators is the development of a trip production rate across differing trip purposes.

In its simplest form, the trip production rate is an indicator of the number of trips that may be attributed to any one location for any one purpose. This might range from a single dwelling of a

given size, to a large facility, including convention centres. The trip production rate may be applied across all previously used metrics, allowing for the identification of reported trip origins, measured and observed pick up locations, and predictions of growth including the conventional use of demand surrogate indicators, discussed in more detail below.

Individual trip production rates are also appropriate in that peaks in trip rates have an impact on vehicle availability and may be considered using temporally disaggregated production. The most common peak, for late night travel at weekends, may be directly attributable to trip productions in entertainment premises, has a direct impact in terms of perceived and actual shortfall in taxi availability, but may not be identified or identifiable from demand surrogates alone. The use of trip production rates allied to both observed and predicted demand models are described in this document, using change rate indicators (predicted demand indicators) over a ten year horizon, and applied to the structure of the fleet over the remaining part of our study.

In section 4, Market Demand Model, we identify the elements of assessment used to create a demand prediction, and its update in discussion with Toronto stakeholders. We also set out our feedback loop which we have applied to reflect changes that different license structure scenarios might predicate.

# 4. Market Demand Model

The Market Demand Model provides a Toronto specific measurement of taxi demand and taxi service, effectively the measurement of demand and supply in the city. The model addresses both the concept of responses to changes in demand, and the determination of adequacy of supply. The approach follows from the combination of both demand prediction indicators and use of measured demand, a composite approach described in the preceding section.

## 4.1 Demand Factors

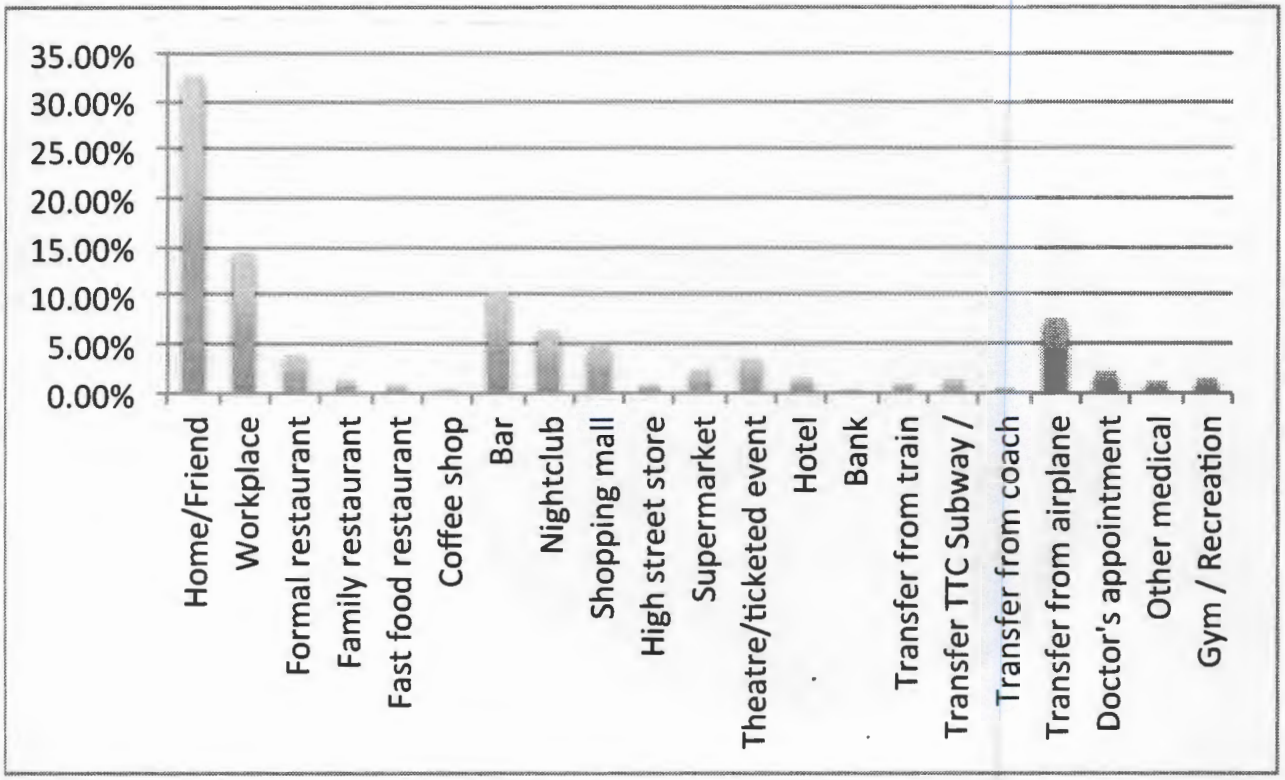
In our initial stakeholder engagement we sought the views of those providing taxi services, those using taxi services and those with an associated interest in the services offered in the city. The process of engagement was not limited to the identification of demand factors alone, and continued throughout the study to provide a wider opportunity to comment, and to develop a series of scenarios for testing in latter stages of the analysis.

A significant and recurring theme related to the identification of current use patterns, ie: how are taxis used at the moment, and which measurable demand factors might be attributed to these uses. We have based our assessment on observed demand indicators, using large response surveys as a basis for identifying and validating demand indicators. We have also made use of current electronic datasets collected as routine in dispatch operations, to identify measurable and recorded trips in the city. The datasets thus collected provided an input both to the development of the market demand model and to economic impact assessment, reported in subsequent section of this document.

## 4.2 Demand Patterns

Current observed and reported demand is identified using three metrics: trip origin, spatial location, and time. Figure 3 illustrates trip origins citywide.

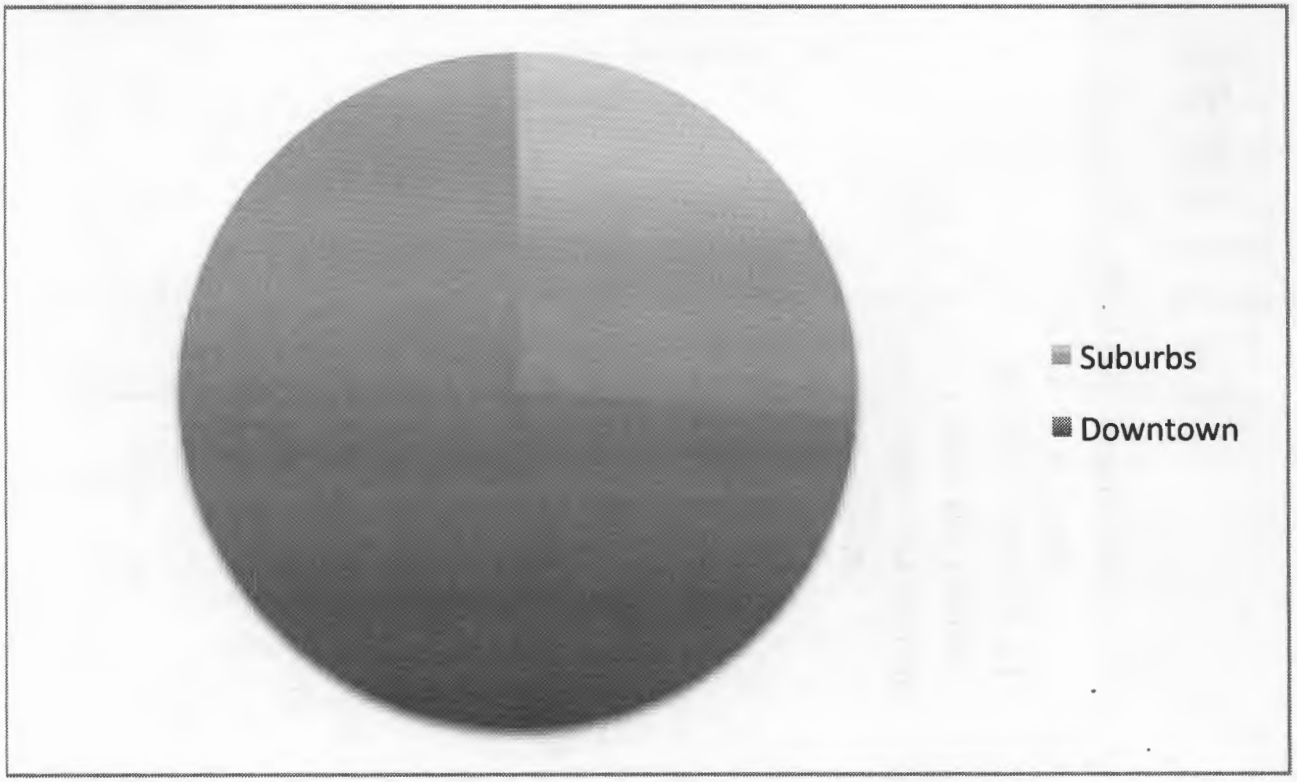
Figure 3: Trip Origins




Source: Passenger reported data, public survey

Stated trip origins indicate that a significant number of trips originate from residential locations, from home or the home of a friend, with the second largest trip origin being from the workplace, both related to the permanent population of the city. Entertainment also scored highly, reflected in the numbers of trip origins from Bars, Nightclubs and Ticketed events. Transfer from airplanes also registered as a significant origin, though transfers from other forms of transportation were less significant. The split between downtown and suburban use of taxis was also identified, see figure 2, with a significant majority of all trip origins defined as being from the downtown area.

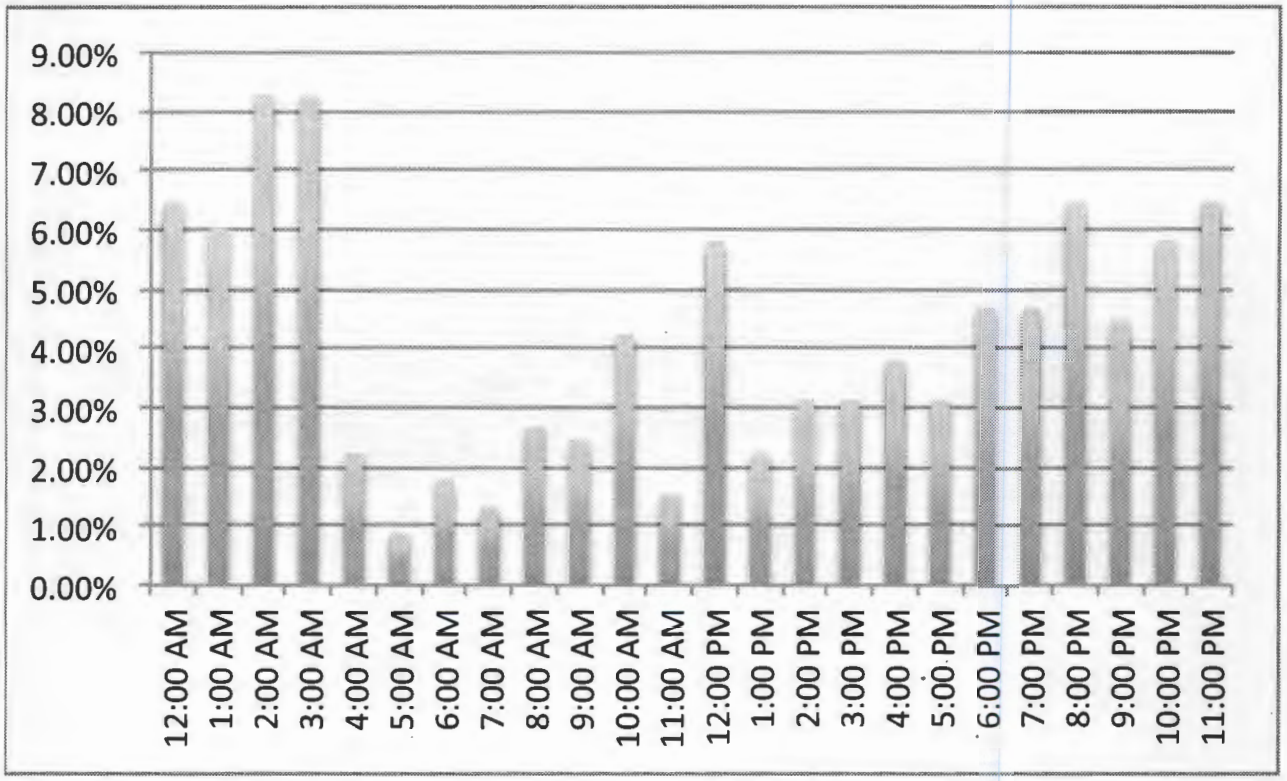
Figure 4: Trip origin split, downtown and suburban.




Source: Passenger reported data, public survey

The percentage split between suburban and downtown trip origins is broadly consistent with the stated trip origin illustrated in figure 4, though the precise definition between suburban and downtown neighborhoods is not given.

