



# Technical Report B - Parking Supply Response

Downtown Parking Space Activity Study for  
Stratford Ontario



D Sorbara Parking & Systems Consulting  
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## Contents

FIGURES.....	2
TABLES.....	3
Approach to the Parking Supply’s Response to Demand .....	4
Detailed Project Work Packages .....	4
Results of Parking Supply Response Surveys .....	5
The Parking Supply Service Line.....	5
The Evidence Base .....	8
Analysis Units .....	10
Block and Zone Unit .....	10
Parking Facility Unit .....	10
The Sample Survey Day Unit .....	11
Performance of the Parking System .....	11
Diagnostic Measure: Volume .....	12
Diagnostic Measure: Duration of Stay .....	18
Diagnostic Measure: Occupancy of Space and Pattern of Accumulation.....	24

## FIGURES

Figure 1: Geographic Distribution of Parking Supply and Type .....	7
Figure 2: Distribution of Parking Inventory Surveyed by Type .....	7
Figure 3: Block Unit of Analysis.....	10
Figure 4: Framework for Parking Supply Response Analysis .....	11
Figure 5: Box-Whisker Showing Comparative Facility Volume .....	13
Figure 6: Box-Whisker Showing Comparative Facility Effective Turnover.....	13
Figure 7: Info Graphic Showing Parking Activity Metric: Turnover.....	14
Figure 8: Info Graphic Showing Parking Activity: Temporal Variation of Volume .....	17
Figure 9: Info Graphic Showing Parking Activity: Duration of Stay .....	21
Figure 10: Info Graphic Showing Parking Activity: Duration of Stay Spatial.....	22
Figure 11: Info Graphic Showing Parking Activity: Parking Space Type & Customer Type.....	23
Figure 12: Info Graphic Showing Accumulation of Vehicles .....	27
Figure 13: Info Graphic Showing Periods of Intensity.....	28

Figure 14: Info Graphic Showing Key Performance Index (KPI) ..... 30  
Figure 15: Block References..... 32

**TABLES**

Table 1: Parking Inventory ..... 7  
Table 2: Survey Dates in 2015..... 9  
Table 3: Statistical Summary of Volume – all Survey Days ..... 12  
Table 4: Statistical Summary of Effective Turnover of Parking Space ..... 13  
Table 5: Peak Hour Occupancy for all Survey Days..... 25  
Table 6: Average Occupancy for all Survey Days ..... 25

## Approach to the Parking Supply's Response to Demand

Through turnover/duration of stay surveys conducted on Monday July 20<sup>th</sup> 2015 and Wednesday July 29<sup>th</sup> 2015 and again on Monday December 7<sup>th</sup> 2016 and Wednesday December 9<sup>th</sup> 2016 from 9:00 am to 6:00 pm provide the study with observations of current parking activity<sup>1</sup>. Targets or indices of how well the supply is responding to the demand inform our analysis of how well supply services its demand. An exploration of the interplay of volume of traffic (demand), the profile of the customer (the duration of stay) and their levels of convenience (walking distance to and from a carpark and destination point) associated with trip purposes and duration of stay provide the body of evidence that is measurable and can be repeated in future surveys of parking space use.<sup>2</sup> This integrated analysis culminates in a wide range of views and insights of the potential parking opportunities going forward.

Field workers experienced in the process provided this study with clean, validated, and reliable raw data that were directly synthesized into information about the parking activity in a timely matter. Through post processing application software, the field data provided us with arrival time, departure time of each vehicle in our study as well as where in the study area that vehicle parked.

The Study provides a range of parking space use statistics – volume, turnover, maximum occupancy, and of customer mix as in duration of stay. In the end, statistically valid ranges of parking activity parameters provide this study with a set of valid and reliable survey responses that support the analysis.

## Detailed Project Work Packages

In this section the major work packages (tasks) are described in terms of **objectives**, **process** and expected **results** or deliverables of Parking Supply Response. This response is evident in the study of the **patterns of use** throughout the day, as well as **duration of stay profiles**, **average and peak occupancy** of space and **turnover** values.

The specific **objectives** of the work packages are:

- Develop diagnostic indices of the relationship of supply to demand; fundamental technical and philosophic underpinnings of the management and operation of public parking space, has been the key role that **turnover**, **duration of stay** and **occupancy** play;
- Understand the extent of parking supply use, its market, and the relative advantages of one type of parking versus another; and
- Document peak period use of parking supply by user type that will inform key operational decisions such as time restrictions, level of enforcement and help to evidence the impact of overstaying on the on-street space on the local commercial economy.

The **process** devised to meet these objectives is as follows:

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<sup>1</sup> The survey schedule also serves to provide use data during theatre and tourist season as well as peak shopping period in December.

<sup>2</sup> In this way a framework has been constructed to provide a laboratory for comparison of demand levels over time..

- Inventory the parking supply and present that inventory in map form (hard copy and electronic) displaying areas of parking and characteristic type (hours of operation, duration of stay limitations, etc), location of on-street parking space marked for disabled, roadway characteristics (width, any special traffic features) and document safety and operational concerns.
- The inventory also marks the extent of the survey for the parking response task (the parking utilization).
- Off-street public parking inventory includes only the municipal parking facilities in the downtown.
- NOT included in this survey is privately owned space (that are open to the public). In a larger more comprehensive study we would have documented their inventory and use but because short preparation time we did not sample their detailed parking activity.
- **Stratford has a significant and growing summer tourist attraction** and it will be necessary to statistically adjust field observations obtained at other times of the year to reflect the potential effects of seasonality.
- Analyse Licence and accumulation surveys a consistent and comprehensive manner.
- Gain insight into the relationship **between the choice of parking location and the duration of stay and** the implied level of convenience or service.

The **results** of the supply response or utilization process will be expressed as:

- Electronic and tabular report on the **inventory** of parking supply in the downtown study area.
- An **analytic workbench** that will allow the study team to “slice and dice” the parking activity data. Individual parking activity profiles for each parking facility surveyed (includes turnover, occupancy table and graph, duration of stay profile) or consolidated by block face, north side of the street, south side or study team defined areas of special study.
- This report includes a statement of the overall performance of the existing parking system based on the results of the Licence plate surveys; performance measures include: peak and average parking space use, turnover of space, optimal turnover of space given current customer duration profile.

## Results of Parking Supply Response Surveys

### The Parking Supply Service Line

It has been the philosophy of this consultant that the parking system should be viewed as a business that provides customers with a number of products and service types.

The fabric of the parking supply resources in the study areas is made up of a number of different types of services. These services are differentiated in the following ways:

- Ownership – private and municipal;
- Levels of access to the parking space – restricted to customers only; employees; and/or accessible to anyone on a first-come, first-served basis;
- The amount of time a user can spend using the parking service – the time restrictions;
- The role of the service within a broader civic objective – municipal parking space designed to be made available to a wider number of customers; encourage turnover of parking space to serve a wider community of users.

From a study-wide perspective, we inventoried some 1,096 public parking spaces<sup>3</sup> in the downtown as shown on **Table 1**. Depending on the survey day, a parked vehicle was registered on some 38 to 43 parking areas (out of a total inventory of 55 parking facilities). The facilities' parking space capacity ranged from 1 space (normally a space restricted to customers that require accessibility) to a municipal parking facility on Erie Street of 136 public spaces. In addition some 260<sup>4</sup> parking spaces located south of Cooper Street were included in the surveys but only in the form of accumulation counts (number of vehicles parked). These spaces are "free" public parking space.

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<sup>3</sup> The differences you may see in the inventory generally reflects the number of Accessible spaces. If we did not see a vehicle park in an Accessible stall all day that space would not show up as inventory in our software.

<sup>4</sup> Although there were times when our field workers reported that the inventory could be as high as 300 spaces when vehicles parked in aisles and at the end of marked parking modules are taken into account.

Table 1: Parking Inventory

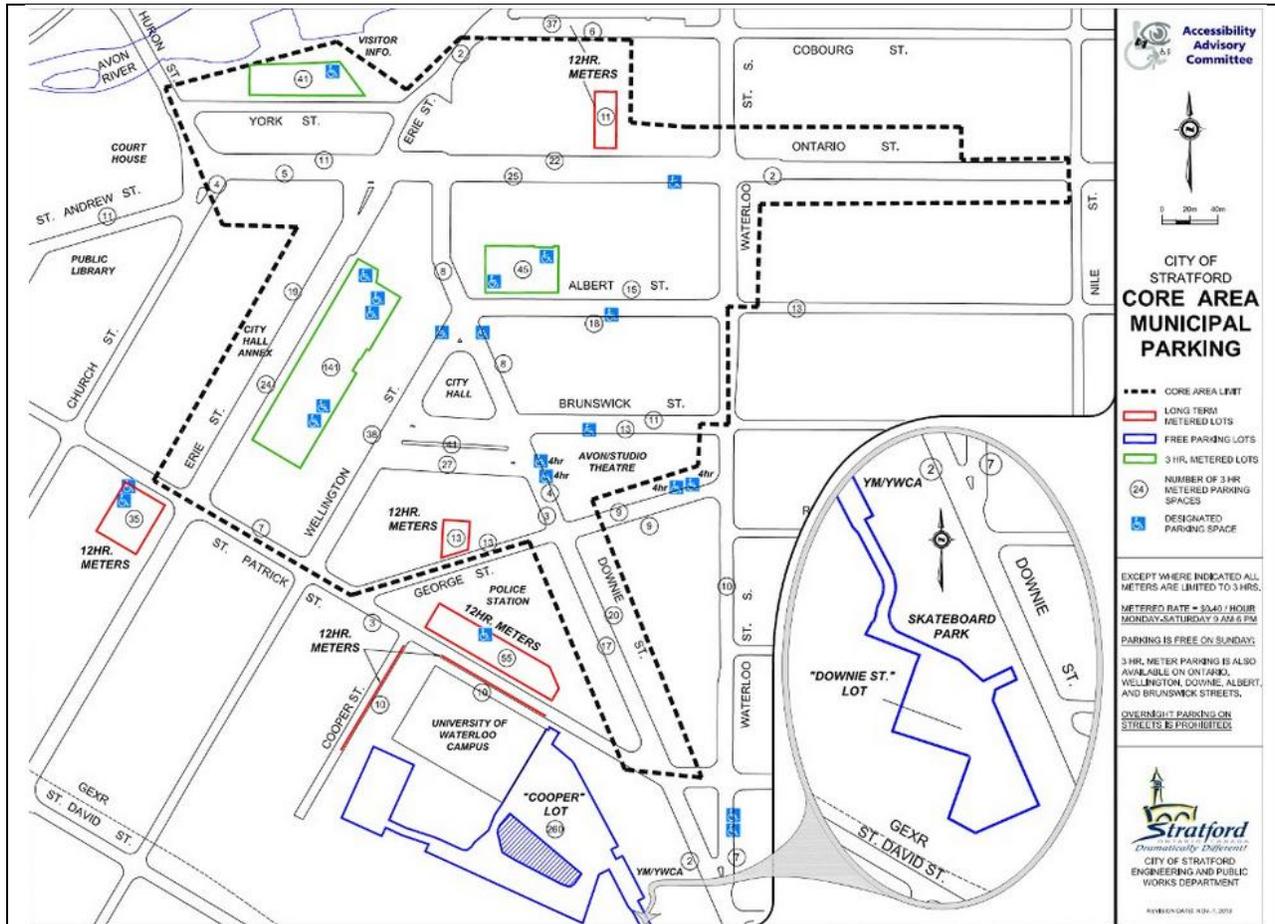


Figure 1: Geographic Distribution of Parking Supply and Type

**Parking Inventory Surveyed**

Type	Number of Stalls
Accessible	20
OFF - FREE	280
OFF - Pub 12 HR	111
OFF - Pub 3 HR	219
OS - 12 HR	64
OS - 3 HR	402

