

IMPROVING TAXI REGULATION THROUGH PERFORMANCE MEASUREMENT

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Introduction

Taxi regulation has long been questioned.¹ Low threshold costs of entry, apparent lack of economies of scale and a relatively homogeneous product suggests a workably competitive market structure. Yet taxi regulation persists in many metropolitan jurisdictions which have retained elements of either entry or pricing regulation or both². None the less, public authorities are obligated to refine and improve the regulatory environment in the public interest.³ The primary challenge for regulatory authorities is how to ensure an adequate supply of taxis to meet demand for taxi services without destabilizing the taxi suppliers. This is complicated by the peak demand problem where taxis are typically in short supply during high demand periods but in excess supply during other periods. The British Columbia Passenger Transportation Board (PTB) and the Vancouver taxi industry cooperated to meet this challenge through the issuance of temporary peak operating permits that eventually led to an increase in licenses for peak service supported by rigorous evidence. This paper describes the research that produced the taxi performance metrics and analyzes the feasibility of embedding the periodic collection of such information into the regulatory process. This paper concludes that taxi regulation could be more *effective* by enabling it to be performance driven.

Economic, Regulatory and Managerial Structure of the Vancouver Taxi Market

Taxi service is a relatively homogeneous product. The customer obtains a taxi by calling the taxi dispatch or finding the taxi on the street. The former is called dispatch service and the latter is called flagged or hailing service. Today, “calling” includes contacting the taxi dispatch by mobile apps. Subsequently, the taxi arrives, loads the passenger and transports the passenger to the desired destination. Taxi service is demanded and supplied 24 hours a day, seven days a week.

The taxi industry in Vancouver was composed of:

- 4 Vancouver taxi firms operating 588 taxicab licenses in 2011. These firms can pick up passengers within Vancouver and deliver them to any destination including drop offs in adjoining jurisdictions. A portion of these taxis have additional permits which allow them to pick up at Vancouver airport (YVR) and drop off in any jurisdiction.
- 24 taxi firms domiciled outside of Vancouver served the Greater Vancouver Regional District (GVRD) operating 960 taxis.⁴ These firms could pick up passengers in their jurisdiction (e.g. the municipality of Burnaby) and like the Vancouver taxis could provide service for trips originating in that jurisdiction to any other jurisdiction including Vancouver. These firms are not legally permitted to pickup in Vancouver. Similarly a portion of these taxis can pick up at the YVR.

Potential substitutes for taxi service include limousine or black car service, bus and light rail transit service, and private automobile transportation. For example the Canada Line opened in time for the Winter Olympics in 2010. This prompted a substantial reduction in taxi trips between Richmond/YVR and downtown Vancouver. However this increased the number of short taxi trips between Canada Line stops and the final destination or origin in Vancouver.

The taxi industry is regulated at two levels. The British Columbia Passenger Transportation Board (PTB) regulates pricing and licensing

of taxis across municipal boundaries. Each municipality in turn regulates within its boundaries and in addition, requires all taxis to meet municipal bylaws.

Sixteen taxi companies operated 525 vehicles that are licensed by the YVR to pick up at the airport. The YVR renegotiates the contracts every 4 to 5 years with no obligation to maintain the current agreements. Taxis providing service to the YVR must in addition, have a license from the PTB and their home municipality, and thus do not confine their service to the YVR alone.

The larger taxi companies in the GVRD and specifically all 4 of the Vancouver taxi firms operate under a shareholder structure often referred to as a coop. The company owns the motor carrier authority, or fleet license, with its designated number of plates, and runs the dispatch service. Vehicles may be registered in the name of the company, but are beneficially owned by the individual operators who are shareholders in the company. The shareholders elect a Board of Directors who, in turn hire the general manager who is responsible for hiring the dispatchers. The taxicab company also provides accounting, cash management, maintenance, equipment acquisition and fuelling service. Taxis operate 24 hours a day, typically in two shifts. The owner of the license can operate the vehicle him/herself or lease the vehicle that is licensed to a driver.⁵

Regulatory, Economic and Service Issues

The decisions by the PTB and the City of Vancouver as to how many cabs to license is the most important decision that they make. If these regulatory authorities allow too few taxicabs, this may result in an under supply of taxis, creating lengthy waits for cab service and sometimes prevent customers from obtaining service at all. An oversupply of cabs can lead to service problems such as aging and ill-kept cabs, high turnover among underpaid and poorly qualified drivers. Allowing too many taxis is tantamount to quasi deregulation of entry.