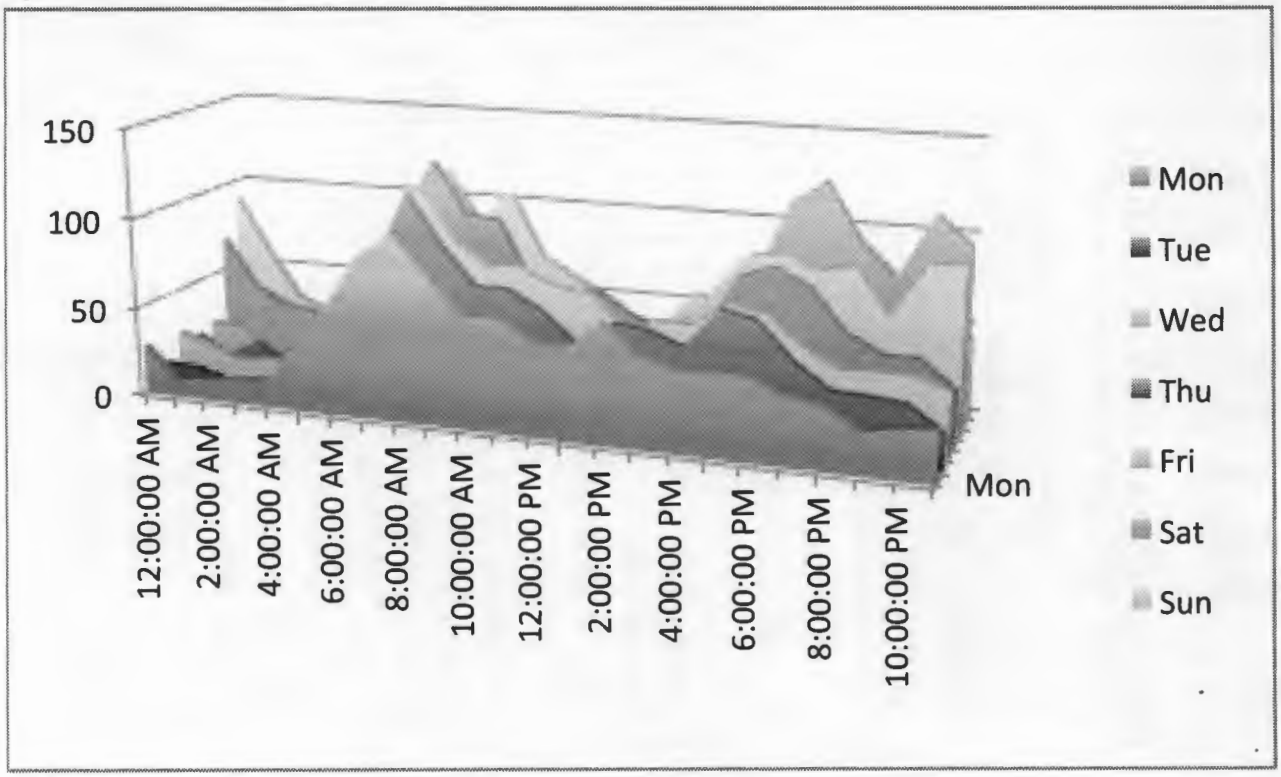
Figure 5: Trip productions by time




Source: Passenger reported data, public survey

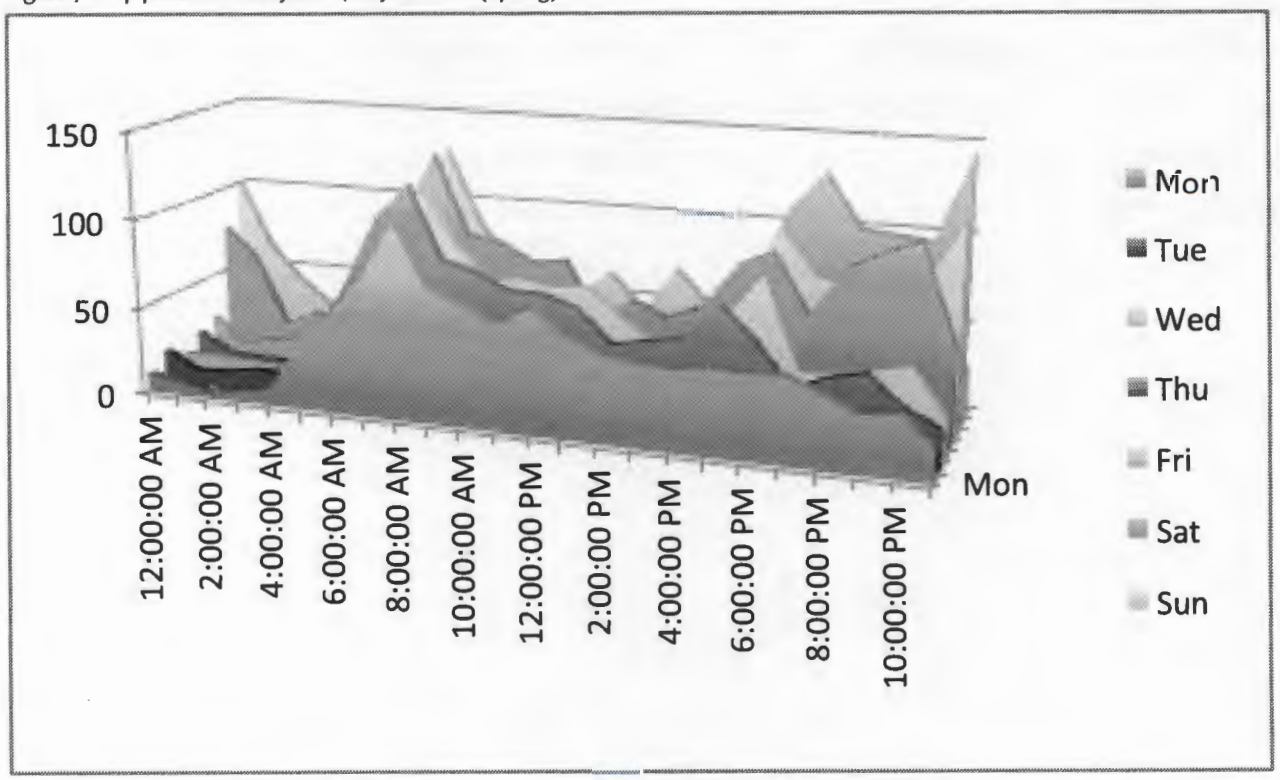
Trip origins may also be split by time of day, see figure 5, and by day of the week and season, see figures 6- 9. A distinct and repeated pattern is observed, with night time peaks particularly visible at 2 and 3am, and distinct troughs around 5am. The patterns fluctuates by day of the week, see subsequent figures, but remains reasonably consistent between seasons.

Figure 6: Trip productions by time / day of week (Winter)



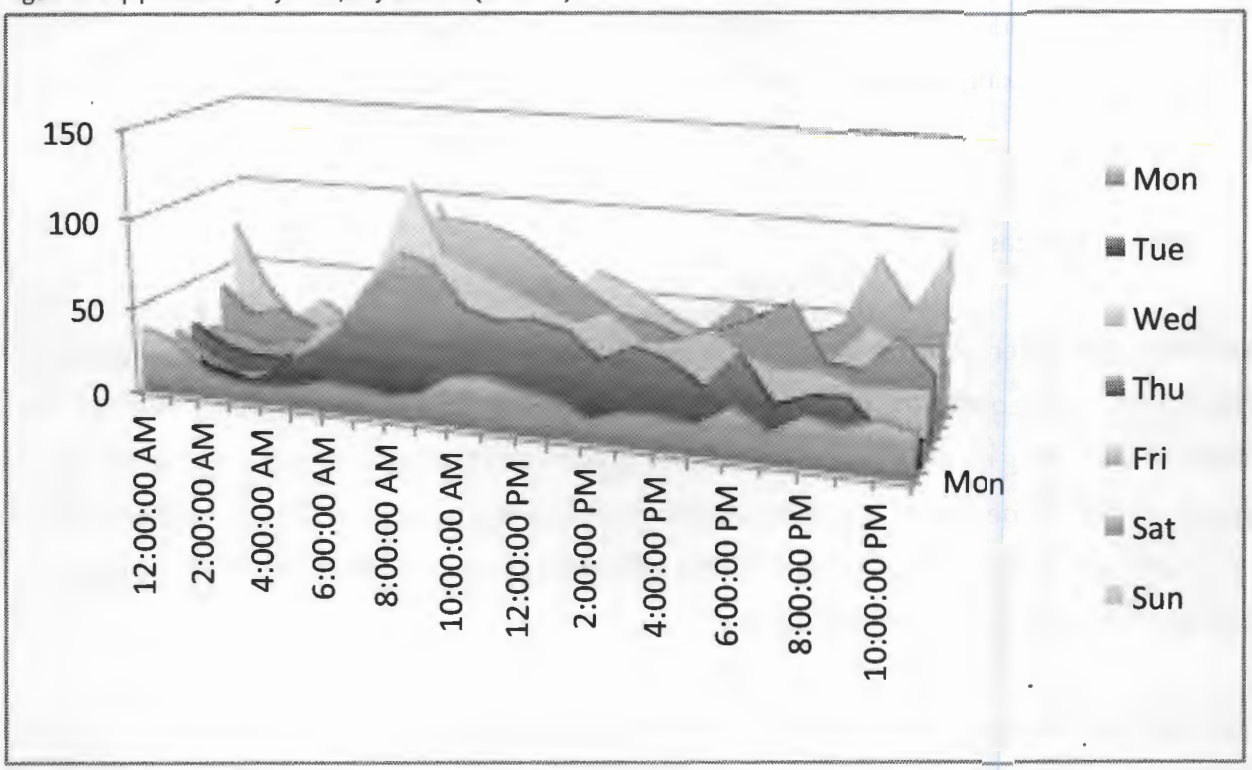

Source: Operator Electronic Records

Figure 7: Trip productions by time / day of week (Spring)



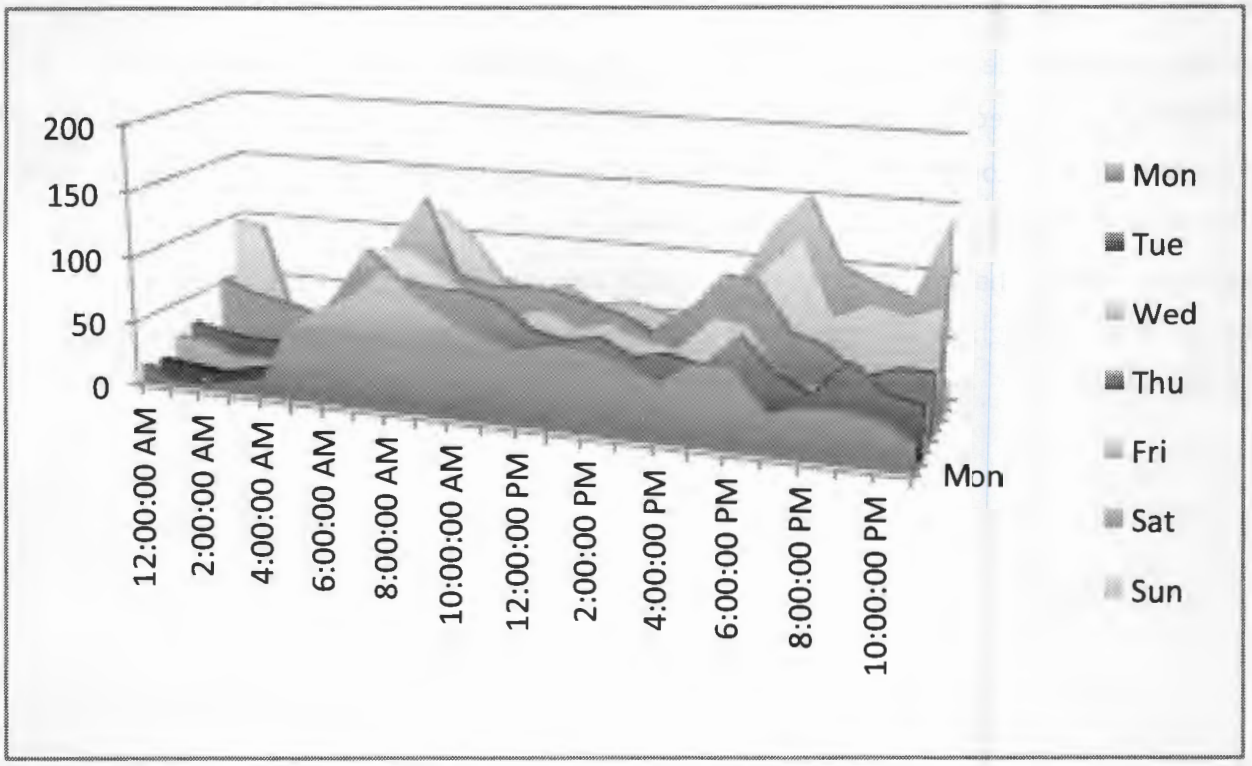

Source: Operator Electronic Records

Figure 8: Trip productions by time / day of week (Summer)




Source: Operator Electronic Records

Figure 9: Trip productions by time / day of week (Fall)




Source: Operator Electronic Records

While it is possible to identify some variation in the numbers of trips being required across the seasons, demand peaking patterns remain remarkably consistent across the year.

## 4.3 Demand Forecasts

In addition to the observation of current patterns of use, the development of a forward looking demand model also requires the application of a growth factor used to predict likely change in the numbers of trips being made in future years. Likely growth can be identified against a number of measures which include likely changes in population size, growth in tourism etc., sometimes called demand surrogates as they approximate factors influencing the use of taxis, with many studies using the sum of such surrogates to forecast future use.

We have also applied a surrogate forecast methodology, using stated predictions across a range of demand surrogates, with an additional element related to trip origin, reflecting differing trip types. As in any city Toronto reflects a range of uses, patterns of demand, and reasons for making taxi trips. We have identified a series of key trip types, based on stated frequency of taxi use from the public survey, to include the six (6no.) primary trip origins. Trip origins within the city are thus identified with measured demand surrogates applied as set out in figure 10. Smaller trip origins, such as transfer from Long-distance coach etc., are also included within an "others" category, but are not measured in terms of surrogate demand indicators. The measure is applied to trip origins within the city rather than trip destinations reflecting the need to determine changes in trip production rate. A weighting is derived from the stated frequency of trip by type determined in the public survey.

Figure 10: Trip Production indicator and frequency weighting

| Trip Origin | Demand Surrogate Indicators | Weight* |
|---|---|---|
| Residential | Occupied Private Dwellings | 32.72% |
| Workplace | Occupied office space / employment rate | 14.46% |
| Entertainment: Bar, Nightclub, Ticketed event, Formal Restaurant | Per Capita Income | 24.13% |
| Hotels | Numbers of Tourists | 1.59% |
| Transfer from heavy rail | Rail passengers | 0.98% |
| Transfer from TTC | TTC passengers | 1.35% |

Source: Passenger reported data, public survey

* Weighting based on reported trip origins.

### 4.3.1 Residential Trip Origins

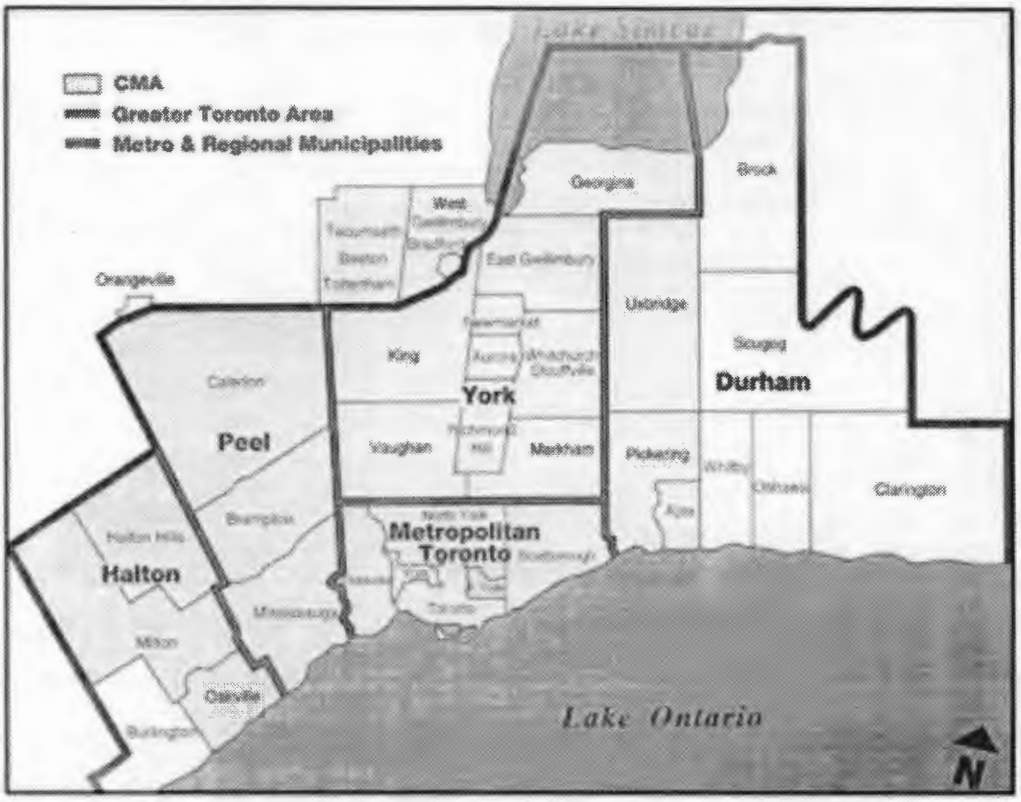
The city's review of demand indicators (2012[2]) identified a strong correlation between population (surrounding population) and demand. Given that 32% of all current taxi trips are attributed to residential trip origins this is a logical element in the analysis, see figure 10, above. Several different statistical measures are available, however, based on distinct and differing geographical distinctions. Metropolitan Toronto Population, CMA Population and Surrounding Population are defined and measured separately, see Figure 11, with a need to distinguish which trip productions may be attributed to which indicator.