The type of parking space was defined by the consultant to represent parking facilities that are distinct in their restriction in maximum time spent and in their physical type - OS (on street) and OFF (off street) spaces.

Total number of space then is 1,096 spaces. Parked vehicles on the Monday survey date were found on 1,036 spaces and some 1,017 spaces on the Wednesday survey date.

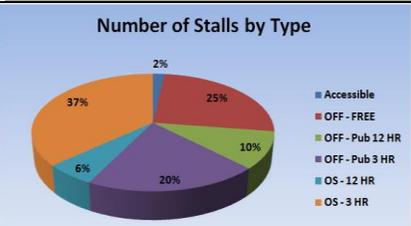


Figure 2: Distribution of Parking Inventory Surveyed by Type

**Notes:**

- Ratio of accessible stalls to total public inventory is within the rate that we have seen in similar downtowns
- Fifty-five (55) percent of the inventory is off street space and this is slightly higher than what is typically found in downtowns of this size. Certainly the municipality is a key stakeholder in terms of land resource and thus potential to influence development in the future planning horizon.

The three (3) hour time limited stalls (57 percent of the total inventory) represents a non typical downtown - where two hours is far more typical.

A second perspective on the parking inventory is to show the different types of products that are available to serve customers of different durations of stay and indirectly different trip purposes. **Figure 1** illustrates the spatial distribution of such parking space. The control of how much time one can park on a parking space would seem to be counter-productive to commercial business owners. Intuitively, one would want customers to stay in the commercial area for a significant amount of time that is, the greater duration of stay the higher the probability of spending more money in the commercial area.

From a parking planning point of view, we strive to generate traffic to the commercial areas as well. The difference is that we want to present to the prospective customer a range of parking products that meet their duration of stay needs. We are saying through the use of different time restrictions and different parking charges for the use of parking space is this: *For example if your trip purpose is under one to two hours please make use of the parking space along Street A that provide you with under three hour parking spaces. If your trip duration is greater than three hours, make use of our off-street parking spaces.*

It is the implicit role of the municipal parking organization to **market** the parking product – to invest in communicating the location of the facilities, and role of the parking service system in the overall scheme of things (how parking is integrated with urban design framework of the study area, and how parking is linked to commercial destinations for example). As well, the role is to provide a **way-finding mechanism** to get our customers to all of our parking space products in as safe, consistent and effective manner.

## The Evidence Base

Parking activity data was collected on two summer days July 20th 2015 and July 29th 2015 and two December days Monday December 7<sup>th</sup> 2016 and Wednesday December 9<sup>th</sup> 2016 from 9:00 am to 6:00 pm<sup>5</sup>. The objective was to examine the parking activity in on these days by collecting Licence plate turnover/duration of stay data. Licence plate surveys require that plate numbers be recorded at a regular interval along specified routes throughout the study areas. In this way, estimates of parking accumulation and duration of stay of each parker within the study areas can be measured.

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<sup>5</sup> The survey schedule also serves to provide use data during theatre and tourist season as well as peak shopping period in December.

Table 2: Survey Dates in 2015

Survey Date	Total Vehicles Surveyed		Parking Space Types Surveyed
Mon July 20 <sup>th</sup>	<b>Row Labels</b> ▾	<b>Sum of Capacity</b>	<b>Sum of Total_Volume</b>
	ACCESSIBLE	10	17
	OFF - 12 HR	111	171
	OFF - 3 HR	219	618
	OFF - FREE	260	
	OS - 12 HR	64	85
	OS - 3 HR	372	1177
	<b>Grand Total</b>	<b>1036</b>	<b>2068</b>
Wed July 29 <sup>th</sup>	<b>Row Labels</b> ▾	<b>Sum of Capacity</b>	<b>Sum of Total_Volume</b>
	ACCESSIBLE	7	19
	OFF - 12 HR	111	243
	OFF - 3 HR	219	670
	OFF - FREE	260	
	OS - 12 HR	64	128
	OS - 3 HR	356	1476
	<b>Grand Total</b>	<b>1017</b>	<b>2536</b>
Mon Dec 7 <sup>th</sup>	<b>Row Labels</b> ▾	<b>Sum of Capacity</b>	<b>Sum of Total_Volume</b>
	ACCESSIBLE	21	42
	OFF - 12 HR	111	178
	OFF - 3 HR	219	744
	OFF - FREE	280	
	OS - 12 HR	64	133
	OS - 3 HR	401	1755
	<b>Grand Total</b>	<b>1096</b>	<b>2852</b>
Wed Dec 9 <sup>th</sup>	<b>Row Labels</b> ▾	<b>Sum of Capacity</b>	<b>Sum of Total_Volume</b>
	ACCESSIBLE	19	36
	OFF - 12 HR	111	144
	OFF - 3 HR	219	478
	OFF - FREE	280	
	OS - 12 HR	64	87
	OS - 3 HR	393	1419
	<b>Grand Total</b>	<b>1086</b>	<b>2164</b>
<b>Grand Total</b>	<b>4,604 to 5000 vehicles</b>		

Downtown – off-street and on street plus accumulation counts on the off street free parking facility.

Capacity shown here is the number of parking spaces that we recorded a parked vehicle on.

In some cases, some parking facilities did not attract a vehicle, so it was not included in this total.

Stepping back, we observed 4,600 to 5000 vehicles over the two seasonal survey periods in the downtown. As we dealing with sample data from four days, most of our statistics need to reflect this sampling environment. Throughout this report we will be making references to the 95th confidence range<sup>6</sup>. The volume therefore that we found ranged from **1910** to **2900** vehicles per day with a daily sampling variation of 15 percent per day. The average daily number of vehicles surveyed was 2405 vehicles. It is important to keep in mind that volume data was only captured on the spaces that are reported on Table 1 - that is where detailed license plate data was recorded.

<sup>6</sup> A confidence range means that if we were to perform the survey of parking space activity again, the peak number of vehicles observed would fall within this range 95 times out of 100.

The 95<sup>th</sup> confidence range based on the survey days yielded a **peak hour** use of between 721 and 1025 vehicles for the summer survey period and 806 to 882 for the December survey period. When you bring in the range of parking spaces surveyed – 1017 to 1036 – and compare spaces to peak use, the range of 67 to 113 percent would form the expected peak use to capacity in the downtown. The over 100 percent condition reflects the situation where vehicles may have been parked illegally as in unmarked spaces. We will address this issue later in this report.

Now this really does not mean much because the use of parking space is so tied to location of that space relative to the destination of our customers, that is, it is not important if there are vacant parking spaces in area that are not within convenient walking distance. The study therefore turns to the critical examination of three primary metrics – volume, duration of stay and occupancy, under a geographic lens.

Before we begin to discuss the salient findings, we want to describe the geographic units that will assist in understanding the results of the analysis.

## Analysis Units

### Block and Zone Unit

The use of the block by block level of analysis is a useful approach to the study of parking activity as it implies and expresses the whole notion of walking distance and the integration of parking space to trip destination over distance.

As is typical for this firm, we have arbitrarily assigned block labels (C107 for example on Figure 3) to each major unit of analysis in our study area. The identification of the block

should generally appear on all graphics throughout this analysis. Throughout this technical document you will see parking activity statistics as they largely relate to these labeled **blocks**. The block is the unit of aggregation that allows us to compare and contrast its parking demand generation and its supply's response to that demand. **Figure 8 at the very end of this report provides a block reference guide.**

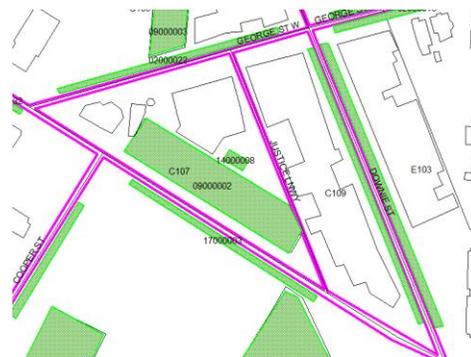


Figure 3: Block Unit of Analysis

### Parking Facility Unit

Electronic mapping files are the primary source of information related to parking facility identification as well as field observations conducted on each of the four survey days. The parking facility in our analytic framework were described with the following attributes:

- Each facility had a unique identifier assigned in a data base.
- A facility is represented as a shape on an electronic map.

- Linked up to each parking facility<sup>7</sup>, we stored:
  - number of parking spaces,
  - intended market for those parking spaces – monthly, transient, private, mixed, etc.,
  - parking rates charged if applicable, and
  - Parking time restriction if applicable (one, two hours for example).
- The parking activity data is linked up to parking facility and can be displayed at various levels of aggregation – by individual facility, by facility types, by block for example.

### The Sample Survey Day Unit

**Table 2** documents the specific survey days. A number of different levels of aggregation options are available to us:

- We could present the full complement of each survey day's parking activity;
- We could present the highest and lowest survey day; and/or
- We could present a statistically significant average or typical survey day.