Studies have found travelers to be more sensitive to the ready availability of taxis than to speed, comfort, or virtually any other service feature.⁶ It makes no sense to allocate taxi service through excessive waiting “costs” because doing so degrades an essential attribute of the service—its convenience and speediness. It makes more sense to match supply with demand.

The balancing of supply and demand is complicated by the inherent feature of any service, the product cannot be inventoried or stored to balance supply with demand. Taxi demand is characterized by high (peak) and low demand periods which result in undersupply of capacity during the peak period and oversupply of capacity during the non-peak period. These include weather related peaks, morning and afternoon rush hour peak, first day and last day of work week peaks, event related peaks and the weekend – late hour peak. The peak demand challenge is particularly acute on weekend nights in Vancouver. This is a year round peak demand period problem for taxis concentrated in the downtown entertainment district of Vancouver on Friday and Saturday night from 10:00 pm to 4:00 am. This peak is increased or widened on “game” and “concert” days. The top 10 hourly demand periods out of 168 hours during a typical week fall within the 12 hour periods between 10:00 pm and 4:00 am on Friday and Saturday nights. All 12 Friday and Saturday hour periods are in top 15 hour periods by number of trips⁷.

Vancouver’s weekend, late evening entertainment activity includes nightclubs, restaurants, bars, regular and special entertainment events. Taxis provide the convenience and service that many patrons demand and are willing to pay for, especially in inclement weather and if the patrons are unable or prefer not to use their private automobiles. The demand for taxi services increased in 2011 due to the enforcement of drunken driving laws which discouraged patrons from using private cars. The subway system stopped service at 1:00 a.m. and limited bus service was available. Consequently taxis have become the transportation alternative of last resort for some people.

It was perceived that the supply of taxis may be insufficient to meet the demand for taxi services during the late night hours of Friday and

Saturday when the entertainment activity in downtown Vancouver peaks. Extensive media attention revealed multiple stakeholders dissatisfied with the level of service provided by the taxi industry. Consumers complained of long wait times to get a taxi dispatched for a trip, of not being able to flag a taxi on the street or find a taxi at a stand without a lengthy wait or walk, and refusal of service by taxis to accept trips to destinations far out from the city. The limited supply of taxis was a significant concern of the Vancouver Police Department (VPD) which is tasked with maintaining order on the streets. Police sought to clear the streets for safety reasons as quickly as possible and inebriated persons pose a hazard to themselves, to other pedestrians on the downtown streets, and to local businesses. The VPD is responsible for the safety of all persons and taxis are often utilized to transport persons who can neither drive nor find a taxi on their own.

The peak demand problem exists in many cities in Canada and around the world with a variety of responses by regulatory authorities.

- In Singapore, a peak hour surcharge of 25% is charged on the metered fare during peak periods. Effective at the end of 2012, taxi companies had to ensure that during peak periods, they must ensure that 70 per cent of their cabs are on the road. This rises to 85 per cent by 2015⁸.
- The city of Austin authorized a \$1 surcharge for rides from 9 p.m. to 4 a.m. everyday as an incentive for drivers to provide service during those hours.⁹
- In Calgary, 55 accessible taxi plates were approved for peak hours on Friday and Saturday nights in 2012. But despite having 1,526 licensed cabs, Calgary still suffers severe shortages of taxis on Friday and Saturday nights. Recently it was proposed to require every one of the city's licensed taxis to be running during weekend peak-demand hours¹⁰.
- Peak service taxis were introduced in Victoria (Australia) in 2002 to improve the availability of taxis at night between the hours of 3 pm and 7 am and during special events. Peak service taxis have distinctive green roofs and are commonly referred to as 'Green Tops'. There are increased fares at peak times.¹¹ A similar program exists in Perth in Western Australia..¹²