It is also noted that trip origins arising from surrounding populations may actually be reflected in demand indicators other than population statistics, such as trip chains from surrounding populations with taxi trips originating from transit of GO train transfers, including those returning from Metropolitan Toronto to its surrounding regions following night time entertainment. The latter reflecting the asymmetrical nature of taxi demand, in which taxi trips may be made in one direction alone, often allied to a public transit journey on an inbound leg of a trip. A detailed discussion of asymmetric taxi demand can be found in King (2012) *'Live GPS data; understanding*

[2] City of Toronto Taxicab Industry Review, preliminary report, Sept 2012, Appendix B p 10 (Toronto Preliminary Report 2012)

*asymmetric demand for mode choice planning by taxi.'* Presentation to IATR conference 2012 (www.iatr.org).

Figure 11: Spatial boundaries and definitions




Source: University of Toronto Data Library Service, accessed: January 2013

Pre-existing studies have applied a variety of demand surrogates that impact on residential populations. The simplest of which, populations (of various spatial definitions), may fail to fully account for specific trip drivers, and run the risk of dual counting from trip chains.

In our analysis we have defined a residential trip production variable specific to the City of Toronto, contiguous to the licensing area controlled by the city, with the result of allocating this surrogate purely to trip productions occurring within the city itself. Section 4.4 details both quantification and application of this surrogate to the demand model.

### 4.3.2 Workplace Trip Origins

The second largest reported trip origin was the workplace, accounting for 15% of all trip origins across the city. Workplace trips were felt to reflect numbers of locations from which trips might originate, but should also reflect the extent to which employment was available. Demand Surrogates used and available include employment across the city, as well as the geographically defined areas as set out in figure 8.

Trip production rates based on occupied office space and weighted for employment rates are seen as an appropriate measurement of workplace trip production.

### 4.3.3 Entertainment Trip Origins

A significant peak in demand for taxis can be associated with the use of taxis home from entertainment. Figure 5, in section 4.2, illustrates the peaking associated with late night use of taxis, with a further illustration of the effect of day of week in figures 6 - 9. Travel from Bars, Nightclubs and ticketed events accounts for 21% of all reported trip origins. Formal restaurants may also be included in this category, accounting for an additional 4% of trip origination, making this group, collectively, the second highest trip origin.

Given the impact of entertainment trip origins on peaks in demand, a factor in the availability and adequacy of the taxi, it would appear appropriate to identify these trip productions on current observed and predicted base. A per-capita income variable is applied to predict growth in entertainment trip origins.

### 4.3.4 Airport Trip Origins

Airport originating trips differ significantly from those within the city. A range of views were expressed in relation to the nature of taxi licensing, particularly at Toronto Pearson International Airport, that focused on the nature of relationship between a citywide license policy and market responses at the airport.

Differences exist both in the nature of permitted taxis operating from the airport, and the potential disconnect between city fleet size and service levels at the airport itself. In short, a

change in demand for taxis at the airport would not necessarily be influenced by a change in the fleet size within the Toronto licensing area. Similar structures and difficulties arise in other airports worldwide, and are seen at the Toronto Pearson International airport. While the majority of airport taxi trips are made in both directions, trips can be picked up at Toronto Pearson by a variety of different taxis from surrounding cities, including those travelling directly to Toronto. Airport trips originating in the city are measured as part of growth in their respective origins, while those originating from the airport are not included. Growth in airport originating passengers using Toronto taxis are not included and may result in an underestimate of growth from this trip origin.

It should be noted that the actual performance of taxis at the airport, and the nature of control applied, fall beyond the scope of this analysis, and should be considered as a separate issue to the definition of services within the City itself.

### 4.3.5 Other Trip Origins

Other trip origins reflect lower levels of demand from other locations within the city. This does not exclude their importance, but limits the impact of their inclusion. Notable differences exist between the strength of correlation identified in the city analysis for GO train ridership, and the potential causation of the mode. In our survey transfers from heavy rail, including GO, accounted for 0.98% of all origins; with 1.34% of trips originating from transfers from TTC transit. Long distance coaches were even lower, accounting for 0.49% of trip origins. Shopping Districts (0.86%) were also low producers of taxi trips.

While other trip origins represent relatively small percentages in their own right, the cumulative effect is larger. This may result in an underestimate where a smaller trip origin grows rapidly. It is proposed that the identification of growth factors be included in review updates.

## 4.4 Quantification

In this section we set out an indication of demand and predicted changes to demand using the trip production growth rates defined in previous sections identified using historic reported and predicted statistics. We have based our calculation on citywide growth using published current and predicted values as described below. We have also set out a performance metric demonstrating the service level achieved within the current fleet.

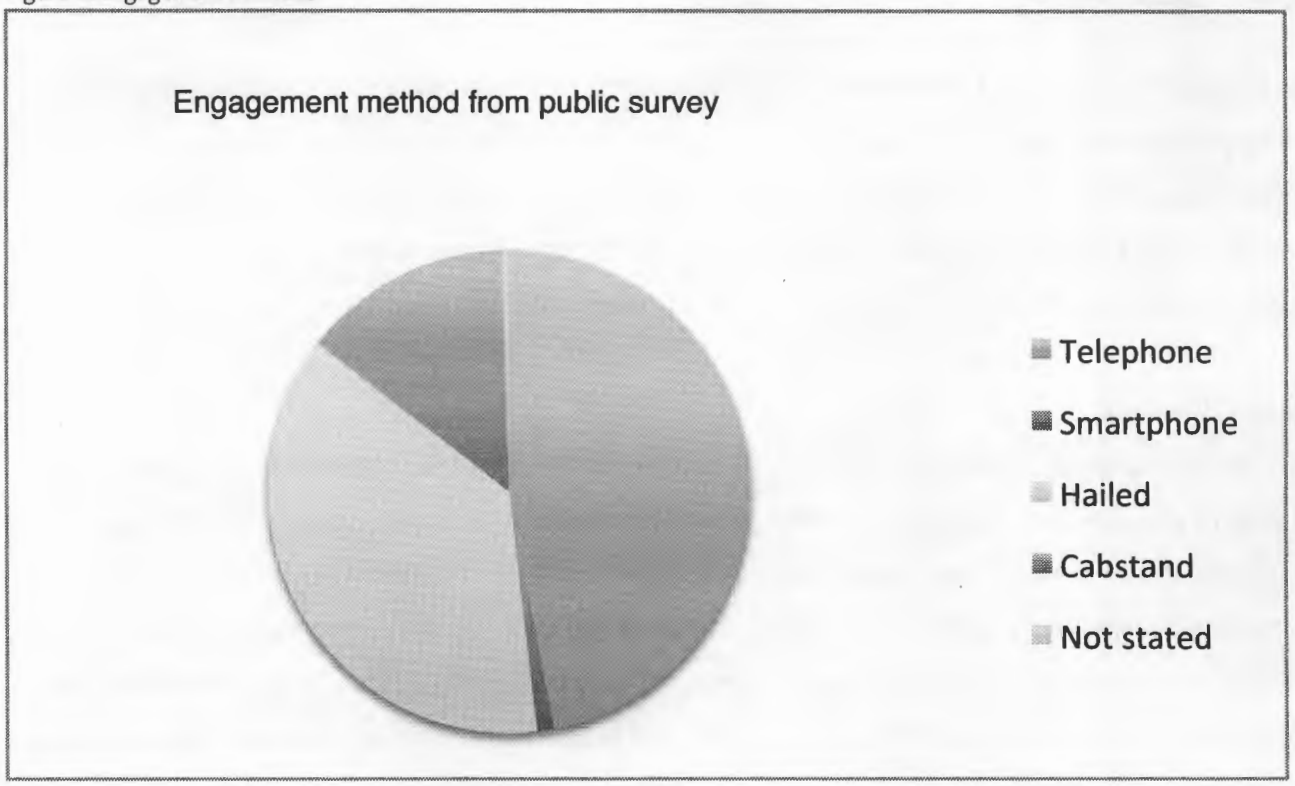
### 4.4.1 Baseline

The study identified a baseline of current taxi use across the city. Use of taxis can occur across a range of engagement methods, the method by which a taxi is procured, across different areas (spatial), different times (temporal), and from different premises (origins) across the city. These variables allow for a range of disaggregation by time and location and form a basis for testing differing licensing scenarios, described in section 5. Taxi use baseline data was identified using two primary datasets, electronic data provided from taxi brokerages, and reported taxi use from public surveys.

Two large traditional taxi brokerages and one app-based brokerage provided operational data which included reported trip numbers at four sample weeks throughout the year. Data was collected for February, May, August and November 2012. A trip distribution rate was obtained for dispatched trips on the basis of these datasets and applied across the dispatched fleet. Independent drivers, those not allied to brokerages, and thus only able to pick up hailed and cabstand trips, were also factored into this calculation. A further survey of taxi drivers identified issues in accessing taxi cabstands, discussed in subsequent sections, but was not used to identify split in engagement type.

Brokerage-dispatched trips represent only a proportion of all taxi trips in the city, with other common methods of engagement including taxi hail, taxi cabstand and apps. The proportion of trips by engagement method was calculated using reported engagement behavior and applied to the total identified trips to give a total baseline figure. Figure 12 illustrates the split between engagement methods.

Figure 12: Engagement methods




Source: Passenger reported data, public survey

The most commonly used engagement method is telephone booking (dispatch) trips, with a significant number of the remaining trips hailed on street. A significant minority of trips were also engaged at cabstand. The least frequent engagement method, smartphone app, is also the fastest growing, with potential impacts on data collection and accuracy in future reviews, discussed in the conclusions section of this document. Baseline statistics are also used to define spatial location and origin type, described above, - an input to the trip production frequency and weighting calculation, see figure 13.

The Toronto preliminary report (2012) estimated 21.9 Million taxi trips were made in any one year, see Figure 13, with a figure of 21.7 Million taxi trips estimated using electronic and survey data (-1%). A breakdown of taxi trips by engagement type is set out in figure 13.

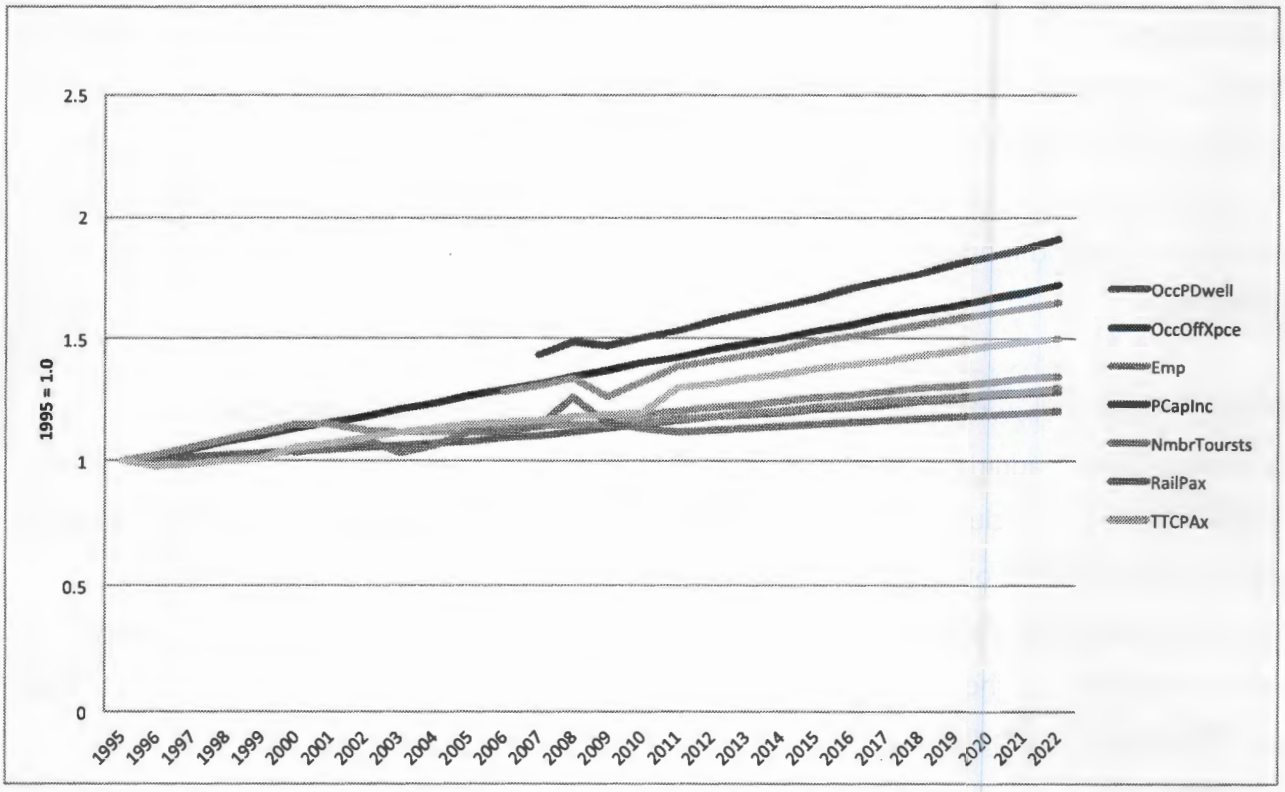
Figure 13: Annual Trip Estimates and breakdown (rounded)

| Engagement Method | Trip Number | Estimation methodology | Total |
|---|---|---|---|
| Dispatched | 10.6 Million | Model base using public survey data | |
| Hailed | 6.7 Million | Model base using public survey data | |
| Cabstand | 4.4 Million | Model base using dispatch company data, survey and license split | 21.7 Million |
| | | Estimated given in Toronto Preliminary Report | 21.9 Million |

### 4.4.2 Predicted changes in demand

Changes in demand are identified using trip production indicators, described in preceding sections. Trip production rates are used for each of the major trip origin types with changes identified against growth indices using current and predicted statistics, see figure 13. We have used the same process as reported in the 2012 City of Toronto preliminary report to normalize demand indicator variables to 1995 = 1.0 where such data was available. Variables with data available only after 1995 are included from the commencement of their availability.

Figure 13a: Indexed projected growth for Demand Surrogate trip production factors



A weighting is applied using reported origin frequencies, which allows for validation and updating over time. Harmonized demand surrogates are imported into the taxi market model as a growth factor, illustrated in Figure 14, below.

Figure 14: Trip production factors based on demand surrogate

| Trip Origin | Weight | Percentage change 2012 - 2022 |
|---|---|---|
| Residential | 0.33 | 6.39% |
| Workplace | 0.14 | 12.37% |
| Entertainment | 0.24 | 21.38% |
| Hotels | 0.02 | 19.46% |
| Heavy Rail | 0.01 | 6.72% |
| TTC | 0.01 | 16.05% |

### 4.4.3 Application to trip productions

For each of the trip production types, identified in preceding sections, a growth rate is applied equivalent to the constituent growth factor index elements, illustrated in figure 11 as trend line growth, weighted by the current incidence of production factor. The sum of the applicable weighted change represents the predicted change in that particular production factor. As both production origin and predicted growth are likely to change over time it will be appropriate to review and update this analysis over time. A method by which the model may be updated is set out below.