The recommended approach was to present the richness of the data collected without discrimination. In the flow of analysis, we will endeavor to use what we collected to evidence a key issue. Therefore we may use one particular day or a set of survey dates to illustrate a point or to provide evidence of a key parking metric. In terms of providing the workbench upon which we will determine where parking surplus or deficits might be or where there may be an opportunity to expand or contract parking services, we will be using the statistically valid and reliable average survey day.

## Parking Supply Response Process



Figure 4: Framework for Parking Supply Response Analysis

## Performance of the Parking System

Three diagnostic measures were used in order to relate parking supply to parking demand generated in our Study Area. These diagnostic measures are:

<sup>7</sup> In the parking system software developed by D Sorbara Parking & Systems Consulting the assigned facility code is made up of key codes that relate to each of the attributes shown in the list; in this way, it is fairly easy to examine only the three hour parking areas for example. This framework also allows us to update consistently over time and retain historical data.

- **Volume** of parkers,
- **Duration** of stay or the customer mix, and
- **Occupancy** of space at critical times of the day.

These measures are quantified from the surveys conducted over the period between 9:00 to 21:00 hours on each of the survey dates shown back on **Table 2**. We will endeavour to follow some structure in our discussion of the parking supply's response to the parking demand.

**Figure 4** graphically displays the three primary components of the analysis of parking supply's response to parking demand.



#### Diagnostic Measure: Volume

The first measure of parking activity is **volume of parkers**. The total number of vehicles attracted to the downtown study area was 1910 to 2900 over the course of the survey days.

Drawn from **Table 3**, the statistical range of volume typically attracted to the off-street parking spaces in the downtown ranges from 600 to 1024 vehicles while the statistical range of volume attracted to the on-street parking spaces ranges from 1208 to 1922 vehicles. The total daily attraction including the Accessible parking stalls is typically 1909 to 2901 vehicles with daily variation of plus/minus 15 percent.

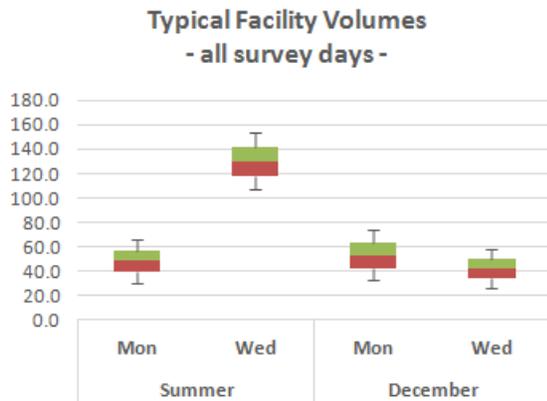
The Wednesday survey data best reflects the impact of matinee theatrical performance parking demands in the downtown when a 22.6 percent increase in volume emerges. Note that the off street parking facilities attracted about 16 percent bump up in volume while the on street parking facilities attracted 27 percent higher attraction.

The on-street parking space is functioning at optimal levels of efficiency here. We will explain this statement as we discuss other parking performance metrics in this report.

**Table 3: Statistical Summary of Volume – all Survey Days**

VOLUME	Summer		December		AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed				
ACCESSIBLE	17	19	42	36	28.5	10.7	11	46
OFF - 12 HR	171	243	178	144	184.0	36.4	126	242
OFF - 3 HR	618	670	744	478	627.5	97.2	473	782
OFF - FREE								
<b>Subtotal OFF-STREET</b>	<b>789</b>	<b>913</b>	<b>922</b>	<b>622</b>	<b>811.5</b>	<b>121.4</b>	<b>618</b>	<b>1005</b>
OS - 12 HR	85	128	133	87	108.3	22.3	73	144
OS - 3 HR	1177	1476	1755	1419	1456.8	205.6	1130	1784
<b>Subtotal ON-STREET</b>	<b>1262</b>	<b>1604</b>	<b>1888</b>	<b>1506</b>	<b>1565.0</b>	<b>224.2</b>	<b>1208</b>	<b>1922</b>
<b>Grand Total</b>	<b>2068</b>	<b>2536</b>	<b>2852</b>	<b>2164</b>	<b>2405.0</b>	<b>311.7</b>	<b>1909</b>	<b>2901</b>

The difference in volume over the course of the two seasons is represented by the "Box-Whisker" graphic - Figure 5. The volume data here reflects the average volume attracted by parking facility.



Addressing the peak bump-up of the critical theatre attraction needs to be part of the parking strategy for the downtown.

**Effective Turnover**

The **intensity** of the use of parking facilities over the course of the survey day is expressed in terms of the **turnover** of space. Turnover is the result of dividing the total volume of parkers by the peak number of parking stalls.

Figure 5: Box-Whisker Showing Comparative Facility Volume

Turnover synthesizes the individual and cumulative effects of demand (volume of parkers), available space (capacity), and the nature of that demand (duration of stay). Table 4 presents the metric.

Table 4: Statistical Summary of Effective Turnover of Parking Space

	Summer		December					
<b>TURNOVER</b>	Mon	Wed	Mon	Wed	AVE	STDDEV	Lo95	Hi95
ACCESSIBLE	3.4	3.2	5.3	6.0	4.5	1.2	2.5	6.4
OFF - 12 HR	2.3	2.3	2.9	2.2	2.4	0.3	2.0	2.9
OFF - 3 HR	4.2	3.1	4.1	4.0	3.8	0.4	3.1	4.5
OFF - FREE								
<b>Subtotal OFF-STREET</b>	<b>3.5</b>	<b>2.8</b>	<b>3.7</b>	<b>3.2</b>	<b>3.3</b>	<b>0.3</b>	<b>2.8</b>	<b>3.8</b>
OS - 12 HR	2.7	2.2	2.7	1.7	2.3	0.4	1.7	2.9
OS - 3 HR	4.7	4.2	5.0	4.7	4.6	0.3	4.2	5.1
<b>Subtotal ON-STREET</b>	<b>4.4</b>	<b>3.9</b>	<b>4.7</b>	<b>4.3</b>	<b>4.3</b>	<b>0.3</b>	<b>3.9</b>	<b>4.8</b>
<b>Grand Total</b>	<b>4.0</b>	<b>3.4</b>	<b>4.3</b>	<b>4.0</b>	<b>4.0</b>	<b>0.3</b>	<b>3.4</b>	<b>4.5</b>

In comparison with other downtown studies, we found the range of turnover metrics here in Stratford reflect a moderately high level of attraction of customers to parking space. Box-Whisker graphic (Figure 6) illustrates the relative ranges of turnover over the course of the two seasonal studies. Info graphic: Turnover (Figure 7) provides a set of representations of turnover metric. The highlights of this parking activity metric that draw from these statistics are listed below.

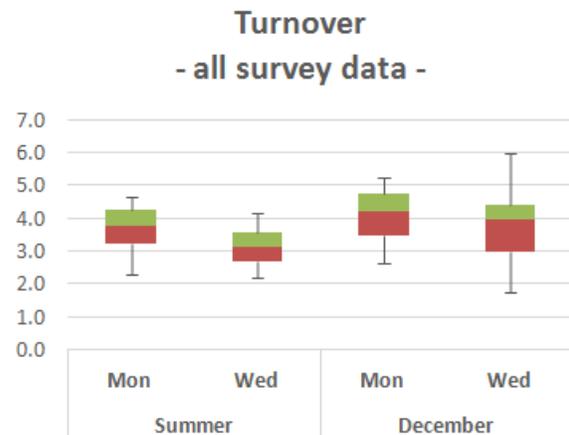
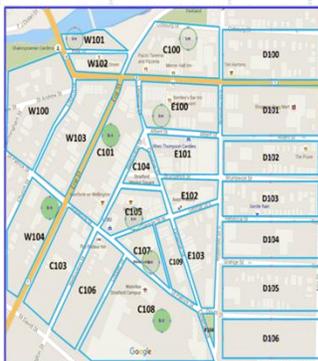
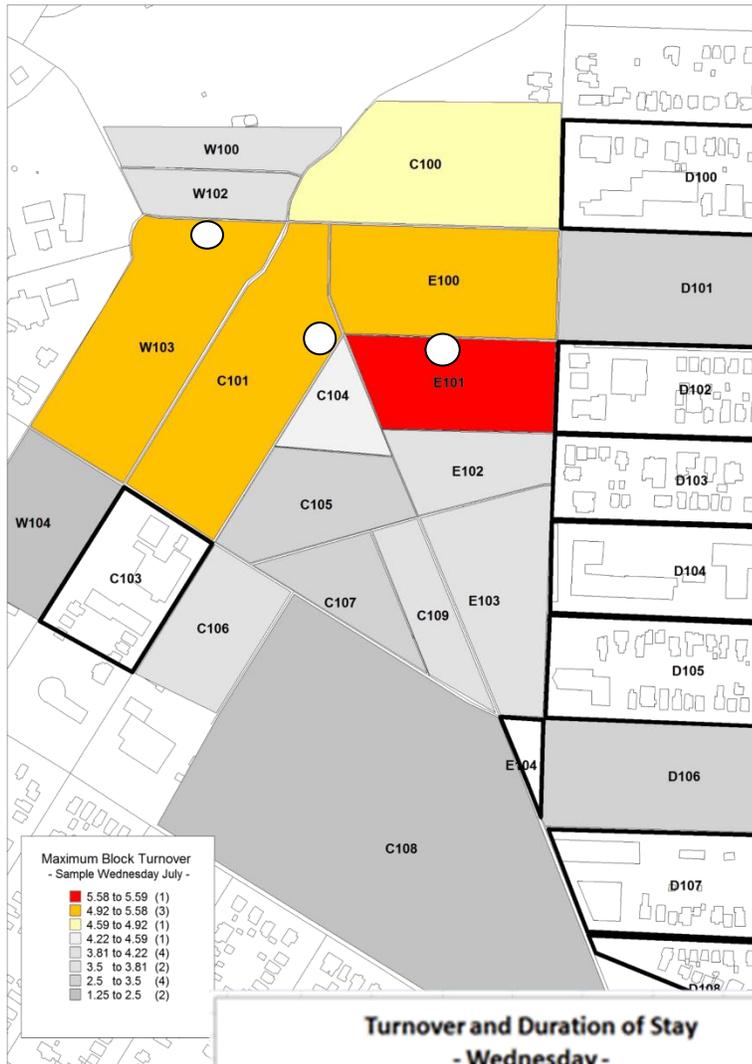