- A significant peak in taxi demand is associated with the use of taxis to go home from entertainment was observed in Toronto. However no specific recommendations were made for meeting peak taxi demand.¹³

The VTA responded to the Vancouver peak demand shortage by employing on-the-street supervisors who directed cruising taxis to high demand locations and hot spots on peak nights, and secured taxis for the VPD when the police had passengers that needed transportation to return home but were in no condition to flag a taxi. The VTA members also worked with the members of the coop firms to ensure that every taxi was on the street if demand was expected to be very high based on historical traffic demand, scheduled events and weather.

Temporary Operating Permit (TOP) Program

The VTA responded strategically with a proposal to create a peak taxi license confined to picking up passengers only in the downtown core on weekend nights. The VTA members have always worked closely with the Vancouver City Taxi Licensing department and the VPD in seeking solutions to traffic and service problems. The VTA interacted with both as participants in the Vancouver Taxi Roundtable

The VTA filed an application for peak weekend Temporary Operating Permits (TOP) as a six month pilot commencing on April 29, 2011 and ending on October 30, 2011. This application had the following features:

- Increase the licensed fleet size by 65 taxis peak from 588 to 653 taxis during the weekend, an increase of 11%.
- Committed license owners to commission the 65 taxis.
- The period of use was 6 months, much of which was in the warmer months when activity in the downtown is consistently high on weekends.
- Set up procedures and policies to ensure that the majority of the taxi fleet was on the street during the peak weekend periods.

- Provided for monitoring the performance of taxi service before and during TOP.

The goal of the monitoring was to measure the impact of the TOP pilot project on the performance of the Vancouver taxi industry in meeting the needs of taxi customers. This was to be achieved by measuring service levels before TOP and during TOP when the supply of taxis was increased. The proposed TOP pilot project was a positive step in meeting perceived shortages in taxi capacity in Vancouver and at the same time, not committing to an irreversible structural change that could irreparably destroy the livelihood of the existing taxi owners serving Vancouver.

In the past, a rigorous measurement of the relationship between taxi supply and service had not occurred. The TOP application was designed to produce factual data about the demand for taxis and the level of service actually provided and support improved regulatory decision making. At that time, it may have been the first such study of its kind or scale in any North American city. The PTB approved the TOP application with the stipulation that Dr. Garland Chow implement the performance monitoring based on the VTA proposal terms of reference and stated “if complete and consistent data are monitored and assessed as described in Professor Chow’s terms of engagement, will provide valuable information in determining an optimal solution to the issue of taxi service in the City of Vancouver on a more permanent basis.”¹⁴

Other conditions were necessary for this TOP pilot project to be effectively implemented. The high cost of vehicle insurance was potentially a barrier. All taxis must be licensed by the Insurance Corporation of British Columbia (ICBC). The Vancouver taxi firms were able to put into service many taxis which according to ICBC limits on lifetime mileage were at end of service life. ICBC normally would not license these vehicles as full time taxis but many of these taxis exceed all other criteria for serviceability. The VTA successfully negotiated with ICBC to license the peak hour taxis at a reduced insurance fee as long as these peak hour taxis traveled less

than a prescribed annual mileage. Another key enabler was the availability of part time drivers to drive these vehicles.

Design of the Performance Measurement Project

The Chow study sought to measure the impact of the TOP pilot project on the performance of the Vancouver taxi industry in meeting the needs of taxi customers and the productivity of the Vancouver taxi industry in terms of vehicle utilization¹⁵. This required the acquisition of data from three sources.