The application of growth factors to baseline taxi trips, illustrated in figure 14, allows the calculation of likely additional demand by trip production factor. It is important to note that this calculation does not include new traffic that may be attracted to taxicabs as a result of a change in licensing structure, nor of trips resulting from new requirements, such as the provision of wheelchair accessible taxis, and these provide the basis for scenario building in the subsequent parts of the study. On the basis of trend line data, operating statistics and reported taxi use at the time of writing, it is possible to suggest an increase in taxi use of 9.63% to the 10 year horizon of

2022. It is noted that this growth excludes additional growth at Toronto Pearson airport and in smaller trip production types (others) which are currently defined as growing at the mean rate calculated and may result in an underestimate of growth allied to these factors.

### 4.4.4 Structural Impacts on Demand

In addition to the measured demand elements, set out above and based on current trip production patterns, a number of additional issues may increase the use of taxis in the city. We have referred to these as structural changes, and note that very little agreement appears to exist between stakeholders as to the appropriate nature of structural reform.

Structural changes may relate to the licensing structures under which Toronto taxis are provided, but may also relate to vehicle design, meter rate structures, and to the availability and suitability of physical infrastructure, such as cabstands. Each of these elements has the potential to affect the nature of Toronto Taxis, and their use. In our submission we identified these as integral to the market assessment model, the application of which is set out in subsequent sections of this report.

# 5. Scenario Building

Having established baseline service levels, public attitude and trade responses, we have developed a series of scenarios that would be appropriate for testing within the market model. A scenario may be defined as a series of variables that may be appropriate to application, effectively potential and realistic options in the development of the Toronto taxi industry. The inclusion of a scenario does not imply that it will promote a favorable outcome, but rather the option represents a potential set of circumstances for testing. Scenarios were developed as a primary part of our stakeholder consultation, including with the city, and are described below. Many of the scenarios included modification of the license structures in the city, and are preceded in section 5.1, by a series of definitions of current and potential future license types.

## 5.1 Definitions of license types applied in the scenario building

Taxi licenses vary in Toronto reflecting their history, with differing types allowing a combination of shifted and non-shifted vehicles, licenses transferability and associated conditions, see figure 15. Current licenses include Ambassador (AMB) and Standard (STD) Licenses, with a number of variations tested as scenarios, using the terms AM1, AM2, ST1, ST2 as described below.

Figure 15 License types and characteristics

| License type (designation) | Transferability | Shift requirements | Driver Stipulations | Issuance restrictions | Notes |
|---|---|---|---|---|---|
| Ambassador (AMB) | Not Transferable | Single shift, limited working hours | Owner Must Drive (OMD) | | License currently issued |
| Single shifted transferable Ambassador (AM1) | Transferable | Max 7 shifts / wk | OMD Min 1725 hrs / year (3 shifts / wk) | Transitional license, no new plates | Transitional type for testing |
| Double Shifted transferable Ambassador (AM2) | Transferable | Min 10 shifts / wk | OMD Min 1725 hrs / year (3 shifts / wk) | Number to increase on measured base | Type for testing |
| Standard (STD) | Transferable | Multiple | | Legacy license no longer issued | License in circulation and by transfer only |

| | | | | | |
|---|---|---|---|---|---|
| Single Shifted Modified Standard (ST1) | Transferable | Max 7 shifts / wk | Owner may engage lessee. No sub-leasing | Transitional license, no new plates | Transitional type for testing |
| Double Shifted Modified Standard (ST2) | Transferable | Min 10 shifts / wk | Owner may engage lessee. No sub-leasing | | Modified license for testing |

The Ambassador license (AMB) is the currently available non-transferable license. Two modified versions (AM1 and AM2) allow for single shifting and double shifting respectively and are able to be transferred. The currently used, but no longer issued, Standard license (STD), is also tested in two modified forms (ST1 and ST2), allowing for single and double shifted operation respectively, subject to the restrictions as set out in figure 15, above.

Differing license types, including modified versions of existing licenses are include in developing scenarios, market tests, described below. In instances where shift drivers are allowed we have allocated a split between Owner Drivers and Shift Drivers, in a double shiftec vehicle that one shift will be provided by a shift driver, described in more detail in subsequent sections.

## 5.2 Scenario Development

A scenario is intended to provide a basis for an analytical test using a common set of measures (metrics) or performance indicators. The indicators are selected on the basis of common impacts and allow for the comparison between scenarios of impacts of each. The scenario represents a series of market modifications (target test) that can be tested against the baseline (base test). In all instances levels of passenger service, measured in terms of Cab Shift Availability (CSA), is maintained, ie: passengers will not experience a reduction in service levels in any scenario.

Following consultation we have selected four (4 no.) primary scenarios on the basis of potential structures - patterns of licensing and control that may be applied legitimately to the operation of taxis. A number of additional variations have also been tested, highlighting the impacts of subsidiary changes within the scenario itself, such as may result from changes in fare amounts, or specific price changes applied to single elements of operator cost. The process of selection was

based on a mix of stated city options as well as structures outlined to the study team in the Stakeholder Engagement element of the study. A review of comments made to the team during the stakeholder engagement elements of the study have been included in the appendices of this document. Figure 16 outlines the options tested under our 4 primary scenarios.

Figure 16: Scenarios tested

| Scenario Description | Ambassador License | Standard License | Wheelchair License | Additional Accessibility requirements* | CSA Variable |
|---|---|---|---|---|---|
| 1: Status Quo | Single Shift, Owner Must Drive (OMD), License not transferable. Issued as market demand dictates | Multiple shifts, variable allocation, license is transferable. No Longer issued but remain in circulation | Specific shifts, brokered operation. Issued against specific demonstrable contracts. | | Baseline measurement and maintaining CSA at 1.0 or above |
| 2: Two Modified license types | Immediate conversion of existing AMB to AM1 licenses, see above. New licenses issued as AM2 as market demand dictates | Immediate conversion of existing STD to ST2, legacy plates. No longer issued, but legacy plates remain in circulation. | Specific shifts, brokered operation. Issued against specific demonstrable contracts. | Proportional or 100% Wheelchair Accessible Taxi (WAT) requirement, tested separately | Maintaining CSA at 1.0 or above |
| 3: Harmonization of plates to OMD | Immediate conversion of existing AMB to AM1 licenses, see above. New licenses issued as AM2 as market demand dictates | Immediate conversion of existing STD to ST2, legacy plates. No longer issued, ST2 re-issued as AM2 on transfer. | Specific shifts, brokered operation. Issued against specific demonstrable contracts. | Proportional or 100% WAT requirement, tested separately | Maintaining CSA at 1.0 or above |
| 4: Harmonization as modified standard | Immediate conversion of existing AMB to ST1 | Immediate conversion of STD to ST2. Conversion of ST1 (previous AMB) to ST2 as market demand dictates. New issue of ST2 as market demand dictates | Specific shifts, brokered operation. Issued against specific demonstrable contracts. | Proportional or 100% WAT requirement, tested separately | Maintaining CSA at 1.0 or above |

* - Described in text

## 5.3 Scenario Options

The primary aim of a scenario is to allow the testing of a measured set of market circumstances, which might include vehicle number, and license 'type', illustrated in figure 18, above. In addition to the 'type' of license issued, a significant discussion has been presented in terms of accessibility in the Toronto taxi market. Accessibility relates to the ability of a taxi, or other vehicle, to provide access to individuals with a variety of disabilities. Many vehicle manufacturers and converters have concentrated on the carriage of wheelchairs, being immediately visible and requiring identification of physical space. This should not reduce the need to consider the needs of passengers and intending passengers with other forms of disability.

The role that the taxi market plays in the carriage of individuals with accessibility requirements can differ significantly by country, prevailing legislation, and current "best practice". The current Toronto taxi market plays a small role in the provision of accessible transportation, both alongside and under contract to bus based accessible services. An Accessible Taxicab Owner's license (W Plate) is issued to individuals on the driver's list, who can demonstrate they are able to deliver full-time, exclusive service to persons with disabilities. Proof of such full-time work includes contracts with individuals and institutions, including TTC WheelTrans. These contracts may be arranged independently or through brokerages. A small number of current W plates are held by brokerages themselves, specifically to fulfil service contract with WheelTrans.

The current approach to taxi accessibility in Toronto reflects common practice in many Canadian cities but differs significantly from other cities and locations where accessible vehicles are either fully integrated or largely integrated in to the taxi fleet. We have developed an additional test within each of the scenarios set out in figure 16, to allow for the impacts of changes to vehicle accessibility to be tested. A description of these tests is set out in section 6, and may be summarised to include tests that demonstrate the impacts of a fully accessible fleet, where all vehicles are required to be made accessible; and a partially accessible fleet, where a proportion of the fleet is required to be made accessible. The test extends to measure the proportion that would be required to achieve a similar level of service for passengers requiring accessible vehicles in comparison to all users.

## 5.4 Metrics applied to scenario testing

In this section we outline the principal measurements, or metrics, against which scenarios have been tested. Metrics relate to the comparative performance of a scenario in terms of economic impacts, societal impacts, use patterns, and potential barriers. We have also included an income model, a calculation of the impacts of each scenario on potential earnings within the trade, and the effect of any structural change to the meter rate as this may also impact on income levels. As a final element we have outlined the impacts of change in terms of license values within the industry.

The development of scenarios, as described above, have been be applied against metrics, set out in detail in section 6, that test:

- Operating impacts, including availability of services experienced by the passenger
- Economic Impacts on the driver,
- Economic Impacts on the taxi brokerage,
- Economic Impacts on garages,
- Economic impacts on owners
- Accessibility impacts experienced by intending passengers with specialist needs, see section 6

The concept of service optimality is used, where service levels to the passengers are maintained or improved. This is best illustrated in the instance of the CSA variable (Cab Shift Availability), a measure of service levels experienced. A baseline value is set as CSA = 1, with all subsequent tests ensuring that CSA values remain equal to 1, or exceed this value, indicating an improvement in service levels. Figure 17 illustrates the impacts of each of the base scenarios measured to the target year of 2022, described in detail in section 6. More detail of each of the scenarios including impacts of changes to accessibility requirement and fare structure are set out in section 6. Data is accurate as of Jan 1st, 2012.

Figure 17: Primary impacts of base scenarios without accessibility requirements or changes to fares (Gain / loss 2012 - 2022)

| Scenario | Impact on service levels (CSA) | Impact on STD / STx owner driver income (in real terms)** | Impact on AMB/ AMx owner driver income (in real terms) | Impact on Brokerage Income | Impact on Garage Income |
|---|---|---|---|---|---|
| 1: Baseline / Do Minimum | Constant*** | Increase +3.28% | Increase +4.9% | Increase +9.6% | Fall -0.5% |
| 2: Two modified license types | Constant | Fall -4.5% | AMB-AM1<br>Fall -6.7%<br><br>AMB-AM2<br>Increase, see sect 6* | Increase +10% | Increase +22% |
| 3: Harmonization of plates to OMD | Constant | STD-ST2 (and AM2)<br>Fall -3.51% | AMB-AM1<br>Fall -5.34%<br><br>AMB-AM2<br>Increase, see sect 6. | Increase +10% | Increase +22% |
| 4: Harmonization as modified . standard | Constant | STD-ST2<br>Fall -7.38% | AMB-ST1<br>Fall -11.2%<br><br>AMB-ST2<br>Increase, see sect 6* | Increase +10% | Increase +22% |

* Additional income may arise from new shift drivers, see section 6

** Prices shown at 2012 value (real terms)

*** A constant service level is measured where CSA is maintained at 1.0, with no loss or improvement to passenger service levels

# 6. Model application and results

In this section we outline the use of the Toronto Taxi Market Model, using the four scenarios, and sub-scenarios, described above, to illustrate its use. A series of modeled measurements (metrics) are used including:

*Operating Impacts*

The level of service experienced by a passenger, measured as waiting time for a taxi

*Economic Impacts*

The economic impacts are measured as the amount of income that can be derived across the taxi industry including: driver income by type, income to taxi brokerages, garages and non-driving owners.

*Accessibility Impacts*

The level of service appropriate to serving individuals with wheelchairs.

## 6.1 Model Structure

The Toronto taxi market model is a spreadsheet model comprising 12 calculation elements, see Model Technical Report, and calculate change across a range of indicators against a defined baseline. We have taken service levels from 2012 to represent a baseline against which growth scenarios have been tested, see figure 18. The model allows for a variety of operational circumstances to be tested, defined as scenarios (see section 5), including impacts of changes in fare structure and accessibility requirement, discussed in more detail in subsequent sections. Primary outputs relate to passenger service levels and income levels across the industry in each of the scenarios, and compare directly to the same measures in the baseline scenario. It is noted that no driver will experience exactly the same levels of cost, nor make the same operating choices. Figures shown therefore relate to a potential mean cost and income. The figure remains comparable across scenarios on the basis of potential operating opportunity as the initial input

assumptions are constant. It is possible and likely that drivers will experience a range of incomes and costs in all scenarios around the figure shown.

Figure 18: Baseline (2012) inputs and model outputs

| Scenario 1 modeled element | Input Value | Output value |
|---|---|---|
| Days worked per week | 6 days | |
| Weeks worked per year | 50 weeks | |
| Years vehicles operate in service | 5 years | |
| Tariff Flag* | $4.25 | |
| Meters / increment | 143 | |
| Indicative income STD Lessee | | $40,370 |
| Indicative Income AMB Owner driver | | $39,722 |
| Service Level: Waiting time, Night Time Entertainment - Home | | 9 minutes 16 seconds |
| Waiting time, Afternoon shopping - home | | 9 minutes 35 seconds |
| Waiting time, Morning commuting | | 8 minutes 53 seconds |
| Waiting time, Evening trip from home to entertainment | | 10 minutes |

* Changes in tariff structure and levels are tested in some scenarios

Data sources used in calculations: Driver survey, Brokerage data, Modeled research output

## 6.2 Model Runs

The completion of a scenario test, referred to as a model run, is undertaken by inputing the variables to each scenario within the model. The subsequent sections describe the impact of each scenario in relation to the identified metrics. The initial scenario identifying a baseline value (figure 18) and the impact of changes in demand to the horizon year of 2022 (figure 19), without changing the underlying structure of taxi supply in the city.

A model constraint has been applied that service levels be maintained as measured at the baseline (2012) value, ie: service levels neither fall nor improve as a result of the scenario being tested -

indicated by a CSA value of 1.0 (the same level of services) . An additional set of calculations is applied, also shown in figure 19, highlighting the impact of adopting accessible vehicles and changes in the fare structure, discussed in section 6.2.1.

### 6.2.1 Do Minimum

The Do Minimum scenario reflects that this test has been undertaken with the same base licensing structures (Ambassador and Standard licenses) as currently in place. The target year of 2022 has been adopted to indicate impacts over the medium term. Additional tests included, illustrated in figure 19, demonstrate the potential impact of adopting accessible vehicles and modifying the fare structure. Accessible vehicle tests undertaken include the requirement that a proportion of the fleet be made accessible (proportion shown in test 1), and that all the fleet be made accessible (test 2). Alteration to the meter rate structure is also tested (test 1 - that the flag is reduced by $1, with the 10km fare maintained at its present level), and (test 2) that the fare is reduced by $1 per trip.