Figure 6: Box-Whisker Showing Comparative Facility Effective Turnover

Info Graphic: Turnover

Facility	TurnOver	Block
E101A	5.59	E101
W103A	5.20	W103
C101BB	5.00	C101
E100A	4.92	E100
C101B	4.76	C101
E101D	4.71	E101
C100D	4.59	C100
E100C	4.47	E100
C104C	4.23	C104
E102A	4.00	E102
W102C	4.00	W102
E103D	3.89	E103
W100 L40	3.81	W100
W103D	3.75	W103
C104C2	3.61	C104
C109B	3.59	C109
E101C	3.53	E101
W103B	3.53	W103
E100 L45	3.52	E100
C106A	3.50	C106
C101D	3.17	C101
D101A	3.00	D101
D106D	3.00	D106
C101 L136	2.72	C101
C105C	2.54	C105
C107 L55	2.51	C107
C100 L11	2.50	C100
E102D	2.50	E102
C101 ACC	2.40	C101
C105B	2.36	C105
C100A	2.23	C100
W100 ACC	2.00	W100
E103A	1.78	E103
C101C	1.50	C101
C105 L13	1.42	C105
W104 L35	1.36	W104
C108D	1.25	C108
C108A	1.22	C108
C108 L280	N/A	C108



Block References – Note that D107 is not shown but is south of D106

Block faces are in clockwise order A, B, C & D

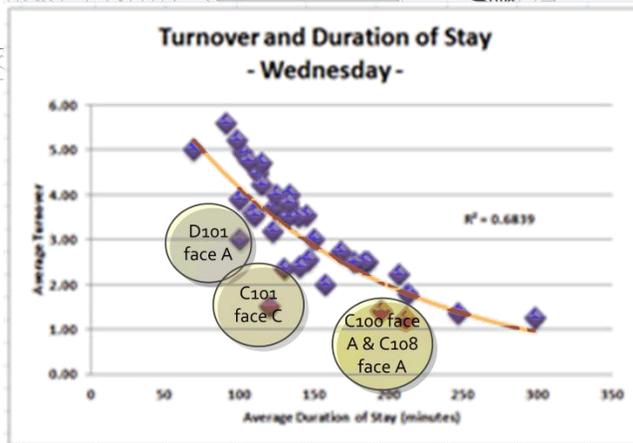
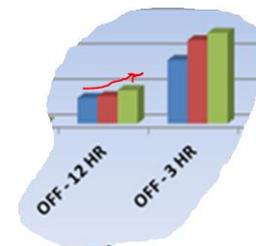


Figure 7: Info Graphic Showing Parking Activity Metric: Turnover

- Three top performers are: north block face along Albert St (Block C103); south side of Ontario St on Block W103; and an interesting one-space accessible parking stall on the east side of Block C101 along Wellington.
- The magnitude of these turnovers together with their short durations of stay (next section) and occupancy throughout the day indicate a very efficient parking system.
- The chart shows the relationship between turnover and average duration; note that the r-square value that measures the strength of that relationship is a significant 68 percent. Previous similar downtown studies normally do not show this magnitude of strength between duration and turnover. The implication is that parking space time restriction of three hours and level of enforcement of that time restriction is working optimally.
- In future studies of the parking activity in the downtown we would analyze those parking areas that do not fit the "line" – explore why they are not attracting the expected volume or the customer type (in terms of duration of stay). The info graphic highlights three such "out-lying" parking facilities that are showing sub-par performance, when their duration of stay and/or their turnover value is not closer to the expected levels as indicated by the solid red line on the chart. In later sections we will examine the sub-par performance is due to overstaying on these spaces or simply an expression of the lack of parking demand.
- The spatial distribution of turnover shown on the geographic information map and is fairly self-explanatory. We take note that the Market Sq parking spaces experienced turnovers of 3.61 to 4.23. There is evidence that customers did stay much longer than the three-hour restriction.

### *Volume Attraction over the Course of the Day*

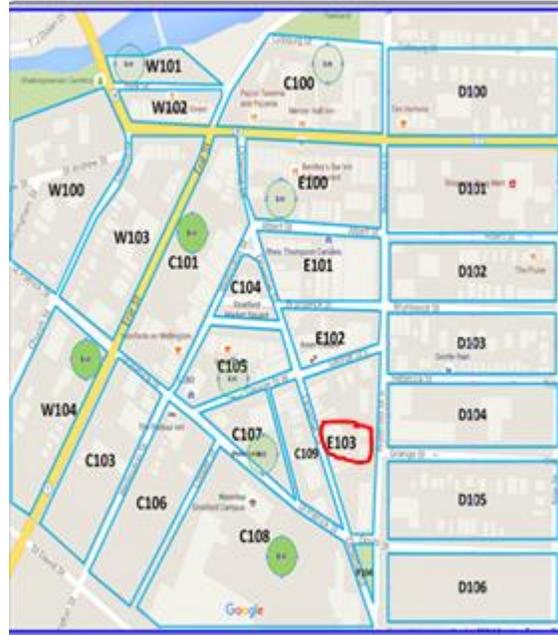
This parking metric **features** the volume of parking customers attracted to the parking supply over the course of the day. **Info Graphic: Temporal Variation of Volume** illustrates and supports discussion points regarding the flow of volume to various types of parking space over the course of the day. Salient findings from this analysis are:



- One would anticipate a build-up of attraction to the on street as the day progresses. This is expected in a downtown setting as the peak hours of activity tend to be in the early afternoons.
- Off-street parking space typically peaks in the morning as it draws from the work trip customer and the on-street space peak in the afternoon hours of the day. In Stratford the off street parking space provides the customer of shorter duration of stay the opportunity to make use of this "product" throughout the noon and afternoon period. Although the order of magnitude of volume is not comparable to the draw of the on-street space, their temporal rhythm of attraction shows us that the off-street space is responding to demand effectively.
- Seasonal morning, noon and afternoon charts are showing the sample December survey data range to be slightly above the range found in the summer survey data.
- The increase in attraction of the on-street from a Monday to a Wednesday in July is indicative of the capacity of the inventory to respond to demand.

- The temporal packaging of the volume served to quantify the net impact of approximately 300 vehicles that are drawn by the Avon Theatre in the downtown. Keep in mind that a significant portion of the theatre crowd would be coming in via inter-regional buses, and likely a significant number of theatre-goers are walk-ins – those who are already in the City's bed and breakfast locales for example.
- From a spatial point of view the inventory on these blocks respond to the demand over the course of the day:

- Not surprising given the number of spaces located here Block C101 (Erie Lot) attracts a majority of the trips to the downtown morning, noon and afternoon.
- Block C101 attracts 60% bump-up in volume from morning to noon and 70% from morning to afternoon.
- In terms of proportionately capturing a significant amount of volume of traffic relative to its inventory, Block E103 attracting a significant increase in volume over the course of the day. This block's inventory could be responding to the demand in the noon period of the day attracted by the lunch time customers. In terms of turnover (volume divided by capacity) the morning ratio is 0.38; 1.47 during the noon period; and, down to 1.05 vehicles per space during the afternoon period. The implication is that the higher turnover during noon period (11am to 2pm) reflects users that have shorter durations. However in terms of inventory it is minor 34 spaces.
- Core blocks C100, C101, C104 and E100, E101 and E102 all south of Ontario and east of Erie offer about 509 spaces. The morning turnover of those spaces reached 0.86, noon hours the turnover is up to 1.48 and then in the afternoon the turnover increases to 1.65 vehicles per parking space. Thus on this survey day in summer the attraction not only increases over the course of the day but the customer duration of stay gets shorter over the course of the day as seen by the higher turnover numbers.



Block References – Note that Day is not shown but is south of Day 6

Having high volume and turnover attracted to our parking inventory is not necessarily indicators of shortages in the parking service. They indicate that spaces are being used by those customers whose durations of stay optimally fit the pattern and intended use of such spaces.

Info Graphic – Temporal Variation of Volume

Block	AM	Block	NOON	Block3	AFT
C101	178	C101	285	C101	303
E100	95	E100	149	E100	200
C104	76	C100	104	C104	115
W100	47	C104	101	C100	104
C100	43	E101	78	E101	94
C107	43	W100	61	W100	79
E101	33	E103	50	W103	48
W103	30	W103	42	E103	36
C109	17	C105	35	C105	31
W102	15	C109	34	W102	25
C105	14	E102	34	C109	24
W104	14	D102	17	E102	24
E102	13	W102	17	C107	23
E103	13	C107	14	D102	13
C108	7	W104	11	D104	5
D102	6	C108	7	D106	4
D106	4	D104	7	W104	4
C106	3	C106	4	C106	3
D101	2	D101	4	D101	3
D104	2	D106	4	C108	1

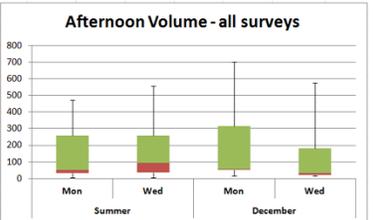
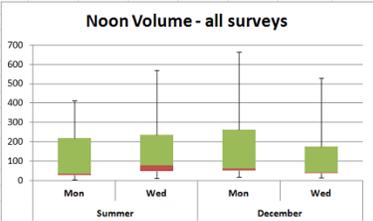
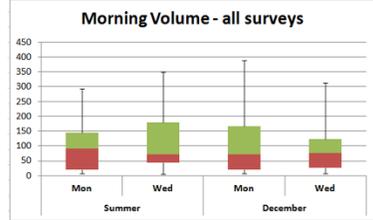
	Summer				December				AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed	Mon	Wed	Mon	Wed				
ACCESSIBLE	8	5	8	6	6.75	1.29904	5.47697	8.02203				
FF-12 HR	92	72	71	75	77.5	8.5	69.1702	85.8298				
FF-3 HR	145	179	167	123	153.5	21.4184	132.51	174.49				
FF-FREE												
Subtotal OFF-STREET	245	256	246	204	237.75	19.9546	218.195	257.305				
5-12 HR	19	43	20	27	27.25	9.60143	17.8468	36.6592				
5-3 HR	293	349	389	312	335.75	36.7517	299.734	371.766				
Subtotal ON-STREET	312	392	409	339	363	39.1599	324.624	401.376				
rand Total	557	648	655	543	600.75	51.0508	550.721	650.779				