Taxi Dispatch Data

The cornerstone of the project methodology was the ability to utilize trip information from the dispatch systems of the 4 Vancouver taxi companies. These systems provided individual trip data including when a customer called dispatch for a trip, when the trip was dispatched, when the passenger was picked up and dropped off. In addition the dispatch data identified the vehicle, pickup and drop off location and whether the trip was cancelled or the passenger was a “no show” at the pickup location. This permitted the calculation of:

- Dispatch response time, how long it takes to assign a vehicle to the job
- Service response time, how long it takes for the taxi to begin a trip after the taxi had been dispatched, and
- Total service time, the time from initial call to the start of the trip.

Over 100,000 trip records of 3 taxi firms, for trips between 9:00 pm and 6:00 am on 4 Friday and Saturday nights before TOP and during the end of TOP were captured and utilized.¹⁶

Taxi Patron Service Survey

The dispatch systems of all but one of the Vancouver taxi companies only collected information for dispatched trips. While that one taxi firm had a dispatch system that collected information on flagged trips, that information was limited to the time the trip started and the time the trip ended (plus vehicle and location identification). Thus the level of service of flagged taxi service could not be measured from data available from any dispatch system.

The taxi patron service survey overcame this limitation. The first survey was conducted in April 2011, prior to the implementation of TOP, to produce a baseline to measure the impact of the TOP program. The second Taxi Patron survey was conducted in September/October and measured the level of service and satisfaction after TOP had been in place for 5 months.

The in-person survey could measure service performance of both flagged and dispatch service whereas dispatch data could only measure service performance of dispatched trips. In addition a personal survey would permit the evaluation of the customer's satisfaction with taxi service and estimate of the length of the total customer cycle. The data for dispatched trips can only reflect what occurred after the taxi company answered the call for dispatch, not before. Similarly, when a person was picked up for a flagged trip, that data says nothing about how long the customer had to search or the distance that the customer had to walk in order to find the taxi. Thus dispatch data does not measure call response time or the time it takes for a customer to reach the taxi firm to request the taxi. Finally dispatch data can reveal whether service has increased or decreased but does not inherently provide any insight on the quality of that service or whether the service provided meets customers' needs. In addition, an in-person survey can collect aspects of service that cannot be measured from the dispatch system such as refusal to take a passenger and demographic information about the taxi user as well as on the trip itself.

The two taxi patron surveys collected a large enough sample to accurately estimate overall satisfaction during two time periods. 910 valid surveys were collected in April 2011 and 853 valid surveys were collected during the September/October survey period. Only persons who used taxis in the past were selected for the surveys. The service evaluation focused on the last trip taken by the respondent from downtown Vancouver on a weekend night. The majority of the "last trips" or over 75%, were taken within the last month before the survey was administered.

Taxi Screen Line Survey

The evaluation of taxi service performance cannot be effectively accomplished without an evaluation of the supply of taxi service. One of the challenges in measuring supply of taxi services was the existence of taxi service provided by suburban taxis illegally providing service. The only absolute method to control the supply of illegal taxis is to completely enforce regulations barring such vehicles from picking up passengers in downtown Vancouver prior to and during TOP. Notwithstanding the best efforts of the VPD and provincial enforcement officers to enforce licensing regulations, there will always be leakage particularly during the peak late night hours when enforcement officers have more important priorities such as attending to intoxicated pedestrians and physical altercations or damage incidents. Therefore the existence of illegal suburban taxis had to be accounted for in the performance and capacity evaluation. The true demand for taxi service and actual supply of taxi service cannot be determined from the Vancouver taxi statistics alone. Suburban taxi firms were not obligated to participate in the project and certainly would not voluntarily admit they were providing service outside of their licence.

Therefore, a screen line count of taxis in the downtown entertainment core was utilized to quantify taxi supply and to identify who is supplying the taxis. The screen line count provided objective information on the availability of taxis, with and without TOP, as well as quantified the role of non-Vancouver taxis and limousines. The Taxi Screen Line Survey or Count monitored the taxis that were in active service in the downtown entertainment district. The screen line survey counted the number of taxis passing by fixed locations, identified whether the taxis were city or suburban and noted whether the service light was on. The screen line survey counted 8010 vehicles in April and 8394 in November at 13 strategically located entertainment district sites.