Figure 19: Input assumptions and outputs: Scenario 1 - Do Minimum 2012 - 2022

| Model Element | Input / Assumption | Baseline value | Output Do Minimum | Output Do Minimum plus proportionate accessibility | Output Do Minimum plus 100% accessibility | Output Do Minimum plus $1 flag reduction maintaining 10km fare (No accessibility requirement) | Output Do Minimum plus fare reduction $1 / trip (No accessibility requirement) |
|---|---|---|---|---|---|---|---|
| Service levels | CSA to remain constant | | | | | | |
| WAT Proportion | | | | 6%* | 100% | | |
| Driver Income STD Lessee | | $40,370 | $42,204 | $42,727 | $36,616 | $42,227 | $39.095 |
| Driver Income STD Shift | | $31,159 | $33,858 | $34,685 | $33,333 | $33882 | $30,750 |
| Owner Income STD with shift driver | | $60,360 | $62,339 | $62,862 | $56,751 | $62,362 | $59,231 |
| Owner Income (AMB) | | $39,722 | $41,701 | $42,224 | $36,113 | $41,724 | $38,593 |
| Owner income (passive, does not drive, without agent) | | $20,553 | $19,833 | $19,529 | $14,765 | $19,833 | $19,833 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Brokerage income (Factor) | | 1.0 | 1.11 | 1.10 | 1.13 | 1.10 | 1.12 |
| Shift Rental Fee (Factor) | | 1.0 | 0.99 | 0.98 | 0.81 | 0.99 | 0.99 |
| License Value (Factor) | | 1.0 | 1.04 | 1.05 | 1.02 | 1.04 | 1.0 |
| **Scenario Description** | | **Numbers of licenses required - total modeled 2022 (change 2013 / 2014)** | | | | | |
| | | **AMB** | **AM1** | **AM2** | **STD** | **ST1** | **ST2** |
| Scenario 1: Base | | 2106<br>New Issue:<br>2013: +79<br>2014: +79 | 0 | 0 | 3463 | 0 | 0 |
| and apply reduced flag | | 2113<br>New Issue:<br>2013: +80<br>2014: +80 | 0 | 0 | 3463 | 0 | 0 |
| and apply fare reduction | | 2290<br>New Issue:<br>2013 +98<br>2014 +98 | 0 | 0 | 3463 | 0 | 0 |
| and apply 100% WAT | | 2377<br>New Issue:<br>2013: +106<br>2014: +106 | 0 | 0 | 3463 | 0 | 0 |
| and apply proportion WAT (350 vehicles) | | 2377<br>New Issue:<br>2013: +106<br>2014: +106 | 0 | 0 | 3463 | 0 | 0 |

Source: Modeled data

* WAT proportion is calculated on the base diversion rate to taxis (estimated at 3%[3]) using a 50% WAT in accessible use factor. A validation exercise is recommended in the 2015 review.

Wheelchair Accessible Taxi requirements have been tested on the basis of a proportion obviously to be made accessible, and separately where 100% of the fleet has been made accessible. Income levels will vary according to this decision, with the proportionate model creating a further question as to how license requirements will be allocated to individuals. Calculations shown in figure 19 illustrates the impact measured across the entire fleet, while the proportionate model will, in fact, result in higher costs to a small number of individuals - namely those requirements to invest in accessible vehicles. Impacts of adopting accessible vehicles will also result in a positive change to the number of trips being made. The measured proportion of accessible vehicles

[3] WAT use based on West Dunbartonshire take up (TRI, 2006). No individual city will reflect the same use as any other. This figure should be reviewed and updated iteratively using observed take up to the next review.

reflects the potential latent demand for such services, derived from previous reviews and applied to the Toronto fleet. It is noted that service levels required to serve this proportion will necessitate a higher number of vehicles than a direct predict and provide method may suggest, as accessible vehicles used in a general fleet will be engaged by a variety of users, reducing their effective availability. An availability factor related to the proportion of Wheelchair Accessible Taxis (WAT) in on-demand service is included in the front end of the model. WATs used in on-demand service differ from existing uses of W Licensed vehicles, which are linked to brokered trips predominantly based on contracted use, and not typically available to passengers on-demand. This factor will require further validation in light of observed use.

Results of the tests related to the fare structure are also included in figure 19. Two tests included, the first testing the impact of a reduced flag, maintaining the level of a 10 km fare. This would be achieved by dropping the flat rate, and reducing the incremental distance purchased. Higher flag rates are often considered to impact on short journeys to a greater extent than long journeys, impacting on lower income trips. The impact of reducing flag, while maintaining a 10km fare, would be considered positive to persons of lower income. The reduction in flag and short trip costs would also impact positively on the number of journeys being made in this price bracket. Transfer rates were determined as a part of the public survey, and applied to this calculation. A small increase in trips and total income is noted across most driver types as a result of this test. The same logic would apply to a general fair reduction, the reduction in fair producing an increased number of trips, but this increase would not offset the loss of income that the fare reduction would create.

### 6.2.2 Scenario 2: Two modified License types

The second scenario tested the impacts of transferring Ambassador (AMB) and Standard (STD) license holders to modified license types, set out in detail in section 5.1, above. AMB licenses would be transferred to a transferable license (AM1) but would continue to be limited to a single shift model, while STD plates would be transferred to a modified standard (ST2) defined as a 'legacy' plate. New licenses would be issued as transferable Ambassador plates available for two shifts (AM2), to be issued as the market dictated. Figure 20 outlines the primary results from this scenario.

Figure 20: Input assumptions and outputs: Scenario 2 (Two modified license types)

| Model Element | Input / Assumption | Baseline value | Output Scenario 2 | Output Scenario 2 with proportionate accessibility | Output Scenario 2 with 100% accessibility | Output Scenario 2 with $1 flag reduction maintaining 10km fare (No accessibility requirement) | Output Scenario 2 with fare reduction $1 / trip (No accessibility requirement) |
|---|---|---|---|---|---|---|---|
| Service levels | CSA to remain constant | | | | | | |
| WAT Proportion | | | | 6% | 100% | | |
| Wait times NTE | | 09:16 | 09:16 | 09:16 | 09:16 | 09:16 | 09:16 |
| Wait times Afternoon shopping | | 09:35 | 09:35 | 09:35 | 09:35 | 09:35 | 09:35 |
| Wait times Morning Commute | | 08:53 | 08:53 | 08:53 | 08:53 | 08:53 | 08:53 |
| Wait times NTE | | 10:00 | 10:00 | 10:00 | 10:00 | 10:00 | 10:00 |
| Driver Income STD / ST2 Lessee | | $40,370 | $37,573 | $35,888 | $29,907 | $37,542 | $33,309 |
| Driver Income STD Shift | | $31,159 | $29,227 | $27,847 | $26,630 | $29,197 | $24,964 |
| Owner Income STD with shift driver | | $60,360 | $57,708 | $56,024 | $50,042 | $57,678 | $53,444 |
| Owner Income AMB / AM1 | | $39,722 | $37,070 | $35,386 | $29,405 | $37,040 | $32,807 |
| Owner Driver Income AM2 | | | CA$57,708 | | | | |
| Owner income (passive, does not drive, without agent) | | $20,553 | $19,833 | $19,529 | $14,765 | $19,833 | $19,833 |
| Brokerage income (Factor) | | 1.0 | 1.10 | 1.13 | 1.13 | 1.10 | 1.12 |
| Shift Rental Fee (Factor) | | 1.0 | 1.22 | 1.29 | 1.05 | 1.22 | 1.28 |
| License Value (Factor) | | 1.0 | 1.51 | 1.47 | 1.45 | 1.51 | 1.41 |

| Scenario Description | Numbers of licenses required - total modeled 2022 (change 2013 / 2014) | | | | | |
|---|---|---|---|---|---|---|
| | AMB | AM1 | AM2 | STD | ST1 | ST2 |
| Scenario 2: Base | 0 | 520 | 793<br>Convert from AM1 to AM2<br>2013: +79<br>2014: +79 | 0 | 0 | 3463 |
| and apply reduced flag | 0 | 513 | 800<br>Convert from AM1 to AM2<br>2013: 80<br>2014: 80 | 0 | 0 | 3463 |
| and apply fare reduction | 0 | 336 | 997<br>Convert from AM1 to AM2<br>2013: 98<br>2014: 98 | 0 | 0 | 3463 |
| and apply 100% WAT | 0 | 249 | 1064<br>Convert from AM1 to AM2<br>2013: 106<br>2014: 106 | 0 | 0 | 3463 |
| and apply proportion WAT (287 vehicles) | 0 | 249 | 1064<br>Convert from AM1 to AM2<br>2013: 106<br>2014: 106 | 0 | 0 | 3463 |

In the base test, the primary variables were updated to reflect a move to a transferable Ambassador plate (AM1). Existing AMB holders would be converted to single shifted AM1 plates, with a further conversion of newly created AM1 licenses to AM2 licenses, a double shifted transferable Ambassador plate, to increase availability as measured within the Taxi Market Model. A legacy Standard plate is also introduced under this scenario. Growth in demand, calculated from growth forecasts, was applied to the target year of 2022, following the same formula as applied in scenario 1.

The initial scenario 2 test resulted in a significant increase in the market value of plates, following the issue of transferable AM1s and double shifted transferable AM2s. License value is related to three factors, the effective availability or transferability of the license; the ability of the trade to support additional values, effectively is there enough income in the industry to support higher license rates; and an investors view of the change in transfer values over time. It is noted that an investment decision may include a view of historic performance as well as current conditions. As

the market is seen to expand in this scenario by creating additional shifted vehicles, so the opportunity, and thus market transfer values increase.

Wider taxi industry incomes also increased reflecting the development of the market for new dispatch demand and increased garage utilisation. Driver income also increased across lessee, owner and shift drivers, albeit to a limited extent, reflecting the increased opportunities for use of some vehicles and lower relative fixed costs.

Scenario 2 also identified a third license type, a double shifted Ambassador license (AM2) issued as demand dictates and applied in the model to the growth in demand. The AM2 license allows for double shifted vehicles and can be transferable, making this an attractive license option in comparison with the status quo. The AM2 license can provide rental income in respect of second shift / additional shift drivers significantly increasing the income rates experienced by AM2 owner drivers receiving rental in this way.

### 6.2.3 Scenario 3: Harmonized licenses, OMD, STD transfers to AM2

The third scenario tested a further option in license structure, by harmonizing licenses to AM1 and AM2 over time. The scenario differs from scenario 2 in the application of an owner must drive principle, reducing the opportunity for absentee license owners, and moving all STD licenses to ST2 legacy, and AM2 on transfer. The speed at which the scenario will impact on the total market will depend, in part, on the churn of owners (frequency of license transfer) as this will impact on the license value factor, discussed below. Figure 21 illustrates the inputs used for this scenario. A churn rate of 100 licenses per year is assumed for the purposes of the initial test.

Figure 21: Input assumptions and outputs: Scenario 3 (Harmonization of plates to OMD)

| Model Element | Input / Assumption | Baseline value | Output Scenario 3 | Output Scenario 3 with proportionate accessibility | Output Scenario 3 with 100% accessibility | Output Scenario 3 with $1 flag reduction maintaining 10km fare (No accessibility requirement) | Output Scenario 3 with fare reduction $1 / trip (No accessibility requirement) |
|---|---|---|---|---|---|---|---|
| Service levels | CSA to remain constant | | | | | | |
| WAT Proportion | | | | 6% | 100% | | |
| Wait times NTE | | 09:16 | 09:16 | 09:16 | 09:16 | 09:16 | 09:16 |
| Wait times Afternoon shopping | | 09:35 | 09:35 | 09:35 | 09:35 | 09:35 | 09:35 |
| Wait times Morning Commute | | 08:53 | 08:53 | 08:53 | 08:53 | 08:53 | 08:53 |
| Wait times NTE | | 10:00 | 10:00 | 10:00 | 10:00 | 10:00 | 10:00 |
| Driver Income STD / ST2 Lessee | | $40,370 | $38,103 | CA$36,045 | CA$30,061 | $38,060 | $33,548 |
| Driver Income STD Shift | | $31,159 | $29,758 | CA$28,004 | CA$26,784 | $29,715 | $25,203 |
| Owner Income STD with shift driver | | $60,360 | $58,238 | CA$56,180 | CA$50,196 | $58,196 | $53,683 |
| Owner Income AMB / AM1 | | $39,722 | $37,601 | CA$35,543 | CA$29,558 | $37,558 | $33.045 |
| Owner Driver Income AM2 | | | CA$58,238 | | | | |
| Owner income (passive, does not drive, without agent) | | $20,553 | $19,833 | $19,529 | $19,529 | $19,833 | $19,833 |
| Brokerage income (Factor) | | 1.0 | 1.10 | 1.13 | 1.13 | 1.10 | 1.12 |
| Shift Rental Fee (Factor) | | 1.0 | 1.22 | 1.24 | 1.29 | 1.22 | 1.28 |
| License Value (Factor) | | 1.0 | 1.52 | 1.52 | 1.48 | 1.52 | 1.41 |

| Scenario Description | Numbers of licenses required - total modeled 2022 (change 2013 / 2014) | | | | | |
|---|---|---|---|---|---|---|
| | AMB | AM1 | AM2 | STD | ST1 | ST2 |
| Scenario 3: Base | 0 | 520 | 1793<br>Includes 1000 transfers from ST2*<br>convert from AM1 to AM2<br>2013: 79<br>2014:79 | 0 | 0 | 2463<br>Re-issue ST2 to AM2 at transfer c.100 PA* |
| and apply reduced flag | 0 | 513 | 1800<br>Includes 1000 transfers from ST2*<br>Convert from AM1 to AM2<br>2013: 80<br>2014: 80 | 0 | 0 | 2463<br>Re-issue ST2 to AM2 at transfer c.100 PA* |
| and apply fare reduction | 0 | 336 | 1977<br>Includes 1000 transfers from ST2*<br>convert from AM1 to AM2<br>2013: 98<br>2014:98 | 0 | 0 | 2463<br>Re-issue ST2 to AM2 at transfer c.100 PA* |
| and apply 100% WAT | 0 | 249 | 2064<br>Includes 1000 transfers from ST2*<br>convert from AM1 to AM2<br>2013: 107<br>2014: 106 | 0 | 0 | 2463<br>Re-issue ST2 to AM2 at transfer c.100 PA* |
| and apply proportion WAT (297 vehicles) | 0 | 249 | 2064<br>Includes 1000 transfers from ST2*<br>convert from AM1 to AM2<br>2013: 107<br>2014: 106 | 0 | 0 | 2463<br>Re-issue ST2 to AM2 at transfer c.100 PA* |

* Varying rates of re-issue of ST2 to AM2 does NOT affect number of AM1 - AM2 conversions

### 6.2.4 Scenario 4: Harmonization to modified standards

The final scenario tested the harmonization of licenses to a modified standard plate, illustrated in figure 22. In this scenario current Ambassador licenses would be converted to to single shifted standard plates (ST1s), with the opportunity for further conversion to double shifts (ST2) to meet market demand.