	Summer				December				AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed	Mon	Wed	Mon	Wed				
ACCESSIBLE	4	10	18	14	11.5	5.2	6.4	16.6				
FF-12 HR	27	77	52	37	48.3	18.8	29.8	66.7				
FF-3 HR	217	235	269	175	222.5	31.9	191.2	293.8				
FF-FREE												
Subtotal OFF-STREET	248	322	333	226	282.3	46.1	237.1	327.4				
5-12 HR	33	48	62	41	46.0	10.7	35.6	56.4				
5-3 HR	413	569	663	531	544.0	89.6	456.2	631.8				
Subtotal ON-STREET	466	617	725	572	590.0	100.0	492.0	688.0				
rand Total	694	939	1058	798	872.3	138.1	737.0	1007.5				

	Summer				December				AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed	Mon	Wed	Mon	Wed				
ACCESSIBLE	5	4	16	16	10.3	5.8	4.6	15.9				
FF-12 HR	52	94	55	32	58.3	22.5	36.2	80.3				
FF-3 HR	256	256	314	180	251.5	47.6	204.9	298.1				
FF-FREE												
Subtotal OFF-STREET	313	354	385	228	320.0	58.9	262.2	377.8				
5-12 HR	33	37	51	19	35.0	11.4	23.8	46.2				
5-3 HR	471	558	703	576	577.0	82.9	495.8	658.2				
Subtotal ON-STREET	504	595	754	595	612.0	90.0	523.8	700.2				
Grand Total	817	949	1139	823	932.0	130.6	804.0	1068.0				



Trace the attraction of top blocks throughout the day. Block C101 (Erie lot) by virtue of its location and inventory is the top draw. Note that morning to noon volume increases by some 60% & then 70% over morning in the afternoon.

Block faces are in clockwise order A,B,C & D



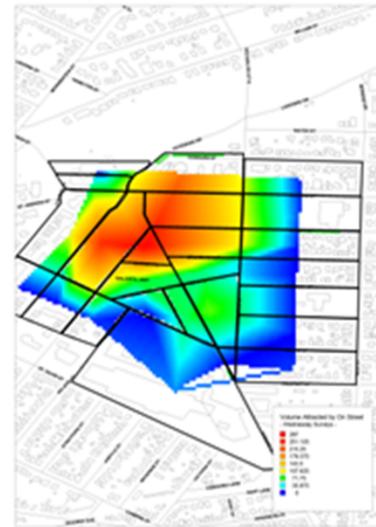
Block References – Note that D107 is not shown but is south of D106

Block	AM - NOON
E103	285%
D104	250%
D102	183%
E102	162%
C105	150%
C100	142%
E101	136%
C109	100%
D101	100%
C101	60%
E100	57%
W103	40%
C106	33%
C104	33%
W100	30%
W102	13%
C108	0%
D106	0%
W104	-21%
C107	-67%

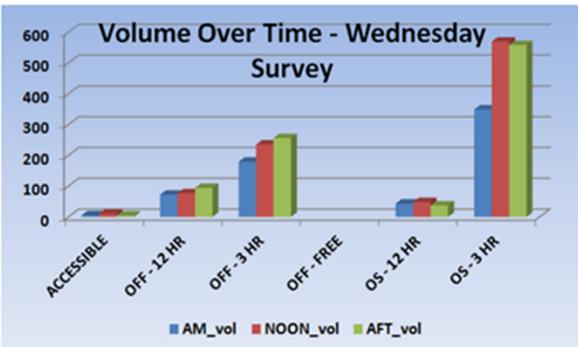
Colour code serves to assist in more easily seeing the dynamic flow of volumes for key blocks.

Block	AM-AFT
E101	185%
E103	177%
D104	150%
C100	142%
C105	121%
D102	117%
E100	111%
E102	85%
C101	70%
W100	68%
W102	67%
W103	60%
C104	51%
D101	50%
C109	41%
C106	0%
D106	0%
C107	-47%
W104	-71%
C108	-86%

Change in Volume from Noon to Afternoon



The spatial illustrates the volume attracted in the afternoon period [above].



The graph illustrates the flow of volume attracted to various types of parking space types. Order of magnitude aside, the off-street lots draw their highest number of visits in the afternoon period. [Data: Wednesday in July 2015]

Figure 8: Info Graphic Showing Parking Activity: Temporal Variation of Volume

### Diagnostic Measure: Duration of Stay



The length of stay of a customer is critical to the characterization of the nature of the parking demand in a commercial area. Length of stay is of course related to trip factors such as:

- The purpose of the trip;
- The level of activity at or near the primary destination point that serves to attract people and therefore, lengthen the time spent in the area.

The parking supply system provides a wide range of products - as it were - to service trips of varying duration of stay – from on street less than three hour time restricted spaces to three to twelve hours at off street municipal lots (in the downtown).

Contrary to a widely-held theory that the duration of stay in the downtown is controlled by the time restriction posted on the parking space – the reality is that these are not necessarily related. People do not drive to the downtown to park their vehicles, but rather to conduct business, re-create, shop, dine, visit a library or work. The activities not the time restriction on the parking space determine the amount of time spent in the study areas.

The four survey days gave us these insights and are sourced on three info graphics (Figures 9,10 and 11) that follow.

Here are some of the salient findings drawn from **Info Graphic - Duration of Stay** (Figure 9):

- Over the course of the four survey days the average duration of stay for those customers who parked on the off-street spaces ranged from 2:05 hrs to 2:40 hrs. Keep in mind that this largely underestimates the duration of stay because the large free space parking facility on the Cooper site was not surveyed through the licence plate method.
- The average duration of stay for those parking on the off-street space that had three hour time limits (similar to the on-street) was found to be 1:53 hrs to 2:31 hrs.
- Over the course of the four survey days the average duration of stay for those customers who parked on the on-street spaces ranged from 1:38 hrs to 2:08 hrs.
- One typical parking activity metric that the parking industry captures as a measure of performance is the ratio of the length of stay between the off-street and on-street customers. Over the course of the four surveys the off-street customer had durations of 28 percent longer than those customers using on-street space.
- Seasonal variation of the customer length of stay as shown by the Box-Whisker graph shows only minor differences in this parking activity metric. The direct comparison of the two highest

draws - the Wednesday in summer and the Monday in December shows that the typical duration of stay is only slightly lower in December than in the summer.

- The average duration of stay by parking facility and location is detailed on the table on the left side of the info graphic. Notable blocks and facilities are: Block C108 (the on-street facilities not the free lot) has the longest average duration of stay while the on-street space along Wellington on Block C101 draw customers with average stays of 1:09 hrs to 2:00 hrs. The Erie lot on this block draws customers with an average stay of 2:48 hrs.

Here are some of the salient findings drawn from **Info Graphic - Parking Space and Customer Type** (Figure 11)

- Average duration of stay is typical for a downtown with the land use activities that exist.
- The series of pie charts shown on Figure 11 serve to answer this question: *If I had a trip to the downtown that I know will be one hour or less which parking service (on street space, off street space) do I select?*
- The pie charts on Figure 11 show the decision that a customer makes under various duration of stay trips. Eighty-eight percent (88) to 92 percent of customers whose length of stay was three (3) hours or less chose to park on-street. Three hours is the time restriction on the use of the on-street space.
- The core customer of one hour or less is best served by the on street (3 HR limit) parking space (63 to 68 percent of the market share).
- As the duration of stay increases, the off street space begins to play a bigger role in meeting the demand; this is typical of the dynamic that is played out between on and off street parking space.
- The "Over 5 HR to 6 HR" customer type parking space choice on the Monday versus a Wednesday in the summer does not follow the theory that as the duration of stay increases the role of the off street space grows. The explanation lies with the fact that the Wednesday survey captured the parking space demands of theatre-visitors.
- The average duration of stay for customers of the off street parking space seem to be more consistent than the users of the on street. This is expected and expressive of a common behavioural characteristic found in many parking studies: the market for the off-street space tends to be those who are most familiar with the location of that space, while the on-street space is much more random and related largely to convenience and location relative to destination.

Presented here are salient findings that emerge from **Info Graphic : Duration of Stay Spatial** (Figure 10) that displays the distribution of the one hour and three hour customer on the Wednesday and Monday survey days in summer.

- The critical three hour customer's choice of where to block on Monday and Wednesday display an interesting shift to the emergence of Block E100 (location of Albert St Lot) and Block C107 (location of St Patrick Lot).

## Technical Report B - Parking Supply Response

- As well the parking facility at the northern limit of the study area (York St) grows in its intensity and role in responding to heavier parking demands of afternoon performances in the downtown.
- This is an optimal pattern to find in a downtown where the longer stay customers (but still visitors) are using the fringe parking facilities (York & St Patrick) and not roaming the streets for the more convenient on street parking spaces.