Summary of Data Collection

The data and analysis from the taxi patron survey, taxi screen line count survey and dispatch data analysis together provide a holistic and more complete picture of supply and demand for taxi service to

Vancouver's entertainment district during peak weekend nights. The different sources of data:

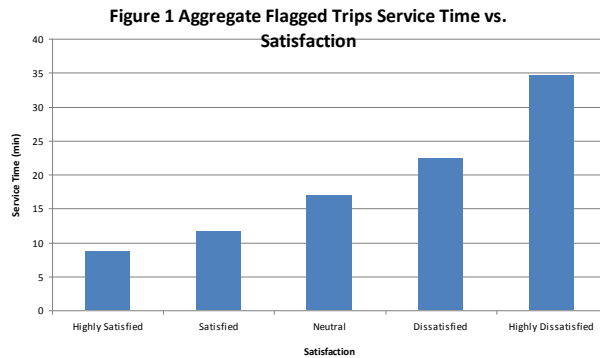
- Complemented each other by addressing market segments that are not covered by the other surveys or data generation vehicles. For example the dispatch data cannot measure flagged trip performance.
- Increased the relevance of the performance measurement, for example the screen line counts recognize the availability of taxis (by their service light) whereas dispatch data can only indicate that a taxi was in service that night.
- Provided cross validation of conclusions which can result in more robust findings or in concluding that some findings are less reliable.

Overall Findings¹⁷

The City of Vancouver taxi fleet increased by 10% during the weekend peak period and the dispatch data evidence of one taxi fleet indicated that the taxi fleet was fully utilized on Friday and Saturday nights with 98% of the firm's taxis on the street. Furthermore the average number of trips per taxi was practically the same with or without TOP. The increased fleet capacity was completely absorbed by market demand and this was a firm indication of unmet demand for taxi services without the added 65 taxis added on Friday and Saturday nights by the TOP program.

Overall, the results of the taxi patron survey indicated that taxi service in from the downtown entertainment core on weekend nights had improved in the months preceding the October survey of taxi service with TOP when compared with taxi services in the months preceding the April survey of taxi service without TOP. This was supported by evidence of improved customer satisfaction and service for both dispatched and flagged taxi service from the Taxi Patron survey. The dispatched trip data found a slight but statistically insignificant decrease in service times from the dispatch data. The Taxi Patron Survey also provided insights on just what is satisfactory service. In Figure 1, the relationship between total service time and

degree of satisfaction with taxi service is depicted. Passengers flagging taxis were satisfied with service slightly faster than 12 minutes and dissatisfied with service that exceeds 22 minutes. Passengers who called dispatch were satisfied with service that was less than 25 minutes and dissatisfied with service over 30 minutes.¹⁸ The reader is reminded that the satisfaction and service times are with respect to service on peak weekend nights, expectations and service are higher during non peak times. The dispatch data analysis indicated that a service response time of 15 minutes was provided well over 90% of the time for dispatched trips.



Assuming that weather had a neutral impact, the service improvement may be attributed to the increase in taxi capacity in the city of Vancouver created by the TOP program. Some of the service improvement might be the result of non-licensed taxis also providing service. It was observed however there is evidence that the level of customer satisfaction with non-licensed taxis was lower than for trips taken with Vancouver licensed taxis.

When considering the optimum number of weekend taxis needed in Vancouver, a confounding factor is the participation of non Vancouver licensed taxis in the passenger market. The percentage of trips made by unlicensed suburban taxis as reported in the Taxi Patron Service survey was 12% in the October survey. This is close to the midpoint of the range observed in the screen line count survey

where it was observed that slightly over 16% of the taxis on the street were non-Vancouver taxis and almost 9% of the taxis with service lights on were non-Vancouver taxis.