Figure 22: Input assumptions and outputs: Scenario 4 (Harmonization of modified standard)

| Model Element | Input / Assumption | Baseline value | Output Scenario 4 | Output Scenario 4 with proportionate accessibility | Output Scenario 4 with 100% accessibility | Output Scenario 4 with $1 flag reduction maintaining 10km fare (No accessibility requirement) | Output Scenario 4 with fare reduction $1 / trip (No accessibility requirement) |
|---|---|---|---|---|---|---|---|
| Service levels | CSA to remain constant | | | | | | |
| WAT Proportion | | | | 6% | 100% | | |
| Wait times NTE | | 09:16 | 09:16 | 09:16 | 09:16 | 09:16 | 09:16 |
| Wait times Afternoon shopping | | 09:35 | 09:35 | 09:35 | 09:35 | 09:35 | 09:35 |
| Wait times Morning Commute | | 08:53 | 08:53 | 08:53 | 08:53 | 08:53 | 08:53 |
| Wait times NTE | | 10:00 | 10:00 | 10:00 | 10:00 | 10:00 | 10:00 |
| Driver Income STD / ST2 Lessee | | $40,370 | $35,768 | $34,378 | $28,426 | $35,740 | $31,750 |
| Driver Income STD Shift | | $31,159 | $27,422 | $26,337 | $25,149 | $27,394 | $31,551 |
| Owner Income STD with shift driver | | $60,360 | $55,903 | $54,514 | $48,651 | $55,875 | $51,885 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Owner Income ST1, owner driver | | NA | $35,266 | $33,876 | $28,014 | $35,238 | $31,248 |
| Owner Income AMB / AM1 | | $39,722 | NA | NA | NA | NA | NA |
| Owner income (passive, does not drive, without agent) | | $20,553 | $19,833 | $19,529 | $14,765 | $19,833 | $19,833 |
| Brokerage income (Factor) | | 1.0 | 1.10 | 1.13 | 1.13 | 1.10 | 1.12 |
| Shift Rental Fee (Factor) | | 1.0 | 1.22 | 1.29 | 1.05 | 1.22 | 1.28 |
| License Value (Factor) | | 1.0 | 1.01 | 0.99 | 0.95 | 1.01 | 0.95 |
| **Scenario Description** | | **Numbers of licenses required - total modeled 2022 (change 2013 / 2014)** | | | | | |
| | | **AMB** | **AM1** | **AM2** | **STD** | **ST1** | **ST2** |
| Scenario 4: Base | | 0 | 0 | 0 | 0 | Converted AMB to ST1 reducing number over time<br>2022: 520<br>2014: 1155<br>2013: 1234 | 4256 in 2022 comprising 3463 STD to ST2 conversions immediately; plus AMB - ST1 - ST2 conversions:<br>2013: +79<br>2014: +79 |
| and apply reduced flag | | 0 | 0 | 0 | 0 | 2022: 513<br>2014:1153<br>2013: 1233 | 2022: 4263 Conversion AMB - ST1 - ST2<br>2013: +80<br>2014: +80 |
| and apply fare reduction | | 0 | 0 | 0 | 0 | 2022: 336<br>2014: 1117<br>2013: 1215 | 2022: 4440 Conversion AMB - ST1 - ST2<br>2013: +98<br>2014: +98 |
| and apply 100% WAT | | 0 | 0 | 0 | 0 | 2022: 249<br>2014: 1101<br>2013: 1207 | 2022: 4527 Conversion AMB - ST1 - ST2<br>2013: +106<br>2014: +106 |

| | | | | | | |
|---|---|---|---|---|---|---|
| and apply proportion WAT (287 vehicles) | 0 | 0 | 0 | 0 | 2022: 249<br>2014: 1101<br>2013: 1207 | 2022: 4527<br>Conversion AMB - ST1 - ST2<br>2013: +106<br>2014: +106 |

Scenario 4 created a larger rise in ST1 and ST2 lessee income without seeing the excess gains in Ambassador income apparent in scenario , but this might in itself create an issue in the (perceived problem of) financing accessible vehicles.

## 6.3 Review

The modeled review has demonstrated potential impacts arising from a range of scenarios Applied to the taxi market in the City of Toronto. Each indicates the impact of potential approaches to satisfy demand over the period to 2022. Measured demand is likely to increase over this period, though the extent of supply currently serves demand well.

The model allows for a review arising from impacts to changing market conditions. This is measured against four license structures: scenario 1 addressing a do minimum approach - effectively maintaining the same license structures, detail above. Figures 19 - 22, above, outline the impact on driver income for each scenario, with scenario three - harmonisation of plates to OMD - performing better than other scenarios where changes were made to license properties. It is further noted that changes to the fare structure involving a reduction in flag, but not their reduction at 10 km, can be achieved at minimal cost. The two accessibility options tested in each scenario does result in a loss of income, reflecting the additional cost of accessible vehicles. This should not be seen as a reason against its adoption, but rather an appropriate indicator of the levels of costs likely to be experienced.

In reaching a conclusion we have combined the positive benefits arising from a variety of model scenarios to recommend changes to both license type, accessible vehicle number and fare level. The potential benefits and costs of each scenario are set out in more detail in section 7, below. The combined model includes a series of inputs tested as described above and summarised in the table below.

| Control Measure | Application |
|---|---|
| License Type | Conversion of all licenses to Ambassador licenses over time. Standard licenses to be converted to ST2 legacy plates, and then to AM2 on re-issue / transfer. Existing Ambassador plates to be converted to AM1 plates and to AM2 plates on demonstrated additional demand.<br><br>90 Conversions from Ambassador - AM1 - AM2 to be applied in 2013, with an additional 90 conversions to be applied in 2014. Further conversions to occur as the market demand dictates, to be determined in model application on a two yearly cycle. |
| Accessible Vehicles | A proportionate model be applied for the period to 2014. This equates to 6% of the taxi fleet be made accessible. The proportionate model be reassessed on review in 2015 to account for changes in the market, including the available vehicle types on review. |
| Fare Levels | Flag Drop charges to be reduced by $1 to $3.25 to support and encourage lower cost trips including those made by individuals with lower incomes. Overall income from fares to be maintained in light of average distances travelled and other changes in costs. Distance increments to be set at 129 meters. |
| Review frequency | That the market model and review be repeated at two-yearly intervals to test for and respond to changes in the taxi market. |

# 7. Conclusions

Our study has developed and applied a Taxi Market Model to the City of Toronto, to test the economic impacts of a number of scenarios addressing changes to the licensing of taxis in the city, numbers of taxis, and a series of variants including changes to the accessibility requirements applied to taxis, and changes to fare structures.

Taxis form a vital part of the transport of any city and are commonly controlled in a combination of three regulatory domains affecting: Quality, Quantity and Economics (QQE). Not all cities apply controls to all three areas, but all apply some control, reflected in Toronto by regulation of numbers of licenses (Quantity), and fares (Economic) controls. Vehicle minimum standards are also controlled, with additional vehicle accessibility standards set at a provincial and federal level in the instance of accessible vehicles. Changes to the structure of licensing impacts directly on the nature of the service received by the travelling public, and on the ability of the trade to sustain itself, impacting on driver income as well as income to the constituent parts of the industry. The quantification of these impacts, and identification of their change, formed a significant element of our study.

The 'taxi industry' in Toronto is comprised of a number of constituents active in delivering service to the public. Vehicle types differ and are recognisable by their license type and function. Licensed 'taxis' as opposed to Limousines or other 'For Hire Vehicles' are restricted to a measured number, controlled by the issue of licenses. Quantity constraint, sometimes called 'license cap' is a common approach adopted by a large number of cities across North America and internationally, but may be considered controversial by some as it applies a constraint to the operation of the market in terms of the numbers of vehicles that may be active at any one time. In contrast, license caps can play a role in market function by reducing the negative impacts of market failure, a possible outcome of an uncontrolled market, and illustrated in the case of taxi services in Dublin, Ireland, where traditional services have been lost.

Toronto's taxis split further between license types, which include 'Standard' taxi licenses, a historic license type allowing for double shifted vehicles and with a transfer value; Ambassador licenses, issued since 1998, and currently available to a single shifted vehicle, driven by its owner, and not

available for transfer; and Wheelchair licenses, available to specific accessible vehicle types under contract for accessible trips alone. The taxi driver is supported by Taxi Brokerages, brokerages offering computerised radio dispatch, including a number of new brokerage market entrants using smartphone app technologies to provide dispatch services. Other market participants include Garages, who provide access to vehicles for shift drivers; and Agents, managing transferable licenses, including those held by absentee owners; and TTC, the public transit operator, responsible for contracting wheelchair accessible transit through its own account vehicles and under contract from taxi brokers.

As any change in the licensing structure, fares or associated quality standards impact across all stakeholders and the public, we have developed a comprehensive assessment approach with a Toronto Taxi Market Model as its core.

### 7.1 Existing services (Baseline)

Current supply of taxis in the city appears to serve the demand for taxis well. A reasonable level of service is identified, see section 3.1.1, with low waiting times in line, or close to, passenger expectations. Moreover as the consistency of service (figure 2) appears strong, it maybe concluded that potential for improvement in passenger service levels, as measured in waiting time, is limited. The highest deviation between passenger expectation and actual service level (3.5 minutes) is demonstrated for suburban locations in the instance of dispatch bookings for trips from home to entertainment. As many such bookings will necessitate taxi drivers to travel distances to the pickup point potential for improvement maybe further reduced.

It is our conclusion that the current baseline (2012) for service levels based on waiting times are appropriate for the current market. We have used this measure of service delivery as a baseline against which future looking scenarios are tested. Each model test has been based on the premise that passenger service levels, measured as waiting times, should be matched or improved upon. The taxi market model, described in subsequent sections, can then be applied to identify the need for further license issuance (in future years) and the numbers of licenses that may be appropriate.

Further considerations related to taxi meter rates and accessibility should also be considered with our conclusions set out in subsequent sections.

## 7.2 Taxi Market Model

A primary element in our assessment has been the development of a taxi market model specific to Toronto. The model is based on the measurement of current service levels, and the identification of relationships between market participants. A target 'horizon' is included, identifying the potential growth in the taxi market to the years 2022, and scenarios tested identifying the impact of the status quo, what changes will occur if the licensing structure remains unchanged; and the economic and operational impacts of changes set out as scenarios.

It is important to note that predictions of growth, as with all estimates of change in economic circumstance, can be impacted by external circumstances not foreseen at the time of prediction. The growth predictions applied to the taxi market model are based on external third party data, from official statistical agencies, and must be subject to the same caveat. It is our view that the predictive time horizon of ten years should be complemented by a more frequent update using live data at a frequency of two years, effectively updating a 'rolling ten year horizon'. This is set out in more detail below.

Scenarios were developed to consider the potential changes in licensing structure, with their impact assessed in light of the relationships identified in the earlier parts of the study. Each scenario represents a 'model run' with additional testing applied within scenarios to identify the impacts of 'variants' affecting accessibility requirements and fare structures.

Live data, and primary information obtained through surveys, allowed the team to validate statistics at the baseline, using a combination of broker data provided as outputs from electronic dispatch software, and stated trip patterns from public surveys. It is noted that the dispatch systems in current use by differing brokers provide a variety of differing outputs. Differences existed in the structure of information (reported record name), and in relation to the zonal

structures applied by the various companies. A process of record standardization has been applied to create common zones and standard record format and this will, in turn, ease future analyses.

## 7.3 Scenario Development and Interpretation

The concept of scenario development is widely applied to transport modelling. A scenario sets out a series of potential operational parameters; including licensing structures, accessibility and fares for testing. The scenario represents a realistic set of circumstances that may be applied, to determine the likely impacts of such an application. Scenarios tested related to taxi licensing structure in the first instance, but was also expanded to include impacts arising from changes in accessibility standards and fare structures.

The range of licensing structures tested is detailed in preceding sections and is predicated on the range of licenses including Ambassador licenses, Standard licenses and variations to these. Impacts of requiring vehicle accessibility was included in the analysis using two primary tests, the impacts of requiring all vehicles to be accessible, and the impacts of requiring a proportion of vehicles to be accessible. Further tests included the impacts of changes in fare structures, including changes in the cost of initial hire, known as flag, and the impacts of changes in the total fare, including distance charges.

### 7.3.1 Accessibility

Accessibility is a significant issue in the provision of all transport services, and is often presented in relation to the taxi industry in terms of vehicle accessibility to wheelchair users. Although this does not represent the full range of accessibility requirements that may be required of a taxi, it does represent the most significant change to vehicle standards, which impact on the cost of provision. Wheelchair accessible vehicles are regulated in Canada under the Canadian standard CSA-D409, which defines basic vehicle design specifications including internal space and door widths, critical in allowing for wheelchair access. The design standard CSA-D409 has emerged from a review of bus designs and has an impact on the taxi industry insofar as it can be applied to the minimum requirements for taxi vehicles.

Current Accessible taxis designs include vehicles that have been converted, typically minivans such as the Grand Caravan and similar, that have been converted post production the addition of accessible ramps and appropriate restraint mechanisms. Purpose built accessible taxis are more common in other countries, partly as a result of the limitations resulting from CSA-D409, offer an alternative to post production conversions, and have the advantage of a better record in resilience to use, demonstrated in a longer life in service, and better operating efficiencies. Purpose built vehicles may offer a more economic method of provision, and are likely to appear in the Canadian market in the near future as a result of next generation vehicles in development and recently introduced in other jurisdictions.

### 7.3.2 Fare Structure

Consideration of taxi fares and fare structure are also included in the market model. In their basic form the model allows for testing of impacts arising from increased fares or their reduction, but has also been extended to allow for the testing of a differing balance between flag and distance rates. Flag charges, also known as flag fall or initial hire, relate to the amount charged for the initial engagement of a taxi, and will often include an initial distance travelled, as is the case in Toronto, other fare components include charges for distance travelled, measured in steps or increments in which a specified distance is purchased in advance; and time based charges charged in the same way.

Flag charges are significant, both to the driver as these can play a significant role in ensuring a minimum income level, and significant to the passenger as the flag can impact on short trips to a greater extent than longer distances. Low income passengers may be considered to be affected more from higher flag charges reflecting the comparative distances of trips by differing passenger types. The flag being regressive, insofar as increases in flag rather than other fare elements, impact on low income users of taxis disproportionately. The inverse may also be true, that a reduction in flag charge, even where overall fare levels are maintained over typical distances, may be progressive in supporting all users and reducing discrimination against lower income passengers.

A further argument has been made in relation to the impacts of reduction in total fares increasing the demand for taxis. The concept was tested in the public surveys undertaken in our reviews, with a positive correlation; although the increased demand levels measured do not result in an increase sufficient to offset loss of income. The difference in income between journeys with reduced flag and maintained distance and status quo was minimal, described below.