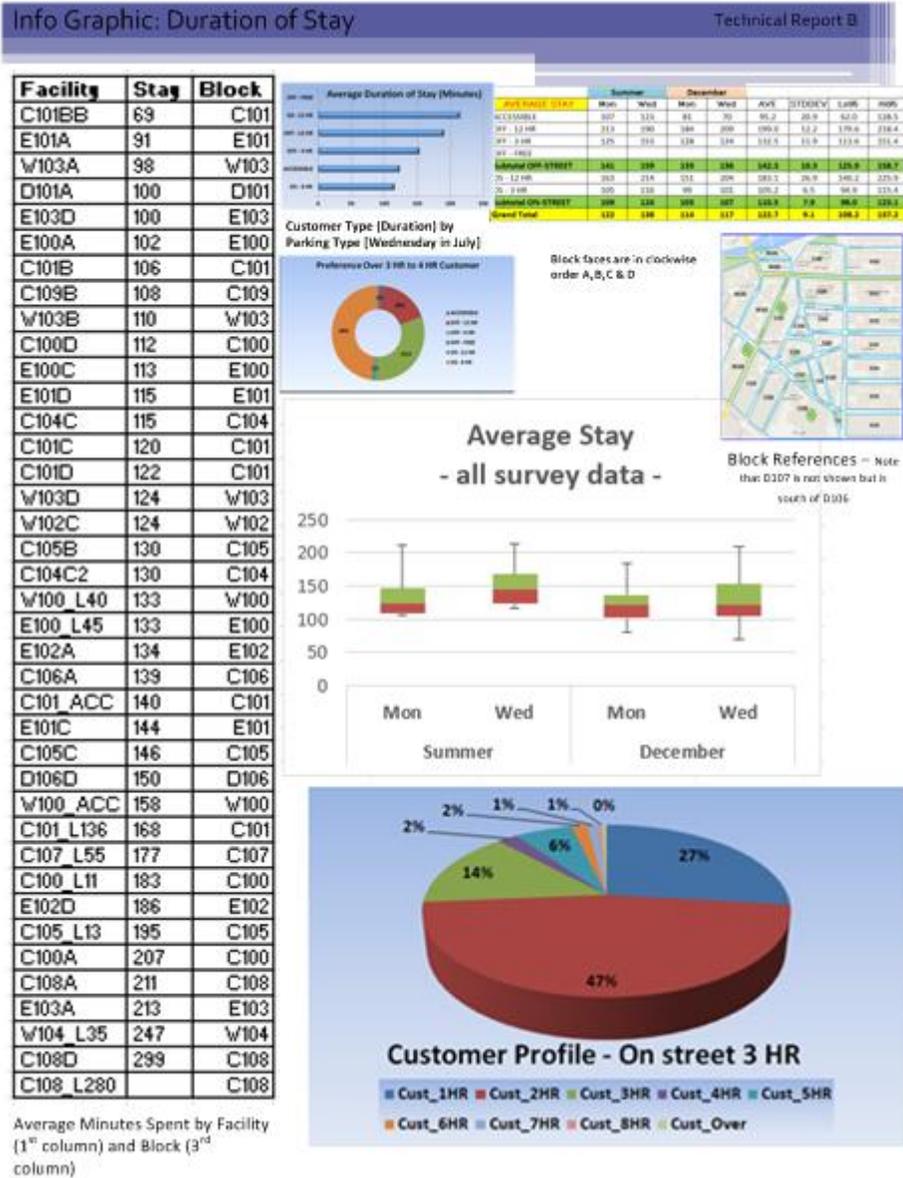


Figure 9: Info Graphic Showing Parking Activity: Duration of Stay

Info Graphic – Duration of Stay Spatial

Technical Report B

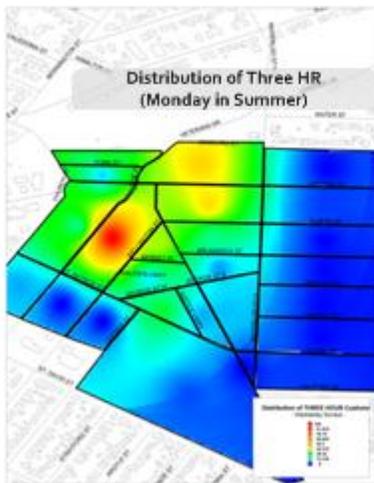
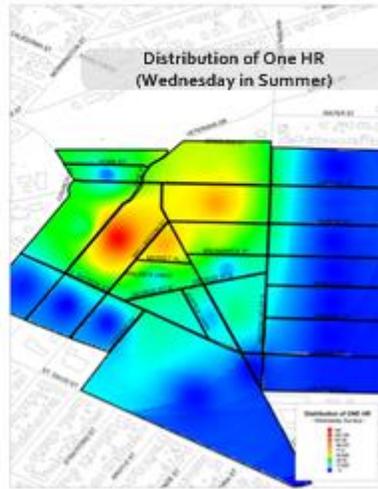
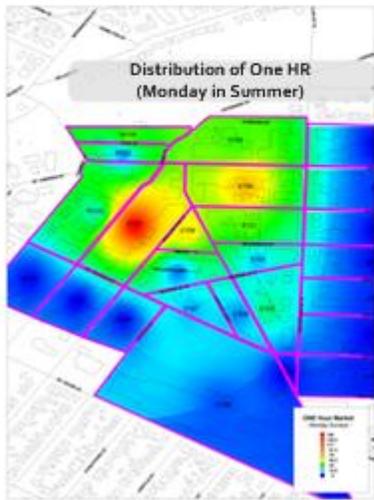


Figure 10: Info Graphic Showing Parking Activity: Duration of Stay Spatial

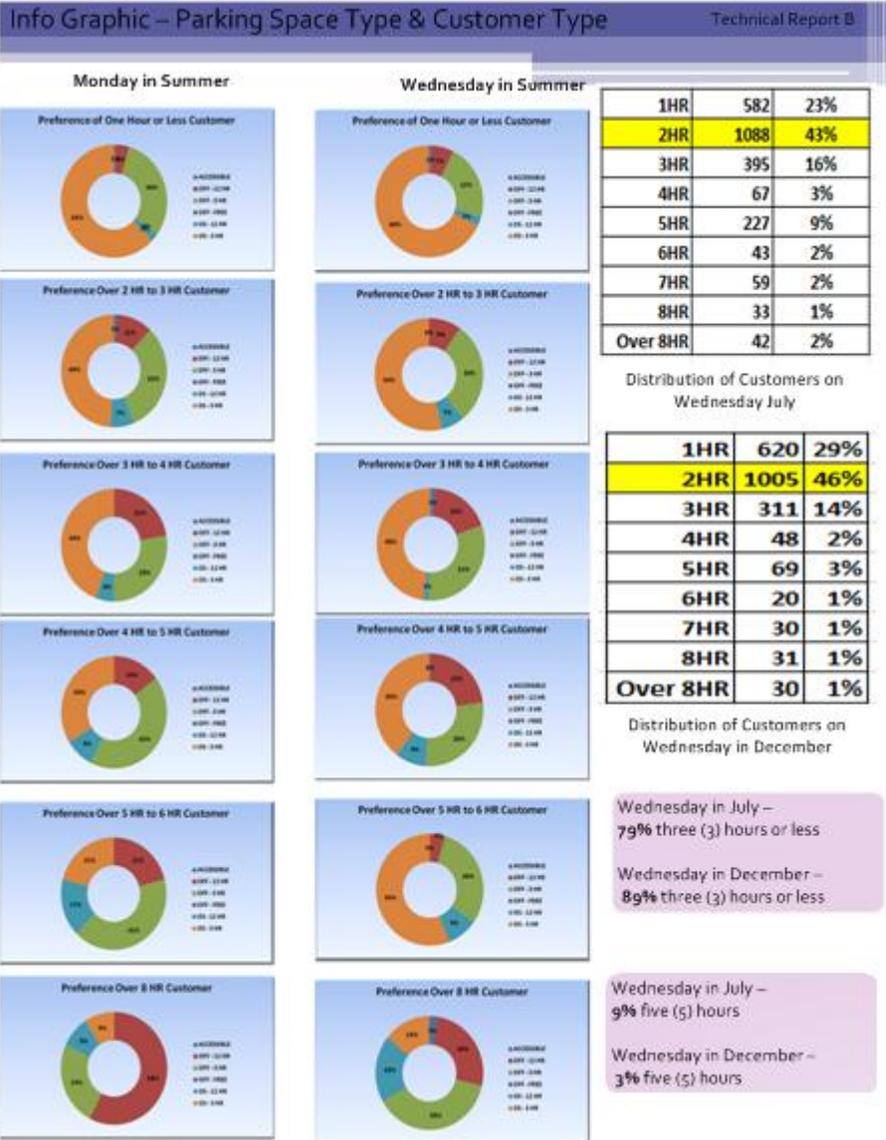
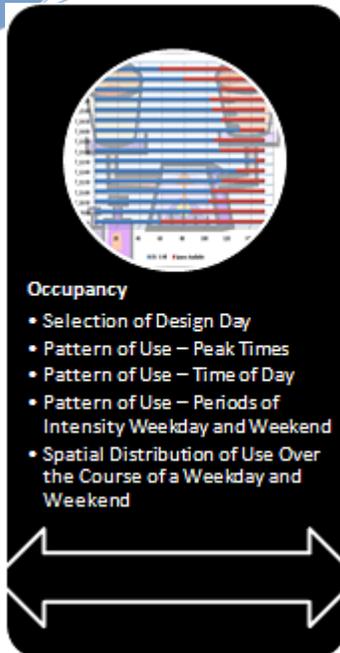


Figure 11: Info Graphic Showing Parking Activity: Parking Space Type & Customer Type



### Diagnostic Measure: Occupancy<sup>8</sup> of Space and Pattern of Accumulation

The third diagnostic measure - **occupancy** - is the relationship between the number of parked vehicles (demand) and the supply of parking. While the computation of this measure is straight forward, its interpretation is complex.

The reporting of occupancy as an overall measure obscures the dynamic or fluid relationship that exists between parking demand and supply. Supply may exist, but is not necessarily located within a reasonable walking distance of the parking demand. Should we be selective in choosing the facilities (and the geographic area) that we want to report upon, while respecting the need for fairness in presentation of the finding?

These challenges create a need to more clearly define what the *occupancy* diagnostic measure is really supposed to show. In this regard, we believe that the answers to the following questions are important to pursue:

- ? Is the demand for parking only intense (relative to the supply) for a very short period of the day?
- ? Is the demand for parking isolated within the commercial areas?
- ? Does the pattern and extent of the parking demand provide any technical support to the perception that there may be insufficient parking supply in the commercial area?

We need to feel comfortable in the answers to these questions; because they determine the kind of response we might take in measuring and in turn resolving any perceived imbalance between parking supply and parking demand.

### *Downtown Parking Space Occupancy Pattern – Peak and Average Use of Space*

**Table 5** that follows serves to summarize the occupancy metric derived over the course of the survey days. From a statistical point of view the range within which we can be confident to find the average peak occupancy 95 out of 100 sample surveys is within the range **69 percent and 91 percent for off street public spaces and 70 percent to 93 percent for on street spaces**. The data lens through which this occupancy data is viewed is set on a peak time that each parking space type exhibited over the course of the survey periods. While this is useful and easy to remember metric, its use is limited in the process of evaluating whether or not there is a parking space deficiency.

However, typically one would look at occupancies of over 85 percent to be an indicator that there may be a parking space deficiency. The scope or focus of the remedy however is not defined by this metric. Where would more space be located? We know through the parking surveys both on the field and

<sup>8</sup> Occupancy and accumulation are used interchangeably throughout this section.

through the information received from the online surveys that parking space location and primary destination determines marketability of the public parking service.