From these observations it was concluded that the effective fleet that was out on the streets on weekend nights in Vancouver is 742 vehicles which is the size of the Vancouver licensed fleet in October of 653 (existing 588 plus the 65 TOP licenses) divided by .88. The .88 adjustment reflects the capacity provided by unlicensed taxis (100% minus 12% of the vehicles) observed. This suggests an additional 89 taxis could be added beyond the 65 TOP licenses or 154 taxis in total. But this is only economically realistic if non-Vancouver licensed taxis are taken off the road. If they are not, then the productivity measured by trips per vehicle could decline significantly from the April 2011 benchmark. Crucial to this conclusion is the assumption that 12% of the taxi capacity on weekend nights is currently provided by taxis not licensed to provide pickup service in Vancouver and that enforcement will not be sufficient to change that figure substantially. This is a conservative figure based on the October 2011 taxi patron survey and corroborated by the April and November 2011 screen line count surveys.

Towards a Performance Based Regulatory Process

The PTB subsequently received applications by the 4 Vancouver taxi firms and multiple suburban taxi firms for permanent peak licenses permitting taxis with this license to operate during peak hours in a designated downtown core. The board sent a request to all of the applicants for data from their dispatch systems that paralleled the data utilized in the Chow report and utilized the 15 minute criteria for acceptable service response. This Chow study was "... given considerable weight in determining public need" by the PTB and along with other evidence the PTB concluded that the issuance of 137 peak taxi licenses which allowed vehicles to operate at specific peak periods was warranted.¹⁹

The utilization of the factual output produced in the Chow report demonstrates the value of factual and objective performance measurement in assessing the supply and demand for taxi services.

The PTB thoroughly examined and accepted the evidence produced, supplemented it with further data from the applicants dispatch systems and made a decision that was relatively transparent with respect to rationale and evidence. Although demand was not directly measured, the level of customer satisfaction was an indicator that demand is sufficiently met or not. This is in contrast to the traditional criteria of the ratio of taxis to population. This is also in contrast to recently developed methods to identify “unmet” demand by identifying whether there is underutilized taxi capacity by observing whether taxis are being used or not.

Modern dispatching systems are GPS based and can collect trip data for flagged as well as dispatched taxi trips. The data is readily accessible if archived correctly and provides evidence of taxi service, productivity, utilization and availability. If this data was available to a regulatory authority, it could monitor dispatched taxi service and relevant activity and proactively initiate changes in the number of taxi licenses that are issued. This includes revoking licenses that are underutilized or making new license available for bidding or purchase. Most regulatory authorities, such as the BC PTB has authority over taxis in adjoining jurisdictions, thus that authority has no incomplete coverage issues as it can require data from all taxi firms in the region. This would eliminate the need for the taxi screen line counts utilized in the Chow study.

This must be supplemented by periodic taxi patron surveys. While new dispatch systems capture information for flagged trips, they do not capture the service cycle, they only counts the number of flagged trips. Flagged trips are important where there are large concentrations of pedestrian traffic as in the case of the downtown entertainment district on weekends. Thus the Taxi Patron study in downtown Vancouver was successfully implemented using rigorous survey protocols at a reasonable cost, notwithstanding the survey’s utilization of cheap labour, students! More importantly, such surveys will provide insights into just what constitutes good and acceptable

service as well as the latent demand suppressed by poor service or rate levels.

Taxi cab regulation need not be a periodic process in which new licenses are issued in batches after public out roar about poor service. It is unlikely that a magic ratio of taxi to population formula that measures demand indirectly can be accurately developed to determine the right number of taxis that should operate. The experience in Vancouver suggests that the number of taxis available to the public should be based on performance that could be monitored annually if not quarterly. The existing taxi cab companies generate extensive records of their call volume and response times which can be used to measure both service and demand. Combined with consumer surveys and periodic analysis of demographic data, regulatory authorities should be able to monitor taxi cab service and capacity to serve effectively and based future expansion of the number of taxi cab licenses on a more objective and proactive basis. Alternatively, municipalities such as the City of Vancouver could monitor taxi performance and proactively request additional taxi licenses in order to service their citizens better.