## 7.4 Scenario Tests

Four differing scenarios were tested in addition to a baseline analysis, with a series of additional options applied in terms of accessibility and fare variants. The scenarios were based on changes to the license structure and included:

- Baseline,
- Status Quo testing, the impact of maintaining the existing licensing structure,
- Two modified license types,
- Harmonizing licenses to modified Ambassador (AM1, AM2)
- Harmonzing licenses to modified Standard (ST1, ST2)

We have used baseline data to identify indicator values for the base year, 2012. Values in the baseline year can be compared with those for each of the target scenarios, also expressed using 2012 monetary values for allow for direct comparisons. Approximate income levels shown for the baseline and for each of the scenarios reflect potential income in a given set of circumstances, rather than a precise income that a taxi driver will receive. The assumed operating parameters remain the same between baseline and scenario outputs, except where specifically changed in the scenario itself, allowing for a comparability between baseline and scenario values. These are set out in figure 23.

Figure 23: impact of scenarios on driver income

| Income level by license / driver type | Baseline | Scenario 1: Do Minimum | Scenario 2: base | Scenario 2: Proportionate accessible | Scenario 2: 100% Accessible | Scenario 2: reducing flag | Scenario 2: Reducing total fare | Scenario 3: Harmonized AMx license | Scenario 4: Harmonized to STx license |
|---|---|---|---|---|---|---|---|---|---|
| STD / STX Lessee | 40,370 | 42,204 | 37,573 | 35,888 | 29,907 | 37,542 | 33,309 | 38,103 | 35,768 |
| STD / STX Shift Driver | 31,159 | 33,858 | 29,227 | 27,847 | 26,630 | 29,197 | 24,964 | 29,758 | 27,422 |
| AMB / AMx Owner driver | 39,722 | 41,701 | 37,070 | 35,386 | 29,405 | 37,040 | 32,807 | 37,601 | 35,266 |
| AM2 Owner Driver | | | 57,708 | | | | | 58,238 | |

### 7.4.1 Accessibility Tests

The impacts of scenarios including accessibility requirements resulted in a reduction in driver income levels on both 100% and proportionate models, although the extent of this difference was limited compared to the extent that is suggested in many discussions, with the difference in income levels only marginal in terms of the proportional provision of accessible vehicles. The number of accessible vehicles required is included in the model output sections above. Proportionate models of the impacts of meeting accessibility needs can provide distinct challenges in their own right, not least in the allocation of licenses and the nature of use of dual purpose vehicles in a general fleet. This issue has led some authorities to prefer a 100% accessible vehicle option, despite the higher costs across the industry that this results in, though this may be solved more readily on a next license issued basis.

It is noted that the lifecycle of the current generation of converted accessible vehicles is unlikely to allow drivers to recover the additional costs from market growth alone. This is likely to differ as 'next generation' purpose built accessible vehicles enter the market, which suggest better fuel consumption and extended life cycles compared to conversions. Purpose built vehicles with extended lives are more appropriate to the consideration of life cycle extensions for accessible vehicles, than conversions. Life cycle extension may allow for an unsubsidised incentive to cover the additional costs of the vehicles, where it is felt likely that such vehicles will be fit for operation over the extended lifespan this creates. As we anticipate there to be a two year lag in the release of next generation purpose built accessible vehicles, we would recommend that the city adopt an

interim solution based on proportionate supply for the next two years, and undertake an accessible vehicle review in 2015.

### 7.4.2 Fare structure tests

The effect of reducing a fare, or changing its structure, can be an increase in the demand for taxi services. As the fare falls, or its comparative level against alternatives, so the demand for services can increase. We have used data from public surveys to estimate the potential response to changes in fares, and have tested both a reduction in flag while maintaining 10 km fares at existing levels; and a reduction in fares for all trips. The former, a reduction in flag has a significant benefit on low income trips, without have a significant impact on the total incomes to taxi drivers. The alternative, a reduction in the overall costs of fares, tested at $1 saving at 10kms, has a more negative impact.

We would recommend that a reduction in flag charges be applied, while 10km fares be maintained at the existing level.

### 7.4.3 License Structure Tests

In addition to predicting changes in demand, accessibility and fare structure, the study modeled the impacts of changes in the license structure itself. The current license structure is based on the use of Ambassador plates, limited licenses allowing for single shifted vehicles. Much comment has been made for and against a variety of licensing options by the press, over the course of the taxi industry review and in our own analysis. We do not consider it within our scope to add to the commentary for or against any individual option, but rather to highlight the impacts likely as a result of changes in structure.

The current Toronto market is well served by the taxi industry. The current supply meets the current use patterns across the city and has achieved a high level of consistency in service. Future growth will require new license issuance, however, in order for service levels to be maintained. In addition to the do minimum option, ie: continuing to issue Ambassador licenses, we have looked at a variety of structural changes to the licensing system, described in section 4. Of these Scenario 3, License Harmonization appears to provide the best outcomes, and we would recommend that

this option is adopted. A full description of our recommendations is set out in section 7.6, and is summarized:

- Immediate conversion of existing AMB to AM1 licenses, allowing for transferability,
- Immediate conversion of existing STD to ST2 (legacy) licenses, and re-issue to AM2 on transfer,
- Conversion of AM1 to AM2 licenses to meet market demand, as market dictates,
- New issue as AM2 as market dictates, after exhausting all AM1 - AM2 conversions
- Adoption of proportionate model of accessibility for an initial period of 2 years, subject to review at 2 years,
- Adoption of a lower flag charge offset by a reduced incremental distance to maintain consistent 10km fares, subject to fare increase,
- An increase in distance based income, to be achieved by a reduction in incremental distance, to ensure that the recommended measures are achieved at zero sum cost to an average driver
- An increase in supply to be effected by proportionate changes in license types at yearly intervals, with the first implementation in 2013, the second implementation in 2014, and subject to review at two yearly intervals, the first being applied in 2015.

## 7.5 Prediction horizon and model updating

In undertaking our work we have been presented by a number of challenges in identifying trend data and surrogate predictions to the target year of 2022. As prediction, by its nature, includes an element of uncertainty we would recommend that the city consider a composite analysis based on 'rolling predictions' described below.

A number of external statistical agencies outlined issues in predicting to time horizons beyond two years. Data reliability falls with future year predictions, and we consider it appropriate to consider a review of values on a two year cycle. This does not reduce the significance of maintaining a ten year horizon as these contribute to the long term stability of the industry, but recommend that the figures are updated on a two year basis for the subsequent ten year horizon.

We recommend that the two year review also consider the nature of changes in the industry that may be determined by a future model run, and will rely, in part, on the ability of the city, or its consultants, to access live data, seen as a challenge in our work. Having established a framework for data collection and its collation in our assessment, we would highlight that the task would be more readily achieved in future reviews. It would also be appropriate for the city to establish regular data collection protocol with the industry to allow for the regular collection of defined information and data, which should be achievable at minimal cost on the part of the trade.

## 7.6 Recommendations

Our study highlights the strength of the current Toronto taxi industry, and some of the positive steps that may be undertaken to ensure maintenance and improvements in service levels.

It is our conclusion that the modification in license structure is appropriate to the long-term interests of the industry, with further development including the adoption of a wider accessible taxi fleet, and modification in the structure of taxi fares to enhance the ability of lower income passengers to make journeys. The combination of an introduction of accessible vehicles to the on demand fleet, to the benefit of wheelchair users and other passengers with disabilities; and the reduction of flag fall cost with increased distance charges, to the benefit of short journey and lower income passengers; appears to offer an effective approach to taxi supply. Our recommendations are set out in figure 24, below.

Figure 24: Recommended action

| Measure | Action | Comment |
|---|---|---|
| Ambassador licenses | Immediate conversion of existing AMB to AM1 licenses | |
| Standard licenses | Immediate conversion of existing STD capacity to (legacy) licenses | Re-issue to AM2 on transfer |
| Market Growth | Conversion of AM1 to AM2 licenses to meet market demand | 90 AM1 to AM2 license conversions in 2013, 90 AM1 to AM2 license conversions in 2014 |

| | | |
|---|---|---|
| Accessibility | Adoption of proportional model of accessibility at 6% of fleet, to be subject to review | Review at 2015 in light of vehicle type availability |
| Taxi fares | Adoption of a lower flag charge offset by a reduced incremental distance | Flag charge to be set at $3.25, see next item |
| Taxi fares | Increasing distance based income to ensure a zero sum cost | Distance increments to be set at 129 m |
| Review | Undertake reviews of baseline and prediction | Toronto taxi market model to be reviews and rerun at 2 yearly intervals. Next review at 2015 |

# Appendix - Stakeholder Engagement

## Stakeholder Engagement

The team undertook an extensive period of engagement with industry representatives, passenger representatives and stakeholders. A standard series of questions addressed baseline, operating practices and potential developments.

Responses were collected representing a wide range of views across all stakeholders, including views from the City of Toronto itself, Disabilities Issues Committee, City Centre management companies, and TTC; as well as from operators, drivers and the public.

All stakeholders expressed the view that taxis played a significant role in the provision of transportation across the city, though a variety of issues were highlighted in their use and development. These ranged from a "laiser faire" market approach to some significantly and strongly expressed views of market failure and the potential for distortion in the market.

In order to fully accommodate the range of views presented to the team, we have identified stakeholder comments in relation to scenarios. Responses have been used to validate and add to the options as set out above and in the production of scenarios for testing, described in subsequent sections.

## License Type / Industry Structure / Ownership

A distinction is drawn between the types of operating licenses (plates) available and industry structure, see preceding sections, though there is clearly a link between the forms of license available and supply of services. The city currently operates three taxi license types: "Standards" (no longer issued); "Ambassadors" (currently available but

restricted to a set number); and "Wheelchair" (sometimes referred to as "W" plates and available only in respect of contracted transportation). By contrast industry operations - typically based on engagement method, split between "Brokerages" (Taxi Brokerages) and "Independents" (also known as "street taxis" in some other jurisdictions). A further operation type relates to bookings made via smartphone applications (apps) which may operate as brokers where licensed, or as additional call companies. Apps sit as an additional layer on top of the traditional brokers or independents with supply being made in vehicles that may be branded as part of a traditional brokerage.

Ownership, by contrast, relates to the holding of plates, which can reside with an owner operator; a third party individual, company or an agent. Third parties lease access to the plate for profit. The term "ownership is a misnomer, see preceding sections, as the plate itself remains the property of the city under current law. A plate value exists due to permitted transfers between individuals, including corporate owners, but does not extend to a property value for the purposes of financing or Lien/ debt recovery.

A wide range of views was expressed in respect of the potential and difficulties associated with various license type options. A number of comments blurred the type of license from the allocation of license, as illustrated above; though we have sought to separate issues to distinct scenarios for the purpose of clarity.

The issue of the difference between an Ambassador and a Standard license was widely addressed, although no agreement existed between responses suggesting a re-issuing of standard plates to current Ambassador drivers (conversion), and its counter - that standard plate holders had understood the limitations on entry. A number of alternatives set out included the requirement placed on "converted" license holders to provide accessible taxis (WAT/WAV), alongside or as a replacement for the current W Plate system.

Some critique was expressed in terms of the provision of Wheelchair Licenses and transport via brokerages, with a suggestion of insufficient "W" plates to fully serve the demand for Wheelchair accessible trips across the city. Widely varying views were expressed in terms of the carriage of wheelchairs and the ability of the current fleet(s) to accommodate this. The most common view expressed from the trade related to the relatively low numbers of trips made by individuals in wheelchairs, though some acknowledgement was made of the hidden nature of this demand (latent demand). A more positive view of demand was expressed by wheeltrans representatives who suggested demand for their own services had increased, with increased demand requiring the addition of a 24 hour service. Wheeltrans had been increasing their use of taxis in the provision of wheelchair transportation through dedicated brokerages across the city and a wheeltrans specific contract.

The process by which wheeltrans services were administered in respect of their taxi operation was considered by some respondents to have a high cost in its administration. The wheeltrans "taxi" service effectively worked on specific scheduling of taxi vehicles in the role of buses, with route definitions dictated by wheeltrans. Additional payments would be made in respect of "last minute" trip bookings. Conflict existed between those seeking to expand the provision of wheelchair accessibility across the wider fleet, in which case the role for wheeltrans may be affected, as would the issue of financial support; and those seeking to limit wheelchair accessibility to defined brokers.

A number of respondents made reference to the AODA, with a difference between a number who considered that the Act required 100% accessibility, and a stated position on the part of the city, that the AODA required the development of an accessibility plan in that timescale. A number of stakeholders were keen to see all of the vehicles within the fleet moving to 100% accessibility arguing that the presence of differing vehicle types would work against market responses to accessibility.

On the issue of license "ownership" and value; a series of comments were made in respect of ownership, transferability and impact in the market. Concerns expressed

related to the values associated with the plate, though few commented directly on the legality of transfer. The existence of three plates with varying levels of transferability, from zero in the case of the Ambassador, to a fully market led value associated with the Standard plate, was felt to be confusing and often inappropriate by some. Some respondents addressed the issue on the basis of market distortion, that the tradability and dominance of certain players led to market failure; while others expressed concern over the treatment of previous applicants on a waiting list. Some sympathy was also expressed related to the impacts felt by Ambassador plate holders with no tradable value. Most felt that the range of plates was not appropriate and some form of consolidation would be called for. A small number of respondents made reference to the potential that may arise from a "conversion fee", an amount levied on change over from Ambassador to Standard plates that might benefit the trade by providing an element of social support, healthcare or retirement benefit. Others suggesting the association of a conversion to a requirement for wheelchair vehicles, discussed in more detail in subsequent sections.

The presence of license agents, those holding standard plates on behalf of others, was a cause for concern. The presence of agents was argued as distorting the market by some, including larger brokerages, although some relationships between brokers and agents was alluded to. "Fees", in general, were alluded to at this point, with the view that the extent of fees and the role of a competitive market for standard plates, was felt to impact on the market. Fees in general were confused, although a common figure was repeated across a range of drivers. A total figure including brokerage and license was most commonly discussed, though some acknowledgement was made of the role of technologies in affecting this. App providers foresaw and claimed credit for a standardization of fees toward a pay per booking base, although this is uncommon in brokerages at this point.

The potential for, and conflicts arising from, taxi apps was also discussed across a wide range of stakeholders. A particular issue arose in terms of the responsibilities and liabilities arising from app based bookings, and the potential for multiple operations, or operations in a number of different "brokerages" that would not necessarily be

apparent to the passenger. Relationships between plate holders, lease and license were considered appropriate for analysis.

Some comments were made in regard to "regulatory capture" a blurring of interests between the regulator and certain industry players, the most common comment relating to the interests of larger brokerages, though no direct evidence was presented of this relationship.

Market dilution and the presence of illegal and grey market operations was presented by a number of stakeholders, though widely varying estimates of illegal operation were quoted. The black and grey market is split between:

* "Taxi" Vehicles with no license. This includes some services at shopping centres on the periphery of the city, sometimes called "pirates"
* "Taxi" Vehicles with an out of town license (eg: Markham), no additional Toronto Pearson Airport license, plying for hire in the Toronto area. This may be encouraged by common liveries or the same company operating, in separate vehicles, in both areas - sometimes called "scoopers"
* "Taxi" Vehicles with an Airport License issued by the GTAA for use at Toronto Pearson International Airport, and licensed for pick ups in Toronto for Airport destined trips only
* Liveries, with a Toronto license operating as "taxis" by avoiding pre-determined minimum fares

Additional comments were made to accessible vehicles operating contract trips under provincial rather than city legislation.

The range of estimates related to the grey and back markets ranged from 2000 to 5000 additional vehicles on top of the licensed Toronto fleet. Although the figure was significantly different across stakeholders it is apparent that a significant competition exists from vehicles that are in breach of local licensing conditions.