Table 5: Peak Hour Occupancy for all Survey Days

OCC @ Peak (%)	Summer		December		AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed				
ACCESSIBLE	50%	86%	38%	32%	51%	21%	31%	72%
OFF - 12 HR	67%	95%	55%	59%	69%	16%	53%	84%
OFF - 3 HR	68%	99%	84%	55%	76%	16%	60%	92%
OFF - FREE	75%	103%	81%	95%	88%	11%	77%	99%
<b>Subtotal OFF-STREET</b>	<b>71%</b>	<b>100%</b>	<b>77%</b>	<b>74%</b>	<b>80%</b>	<b>11%</b>	<b>69%</b>	<b>91%</b>
OS - 12 HR	50%	91%	78%	78%	74%	15%	60%	89%
OS - 3 HR	68%	99%	88%	76%	83%	12%	71%	94%
<b>Subtotal ON-STREET</b>	<b>65%</b>	<b>98%</b>	<b>87%</b>	<b>76%</b>	<b>82%</b>	<b>12%</b>	<b>70%</b>	<b>93%</b>
<b>Grand Total</b>	<b>68%</b>	<b>99%</b>	<b>80%</b>	<b>74%</b>	<b>80%</b>	<b>11%</b>	<b>69%</b>	<b>92%</b>

Table 6 serves to step away from the peak hour of the day and look at **average occupancy** of space over the course of the day.

Table 6: Average Occupancy for all Survey Days

AVG OCCUPANCY (%)	Summer		December		AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed				
ACCESSIBLE	31%	55%	67%	76%	57%	17%	41%	74%
OFF - 12 HR	57%	71%	50%	47%	56%	9%	47%	65%
OFF - 3 HR	59%	79%	70%	44%	63%	13%	50%	76%
OFF - FREE	64%	80%	75%	80%	74%	6%	68%	81%
<b>Subtotal OFF-STREET</b>	<b>61%</b>	<b>78%</b>	<b>69%</b>	<b>61%</b>	<b>67%</b>	<b>7%</b>	<b>60%</b>	<b>74%</b>
OS - 12 HR	37%	73%	54%	47%	53%	13%	40%	66%
OS - 3 HR	54%	80%	72%	61%	67%	10%	57%	76%
<b>Subtotal ON-STREET</b>	<b>52%</b>	<b>79%</b>	<b>69%</b>	<b>59%</b>	<b>65%</b>	<b>10%</b>	<b>55%</b>	<b>75%</b>
<b>Grand Total</b>	<b>57%</b>	<b>78%</b>	<b>69%</b>	<b>60%</b>	<b>66%</b>	<b>8%</b>	<b>58%</b>	<b>74%</b>

The order of magnitude shown above are higher than is normally expected in a downtown with the quantity and nature of land uses. The average occupancy of space ranges from 58 to 74 percent of inventory with a fairly consistent range for both on- and off-street parking supply. Again the average occupancy is highest on the Wednesday in summer (theatre attraction).

Info Graphic: Accumulation of Vehicles (Figure 12) presents a wide range of information related to this parking metric. Within the Core area, the demand for parking facilities exceeded 80-90 percent of capacity for the critical period between 11:00 and 15:30 hours. The shape of the accumulation chart indicates a very high level of intense demand throughout the day; the shape of the curve indicates that demand level is fairly consistent over the course of the day

### *Parking Space Occupancy Pattern – Periods of Intensity*

Info Graphic: Showing Periods of Intensity (Figure 13) present this key parking activity metric. While peak hour occupancies are important indicators of the balance of parking demand and supply, it is

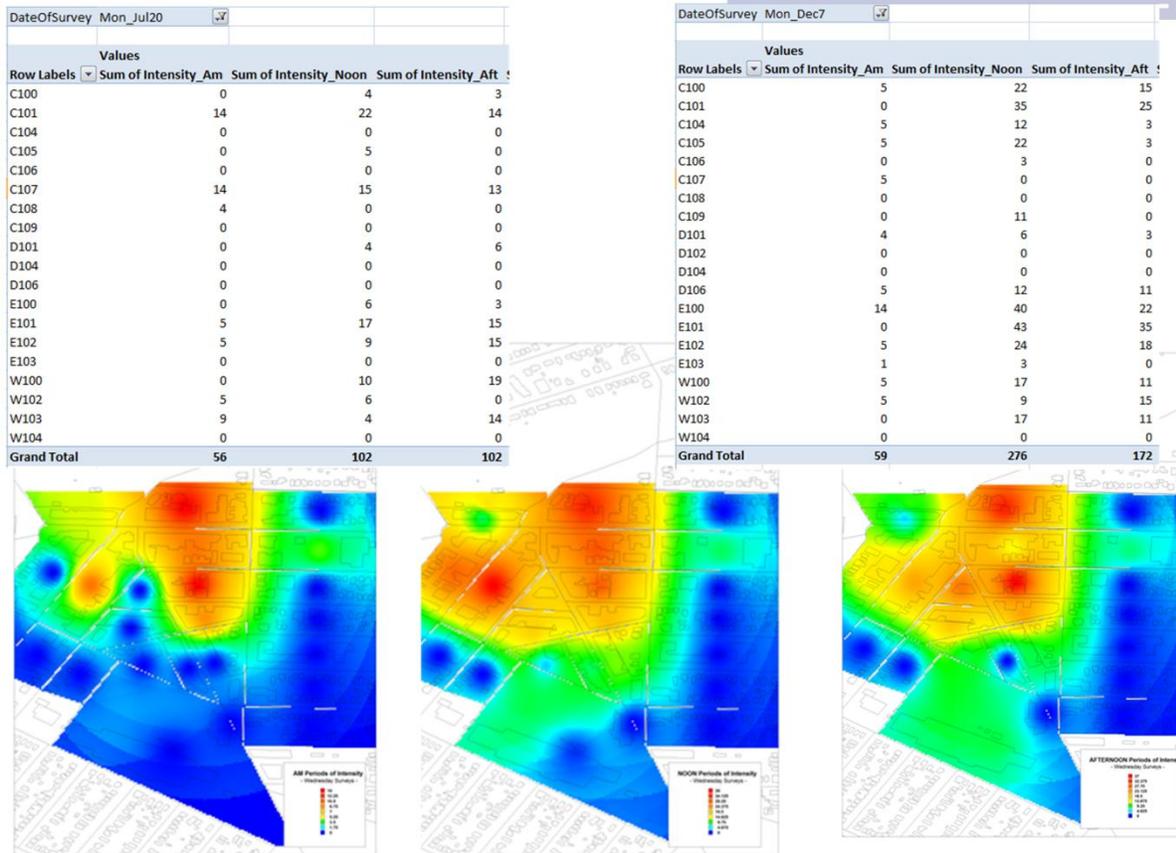
important to look at the number of periods throughout the day that high occupancy of space is actually occurring.

Flowing out of the field surveys we have the following salient finding:

- Periods of intensity (consecutive 15 minute time segment where occupancy is over 85 percent of capacity) start in the morning period down the spine; some of this intensity in the morning at least would be driven by longer stay parkers
- Moving into the noon segment, the area of intensity spreads west along Wellington and municipal parking facility (Erie Lot)
- The afternoon segment appears to move away from the west portion of the core and back to the central spine of the downtown - similar to the morning pattern
- On the peak summer day the parking facilities along the C-corridor and E-corridor absorb most of the parking demand during the noon hours.
- The block C101 (Erie Lot site) has the highest number of peak 15 minute periods of intensity with 51 during noon hours on the Wednesday in summer; Block E100 (Albert Lot) shows the maximum number during the afternoon on Wednesday in December; Blocks E100 and E101 show maximum number of consecutive periods of 85% occupancy on the Monday in December and C101 shows the maximum number of consecutive periods on the Monday in summer.
- Customers are finding the core area parking spaces and surrounding blocks are acting as overflow parking opportunities.



Info Graphic: Periods of Intensity



Follow the spatial progression of the "Intensity" metric from morning, noon and afternoon periods of the day.

Figure 13: Info Graphic Showing Periods of Intensity

### *Measure of Optimal Use of Parking Space - KPI*

The final metric that will be discussed is one that indicates the overall efficiency of parking space utilization. The metric – key performance index space optimization – integrates the following metrics:

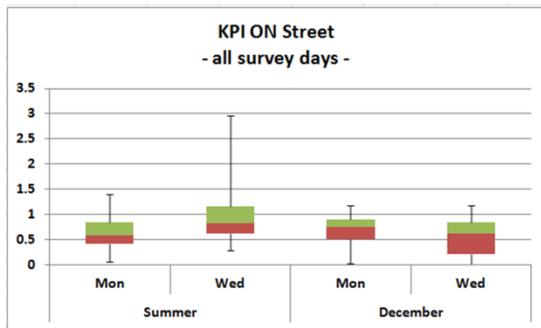
- Duration of stay;
- Average occupancy of space;
- Turnover of space which synthesizes duration of stay and volume of demand; and
- Length of survey period.

The metric is expressed as a percent and a high value indicates that the parking space is currently attracting parking demand at its maximum level given current duration of stay and turnover characteristics. The metric is computed for every on-street and off-street parking facility and serves to point to areas where a high optimal value points to some form of remedial strategy to better serve the demand.

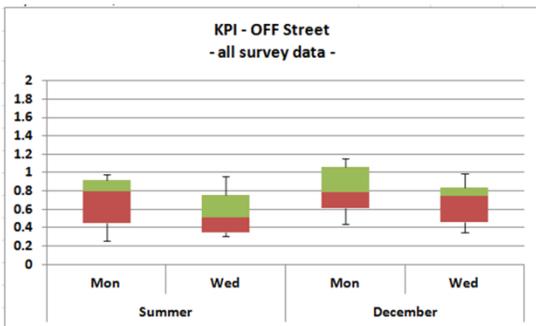
**Info Graphic: Key Performance Index (KPI)**, Figure 14 provides an array of this key metric. The following salient findings emerge:

- Seasonal performance of the parking supply is evident as the summer survey day when theatre is attracting people is clearly higher than normal.
- Excluding this peak day in July, the range of KPI's for both on- and off-street parking facilities are in comparable range.
- Consolidating all the facilities by type and computing statistical ranges underscores the consistent KPI values with off-street KPI's ranging from 32 to 56 percent. This means that while we indeed have individual off-street facilities that are performing at optimal levels, when they are viewed as a whole, indicators point to a level that is sustainable.
- Consolidating all the on-street parking facilities, the KPI's range from 36 to 60 percent. The map shows areas of on-street where the relationship among the parking activity metrics: duration of stay, average occupancy of space, turnover of space and survey time period reflect block faces that are operating at optimal and capacity levels.
- On-street areas that are optimally responding to parking demand are: West side of Downie between Market Sq and George (but is only three (3) spaces). The impact however on the development of a parking strategy is that having optimal use of on-street space - which is limited by its physical geometry - will not serve as areas of potential increases in capacity.
- The map plotting of average block KPI's further underscores this key point: if off-street space was optimally performing then there would cause to begin the process of examining infrastructure changes to those sites. Only the Albert St lot appears to be consistently performing at above normal conditions pointing to not only its crucial role in the downtown but also to its future. Unfortunately an overview of its geometry limits this site as a structured parking facility. This site's potential and role in the future would require either acquisition of adjoining properties and subsequent joint development with local commercial/residential stakeholders.