The implementation of the taxi performance monitoring program envisioned here is technically feasible but may require new regulations and reporting requirements. For example to avoid information gaps, all taxi operators would have to subscribe to a central dispatch service. Taxi firms may object to the cost of providing information and governments are cash strapped when it comes to new programs. This barrier could be minimized by increasing license fees for new licenses to fund the cost of the performance monitoring that made the new licenses available.

There are some jurisdictions that have moved in this direction, notably in Australia. Western Australia monitors dispatch trip performance quarterly.²⁰ New South Wales makes an annual determination on the number of new licenses to issue every year, in various categories such as peak versus multipurpose license and by location.²¹ With the recent experience in Vancouver, the PTB and other regulatory authorities across Canada are encouraged to explore

this direction to make taxicab regulation more responsive to public need.

¹ Regulation in this paper refers to economic regulation of price, service and entry. Safety regulations including vehicle safety and driver requirements apply in every jurisdiction and are not the subject of this paper.

² An inventory can be found in Shaller, B., Entry Controls in Taxi Regulation: Regulatory Policy Implications of U.S. and Canadian Experience, Sept. 2006.

³ Evaluation of taxi regulation in British Columbia includes: Mussallem, G. "Taxicab Review – Vancouver Region" (Motor Carrier Commission, British Columbia, May 1989), Lanyon, S., A Study of the Taxi Industry in British Columbia, Taxi Review Panel" (Ministry of Transportation and Highways, Victoria, BC, June 15 1999) and Evans, B. and J. Webb "An Examination of the Taxi Supply in the Lower Mainland" prepared for the Motor Carrier Commission of British Columbia (Oct. 2001).

⁴ British Columbia Passenger Transportation Board (PTB), Licence (sic) Application Decisions on Peak Period Taxi Service in the City of Vancouver, 2012.

⁵ Lanyon, p.24.

⁶ Cervero, R. "Revitalizing Urban Transit" Private Innovations in Public Transit, Weicher, J.C editor. (Washington D.C.: American Enterprise Institute for Public Policy Research, 1988).

⁷ Calculated from confidential Yellow Cab dispatch data by author.

⁸ Christopher Tan, "Will new taxi rules boost availability?" The Straits Times, Nov 26, 2012.

⁹ Alexandra Klima "Cabs to tax peak hours fee" The Daily Texan, Feb. 9, 2012.

¹⁰ Jeremy Nolaïs "Calgary to force all cabs to operate during peak hours", Metro, February 18, 2014

¹¹ <http://www.taxi.vic.gov.au/taxi-reform/about-taxi-and-hire-car-reforms>

¹² <http://www.transport.wa.gov.au/taxis/15247.asp>

¹³ Taxi Research Partners, Determining the Appropriate Number of Taxicabs and its Impacts for the City of Toronto, 2013.

¹⁴ PTB, p. 13.

¹⁵ Chow, G. Peak Demand and Supply of Taxis In Vancouver's Downtown Entertainment District Final Report, February 27, 2012. Hereafter the Chow report.

¹⁶ The 4th Vancouver taxi firm was missing data for 2 of the weeks and was excluded from the "with and without" TOP analysis. This was the smallest of the 4 taxi firms.

¹⁷ Detailed findings can be found in Chow (2012) or PTB (2012)..

¹⁸ Figure comparable to Figure 1 was left out due to space limitations and available on request from the author.

¹⁹ PTB, pp. 13, 40, 49 and 50.

²⁰ Western Australia Department of Transport, Taxi Industry Service Standards, Quarterly Report: July –September 2013.

²¹ <http://www.transport.nsw.gov.au/content/background>. It was beyond the scope of this research to determine what evidence is collected and how it is utilized in the the New South Wales taxi scheme.