All stakeholders made reference to the need for a taxi system that functioned. The extent of issue varied across respondents though all wanted to see the avoidance of exploitation, reduction in market failure and "better control".

## Vehicle accessibility

Vehicle accessibility was touched on as a part of the standard questioning. Accessibility in the taxi fleet was introduced as use of taxi vehicles that were able to provide increased access to individuals with a mobility impairment. Wheelchair Accessibility was also introduced with reference made to Wheelchair Accessible Taxis (WATs) as a generic term, and vehicles complying with Canadian Standard CSA D409 as Wheelchair Accessible Vehicles (WAVS). A good number of WAVs are not taxis, the standard initially defined for bus manufacturers. For the sake of clarity the discussions focused on WATs as any taxi, in common use, able to carry a wheelchair, whether D409 compliant or not; and WAVs as related to compliant taxi vehicles for the purposes of the discussions.

Two forms of WAT exist, those which are purpose built to allow for use of wheelchairs, and those which are converted for the purpose. Post production conversions are more common in North America, with the MV1 being one of a very few WATs purpose built for the North American market. The MV1 has been designed to be compliant with the Americans with Disabilities Act (ADA), though some questions were raised whether it would conform to the CSA D409. Other production purpose built WATs include the London Taxi, which would not conform to either ADA or CSA D409; and the pre-production prototype Karsan V1, which has been designed to meet these standards. London style taxis are manufactured by a number of competing manufacturers, including LTI and Allied Vehicles, which has had an impact in the price in the London market. One Canadian market has licensed the LTI London taxi for use in its jurisdiction, though this has been achieved by applying for, and receiving, an exemption from the CSA D409 standards.

Post production conversions have a greater role in the current market as these are available to the local taxi suppliers without the need for exemptions. It was suggested by some respondents that the use of a post production converted vehicle, where the conversion was made to a used vehicle, would not require certification of conformity.

The most common discussion related to the costs of operating accessible taxis, being a limiting factor in their use in the Toronto market. A variety of, differing, costs were presented in the course of the stakeholder engagement, though many of these did not present like for like purchase costs in comparing WATs with non-accessible vehicle types. Other price related factors included the additional insurance burden that would be carried by the WAT operator, and the need for additional payments to offset both additional operating time taken in loading and unloading; and the unwillingness on the part of ambulant passengers to use accessible vehicles. Subsidies were presented as a standard form of support for wheeltrans, with the additional comment that the Taxicab industry may be expected or required to provide accessible vehicles with no city support though some variation existed in this area of discussion, with commentary on the benefits of taxi use across the city in place of wheeltrans, and the potential to include any user side support in electronic ticketing, such as the "Presto" card.

A small number of respondents indicated that WAT users would typically comprise lower income members of society. To place a financial burden on this groups might be seen as discriminatory.The conclusion being that any additional costs of providing WATs be borne by the wider community.

A view was widely expressed that ambulant passengers were not keen to use accessible taxis. There may be a number of reasons for this including the external markings of the number within the fleet that are accessible. It may also relate to the proportion of WATs in the Toronto fleet marking them out as something unusual. A few comments were made regarding the design of WATs, and in particular of the location of side door ramps as limiting or making access very difficult for able bodied travellers, though we would suggest that this was more related to the design of the

conversion rather than a fundamental unwillingness to use such vehicles. market. Similar commentary is included in preceding sections in relation to market diversion in the current market.

Turning restrictions were also highlighted to the team, one example being restrictions placed on turns in the Yonge and Eglinton area, resulting in more circuitous routes, illegal u-turns or service refusals.

# Appendix 2 - On-line public survey

The Taxi Research Partners are undertaking this survey on behalf of the City of Toronto. We would be very grateful for a few minutes completing this. This survey should take 5 minutes or less to complete.

All responses are confidential, we will not use any information collected outside of this study.

Any questions regarding our work can be addressed to us directly on: 1-202-407-9723, or by email: james@taxiresearch.org

**1. Have you used a taxi in Toronto over the last 12 months?**

- ○ Yes
- ○ No

**2. When did you last use a taxi in Toronto**

- ○ Today
- ○ This week
- ○ Last Week
- ○ Last Month
- ○ Within last 3 months
- ○ Within last 6 months
- ○ Within last 12 months

The following questions relate to your last taxi journey in a Toronto taxi. We will ask you about that journey. Please answer for that journey only.

**3. Please tell us which of the following best describes the PLACE where you boarded your taxi. Please also tell us the name of the street intersection where you boarded.**

- ○ From the suburbs of Toronto
- ○ From Downtown Toronto
- ○ From a University or College Campus
- ○ From Pearson International Airport
- ○ From Billy Bishop Toronto City Airport
- ○ from Union Station

Please specify the name of the street intersection

**4. Thinking about your last journey, what activity did you take your taxi from. If you were engaged in more than one activity, e.g.: Shopping then stopping for a coffee, please choose the LAST activity only.**

- ◯ From Home / Friends house
- ◯ Workplace
- ◯ Formal Restaurant
- ◯ Family Restaurant
- ◯ Fast Food Restaurant
- ◯ Coffee shop
- ◯ Bar
- ◯ Nightclub
- ◯ Shopping Mall
- ◯ High street store
- ◯ Supermarket
- ◯ Theatre / ticketed event
- ◯ Hotel
- ◯ Bank
- ◯ Transfer from Go / VIA / Amtrak train
- ◯ Transfer from TTC subway or streetcar
- ◯ Transfer from Coach Canada / Megabus / long distance coach
- ◯ Transfer from Airplane
- ◯ Doctors appointment
- ◯ Other medical appointment
- ◯ Gym / recreation

**5. On your last taxi journey, how did you engage your taxi**

- ◯ Called Taxi company by phone
- ◯ Used a smartphone app
- ◯ Hailed a taxi on the street
- ◯ Went to a cabstand

**6. Approximately what time did you travel?**

| | HH | MM | AM/PM |
|---|---|---|---|
| Time of day | ☐ : | ☐ | ☐ |

**7. If you booked your taxi BY PHONE, approximately how long did you wait for the taxi?**

Minutes ☐

**8. Please tell us for each of the following situations, if you would be less likely, or more likely to use a taxi**

| | Much less likely | Less likely | Unchanged | More likely | Much more likely |
|---|---|---|---|---|---|
| If a taxi were able to get to you 10 minutes more quickly | ○ | ○ | ○ | ○ | ○ |
| If a taxi ride was reduced by $1 for an average trip | ○ | ○ | ○ | ○ | ○ |
| If a taxi ride was increased by $1 for an average trip | ○ | ○ | ○ | ○ | ○ |
| If there were more cabstands in downtown locations | ○ | ○ | ○ | ○ | ○ |
| If you had access to a free taxi app that visually tracked the arrival of your taxi | ○ | ○ | ○ | ○ | ○ |
| If the cost of a subway ride increased by $1 | ○ | ○ | ○ | ○ | ○ |
| If more accessible taxis were available | ○ | ○ | ○ | ○ | ○ |

**9. This question asks about waiting times for taxis.If you have experience of making one of the following journeys, please tell us how long you waited for a taxi to arrive.**

| | Immediately available | Up to 5 minutes | Five minutes up to 15 minutes | 15 minutes up to 30 minutes | 30 minutes or longer | I have no experience of this trip |
|---|---|---|---|---|---|---|
| Last time you took a taxicab home from the bar after midnight on a weekend | ○ | ○ | ○ | ○ | ○ | ○ |
| Last time you took a taxi from shopping mid week during the middle of the day | ○ | ○ | ○ | ○ | ○ | ○ |
| Last time you took a taxi from a train station cabstand to work in the morning | ○ | ○ | ○ | ○ | ○ | ○ |
| Last time you took a taxi from home to the theatre / ticketed event on a Friday evening | ○ | ○ | ○ | ○ | ○ | ○ |

**10. This question asks how long you think you SHOULD wait for a taxi. For each of the following examples how long do you think a customer should have to wait for a taxi. Please include reasonable time for a taxi to arrive safely.**

| | Immediately available | Up to 5 minutes | Five minutes up to 15 minutes | 15 minutes up to 30 minutes | 30 minutes or longer |
|---|---|---|---|---|---|
| Waiting for a taxicab home from the bar after midnight on a weekend | ○ | ○ | ○ | ○ | ○ |
| Waiting for a taxi from shopping mid week during the middle of the day | ○ | ○ | ○ | ○ | ○ |
| Waiting for a taxi from a train station cabstand to work in the morning | ○ | ○ | ○ | ○ | ○ |
| Waiting for a taxi from home to the theatre / ticketed event on a Friday evening | ○ | ○ | ○ | ○ | ○ |

**11. Thinking about the use of Cabstands. Please tell us what distance would you consider is NEARBY (in city blocks); and what distance would be TOO FAR to walk to a cabstand.**

A taxi stand is nearby within (city blocks) _____

A taxi stand is too far beyond (city blocks) _____

**12. What is your gender**

○ Male

○ Female

**13. What is you age group**

○ Up to 16

○ 16 up to 19

○ 19 up to 21

○ 21 up to 35

○ 35 up to 45

○ 45 up to 65

○ 65 and over

**14. Please enter your postal code**

**ZIP/Postal Code:** _____

# Appendix 3 - On-line driver survey

## Toronto Taxi Drivers survey

**Taxi Research**
Market | Infrastructure | GIS | Fares

The Taxi Research Partners have been asked to undertake a review of taxi services in Toronto. As a key member of the taxi community we would like to ask for a few minutes of your time in completing this analysis. All responses are confidential and will not be used outside our study.

I welcome your views, and ask for any comments you feel relevant to our work. I have included an open comment question at the end of the survey, please do use this to highlight your views and concerns.

All information collected in this survey will be treated as confidential and will not be used outside of our study.

Your answers are very important to us, and will help us fully understand the Toronto taxi market. We appreciate your help in our study.

Sincerely

James Cooper
Head of Taxi Research

**Which of the following best describes you.**

- ☐ I am a taxi driver with my own Standard licence
- ☐ I am a taxi driver with my own Ambassador licence
- ☐ I am a taxi driver with my own Wheelchair vehicle licence
- ☐ I am a taxi driver leasing a vehicle under a Standard Licence
- ☐ I am a taxi driver operating under a different licence (please specify)
- ☐ I am a shift driver
- ☐ I am involved in the taxi trade but not as a driver. (please specify your involvement)

Additional information

**Which of the following best describes your vehicle**

- ◯ I own my vehicle outright
- ◯ I own my vehicle and have financing
- ◯ I own a share of my vehicle with another driver
- ◯ I lease my vehicle from another driver
- ◯ I lease my vehicle from a company

Other (please specify)

**If you do not own your vehicle how much do you pay in rent / shift rate? You can enter a value for a day, week or month, you do not need to enter all three.**

$ DAY

$ WEEK

$ MONTH

**If you have financing for your own vehicle, how much do you pay? You can enter a value for a day, week or month, you do not need to enter all three**

$ DAY

$ WEEKLY

$ MONTHLY

**What do your daily, weekly or monthly payments cover? Please check all items covered. Please add any additional items coved by your payment in the others box**

- ☐ Vehicle use
- ☐ Vehicle Maintenance
- ☐ Insurance
- ☐ License lease
- ☐ Additional permits, eg airport
- ☐ Fuel

Other (please specify)

**What Vehicle do you drive?**

Vehicle Make

Vehicle Model

Vehicle Year

**How many days a week on average do you drive a taxi?**

Days / week

**What time of day do you normally choose to drive?**

- ◯ Mainly daytime shifts
- ◯ Mainly Nighttime shifts
- ◯ Mix of daytime and nighttime

**How many hours a day on average do you usually drive?**

Hours per day

**In a typical day, how many trips do you carry?**

Single trips:

**Do you accept credit cards?**

- ◯ Yes
- ◯ No

## Costs

For the next question, please enter values for EITHER 1 DAY, 1 WEEK OR 1 MONTH

### On average, what do you pay a DAY for each of the following:

| | |
|---|---|
| Fuel | |
| Maintenance | |
| Dispatch Fee | |
| Rent / Shift rate | |
| Vehicle Interest Payment (bank loan / hire purchase) | |
| Motor Insurance | |

### On average, what do you pay a WEEK for each of the following:

| | |
|---|---|
| Fuel | |
| Maintenance | |
| Dispatch Fee | |
| Rent / Shift rate | |
| Vehicle Interest Payment (bank loan / hire purchase) | |
| Motor Insurance | |

### On average, what do you pay a MONTH for each of the following:

| | |
|---|---|
| Fuel | |
| Maintenance | |
| Dispatch Fee | |
| Rent / Shift rate | |
| Vehicle Interest Payment (bank loan / hire purchase) | |
| Motor Insurance | |

## Maintenance / Parts

**If you LEASE your vehicle, does your lease include maintenance?**

- ◯ Yes - I do not need to pay additional money for maintenance
- ◯ Yes - but I need to pay for some maintenance
- ◯ No - I pay for my own vehicle maintenance

**In the last 12 months, which of the following have been replaced or repaired on your taxi? For each item, please enter how many items were replaced in the last 12 months. If you replaced "sets" please count all items individually: e.g.: If you replaced ALL FOUR TIRES at the same time, please enter "4".**

| | |
|---|---|
| Batteries | |
| Alternator | |
| Starter Motor | |
| Radiator | |
| Water Pump | |
| Brake Pads | |
| Brake Drums | |
| Brake Lines | |
| Exhaust System | |
| Gearbox | |
| Engine | |
| CV Joints | |
| Tires | |
| Shock absorbers | |
| Springs | |
| Headlights | |
| Taillights | |
| Body Panels | |
| Bumper | |
| Respray | |
| Seat (front) | |
| Seat (rear) | |
| Air conditioning system | |
| Windscreen | |
| Wiper blades | |
| Wiper motor | |
| Swing out step | |

Roll Bars

**Please add any items you have replaced, but are not included above, and the APPROXIMATE DATE FOR THE LAST TIME you replaced these**

Other: Specify part name, how many replaced last time, and the approximate date

Other: Specify part name, how many replaced last time, and the approximate date

Other: Specify part name, how many replaced last time, and the approximate date

Other: Specify part name, how many replaced last time, and the approximate date

**Approximately how many kilometres with passenger do you drive your taxi?**

In a day

In a week

In a month

In a year

**Thank you for completing our survey. Please click to move to the prize draw**

◯ I have completed all questions accurately and to the best of my knowledge.

**Please use the following space to let us know of any issues regarding the supply of taxis in the city of Toronto.**

# Appendix 4 - Stakeholder Engagement Participants

Dispatch Companies
Beck Taxi
Diamond
Royal

Taxi Driver Groups
iTaxi Workers Association
W Plate Drivers
Gerry Manley
John Duffy
Jafar Mirsalari
Louis Seta
Taxi Drivers Coalition

Accessible Taxi Fleets (Wheel Trans Contract)
Co-Op
Royal

Transit Providers
Wheel Trans

PV and Limo Licensees
Wheelchair Accessible Transit

App Companies
Hailo
Uber

Disability Stakeholders
Disability Issues Committee (Transportation Subcommittee)
Oliver Ramaker

Tourism/Business Groups
Toronto Economic Development
Liberty Village BIA