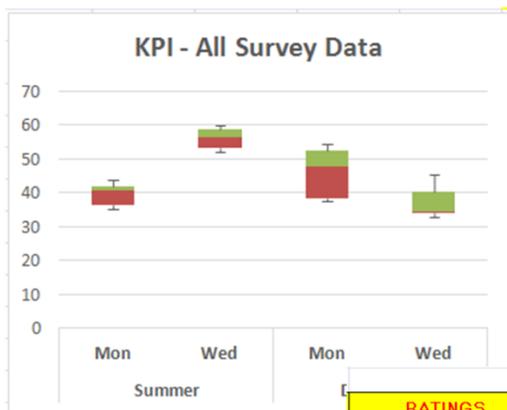
Info Graphic: Key Performance Index (KPI)



On street Individual Facilities

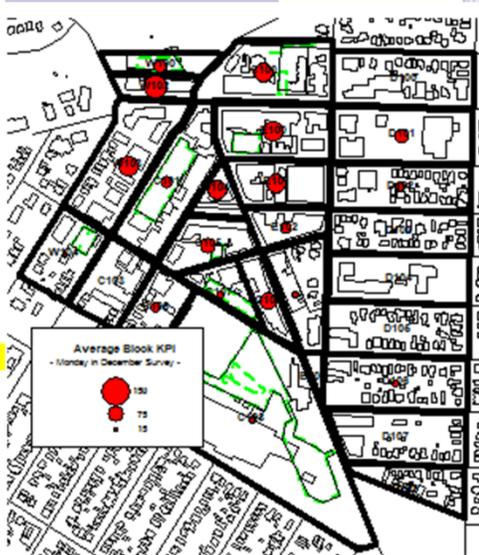


Off street Individual Facilities



All Facilities

Block	Max. Dec
W102C	115%
100_L40	115%
C101B	112%
E100A	112%
C104C	111%
W103A	111%
E100C	111%
E101A	110%
W103D	109%
C100D	108%
100_L45	106%
100_L11	106%
E101AA	100%
E101C	92%
E101D	91%
W103B	90%
C109B	87%
C105B	86%
C104C2	85%
E100AA	84%
C101D	84%
E105C	84%
E102A	81%
E102D	80%
101_L136	79%
C100A	77%
D101A	69%
C108D	68%
E102C	65%
E103D	65%
107_L55	64%
D106DD	60%
105_L13	60%
E103A	51%
C106A	51%
C101BB	50%
E102AA	47%
D102A	44%
104_L35	44%
C101C	38%
101_ACC	23%
D106D	21%
D104D	20%
107_ACC	16%
100_ACC	16%
E103B	11%
C108A	11%
C108B	3%
W104AA	3%
E103DD	3%
E102CC	2%
02_L280	2%



Plot of data presented to the left. Average KPI's computed for each block. Note that a high optimal KPI score for blocks that only present on-street parking space is not going to point to changes physically in the infrastructure. The only block that contains a municipal lot and scores high is the Albert Lot

KPI - Offstreet	Mon_July	Wed_July	Mon_Dec	Wed_Dec	Description
C100_L11	91%	95%	79%	35%	Cobourg
C105_L13	26%	58%	106%	99%	George
C107_L55	91%	93%	44%	35%	St Patrick
W100_L40	98%	32%	115%	84%	York
W104_L35	25%	51%	64%	74%	Kalb flesch
E100_L45	80%	30%	106%	58%	Albert
C101_L136	64%	39%	60%	83%	Erie

KPI - Individual Off street Facilities by Survey Day

RATINGS	Summer		December		AVE	STDDEV	Lo95	Hi95
	Mon	Wed	Mon	Wed				
ACCESSIBLE	22.7	41.8	20.3	16.6	25.3	9.7	9.8	40.8
OFF - 12 HR	40.9	52.1	36.9	34.0	41.0	6.9	30.0	51.9
OFF - 3 HR	43.9	58.5	54.5	33.9	47.7	9.6	32.5	62.9
OFF - FREE								
<b>Subtotal OFF-STREET</b>	<b>42.4</b>	<b>55.3</b>	<b>45.7</b>	<b>33.9</b>	<b>44.3</b>	<b>7.6</b>	<b>32.2</b>	<b>56.5</b>
OS - 12 HR	27.0	53.6	39.1	34.7	38.6	9.7	23.2	54.0
OS - 3 HR	41.5	60.0	54.2	45.6	50.3	7.2	38.8	61.8
<b>Subtotal ON-STREET</b>	<b>39.4</b>	<b>59.0</b>	<b>52.1</b>	<b>44.1</b>	<b>48.6</b>	<b>7.5</b>	<b>36.7</b>	<b>60.6</b>
<b>Grand Total</b>	<b>40.7</b>	<b>57.7</b>	<b>49.9</b>	<b>39.3</b>	<b>46.9</b>	<b>7.5</b>	<b>35.0</b>	<b>58.7</b>

KPI - Consolidating Facilities by Type

Figure 14: Info Graphic Showing Key Performance Index (KPI)



## Summary of Technical Report B

Through turnover/duration of stay surveys conducted on Monday July 20th 2015 and Wednesday July 29th 2015 and again on Monday December 7<sup>th</sup> 2016 and Wednesday December 9<sup>th</sup> 2016 from 9:00 am to 6:00 pm provide the study with observations of current parking activity<sup>9</sup>. Targets or indices of how well the supply is responding to the demand inform our analysis of how well supply services its demand.

Three primary diagnostic metrics were examined as a result of the field evidence collected. The report discussed volume, duration of stay and occupancy of space over the course of the survey day. These three metrics were examined on facility level, block level and more global downtown-wide scope. Info graphics provide some technical data for discussion purposes and provide evidence to strategic items developed and discussed in the Executive Summary document.

Salient findings in each of the parking metrics were presented for discussion. The next document provides a set of strategic items that form the basis from which we can develop our short and longer term parking management strategy.

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<sup>9</sup> The survey schedule also serves to provide use data during theatre and tourist season as well as peak shopping period in December.

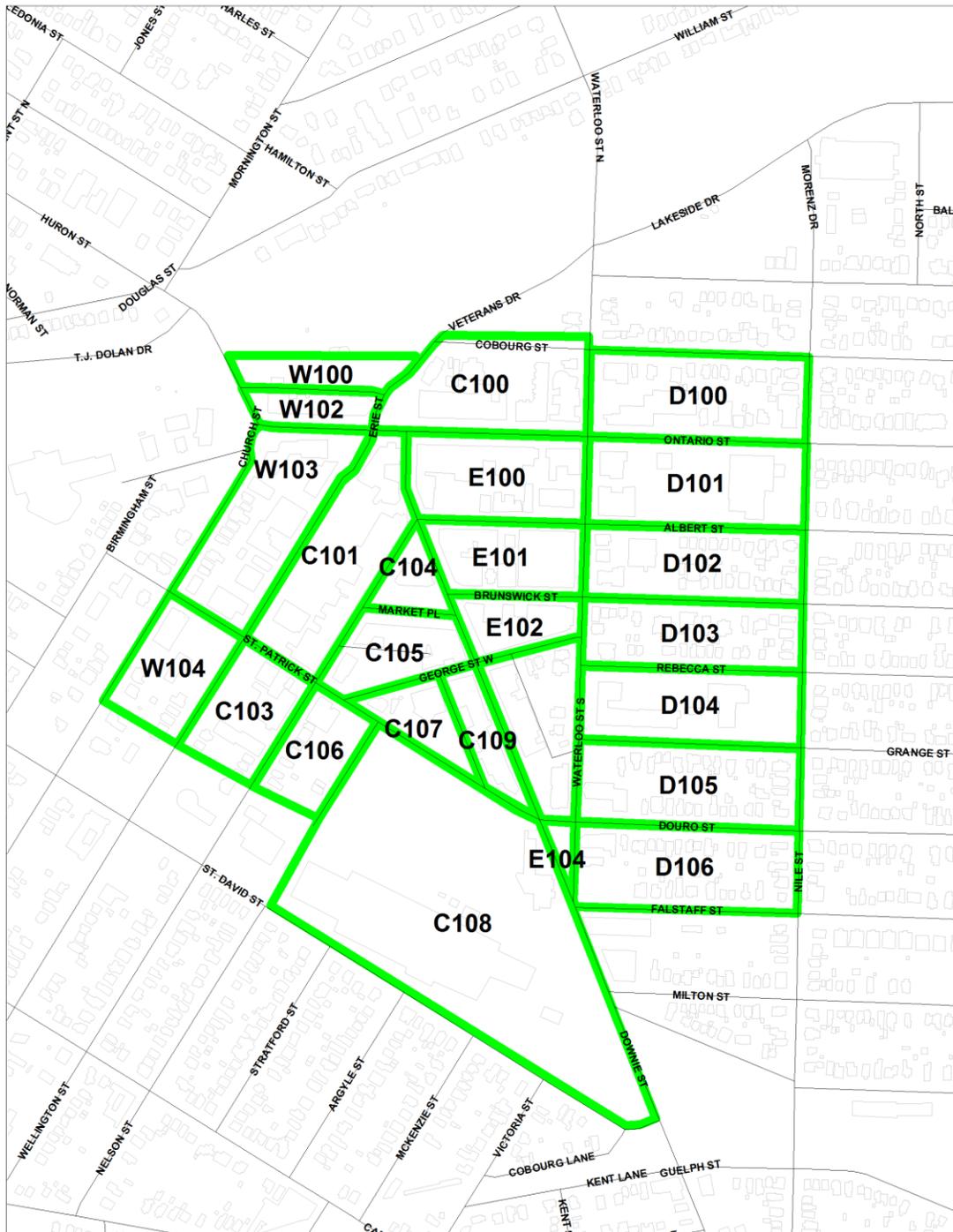


Figure 15: Block References

