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TRIP GENERATION STUDY OF DRIVE-THROUGH COFFEE OUTLETS

There has been a dramatic increase in the number of drive-through coffee outlets in recent times as more commuters seek a convenient morning coffee to start the day. The RMS Guide to Traffic Generating Developments does not yet include drive-through coffee outlets, which have unique operational characteristics compared to other drive-through facilities.

Roads and Maritime Services (RMS) recognised the need to better understand the main "drivers" of traffic generation for these sites. Data was collected from outlets throughout NSW, Queensland and Victoria and relationships between a wide range of variables and traffic generation were tested using regression analysis.

This paper describes the data collection and analysis methodology and survey results, highlighting the effects of frontage traffic volumes, ease of access, site exposure, signage, service times, queuing, passing trade and qualitative variables such as years of operation and reputation; culminating in recommended traffic generation rates for adoption in the RMS guidelines.

1. Introduction

1.1 Background

Bitzios Consulting was commissioned by Roads and Maritime Services (RMS), NSW to undertake a traffic generation study of drive-through coffee outlets (DCO). The need for this study has arisen from the increasing number of outlets opening in recent times and the fact that the RMS Guide to Traffic Generating Developments (Guide) does not include this specific type of development.

Whilst the Guide contains data on drive-through fast food outlets, the drive-through coffee outlets are unique in that the business focus is almost exclusively on beverage sales with limited food available. Most of these outlets do not have seating and only have limited parking mainly for the purpose of providing a space for patrons to park while they wait for a larger than usual order. This service is becoming increasingly popular and in order to assist in better and consistent planning outcomes it is necessary for reliable trip generation and parking demand data to be collected and analysed to include in the Guide.

1.2 Scope

The study involved:

- determining the sample number of outlets required to provide meaningful results;
- identifying suitable outlet survey sites;
- obtaining agreements from outlets to conduct surveys at their premises;
- gathering site survey data relevant to the study objectives;

- conducting on-site surveys to collect all road traffic trip generation data, time-segmented usage patterns and service times;
- tabulating, analysing and graphically presenting the collected data to identify key statistical dependency relationships; and
- presenting survey and analysis methods, identification of relevant predictive statistical relationships between outlet operations and attributes, comparisons, trends, consistencies and variations in order to recommend traffic generation rates to adopt in the Guide.

2. Site Selection

The initial investigation of suitable sites revealed that there were wide variations in the location, type and operation of outlets. It was therefore necessary to seek a range of outlets that would provide a representation of these variations. Outlets were sought in metropolitan, sub-metropolitan and regional areas of New South Wales, Queensland and Victoria.

Twenty-two outlets were identified as potentially suitable sites and were invited to participate in the study. Of these, ten outlets provided agreement for surveys to be conducted at their premises. Whilst the selection process to secure participation of suitable sites targeted businesses that had been operating for at least one year, due to the limited number of outlets prepared to participate in the study, two of the ten sites, both in Bathurst, Regional NSW, did not meet this criterion.

3. Survey Procedure

3.1 Survey Schedule

Outlet sites were surveyed between 12th May 2015 and 23rd June 2015. Two of the ten outlets were surveyed for six days and the other outlets were surveyed on a weekday during the peak business periods in the morning and afternoon. Other than the two six-day surveys all surveys were conducted on either Tuesday or Wednesday and all surveys were conducted outside of school holidays or public holiday-weeks.

All morning surveys were conducted between 6:30am and 9:00am to ensure comparison consistency and to capture the peak business hour (site peak) and peak traffic hour (network peak) of operation. The business nature of drive-through coffee outlets attracts mostly morning patronage, which is reflected by the number of outlets that elect not to open in the afternoon or close earlier than the network PM peak adjacent to the business. For these reasons, the afternoon survey times varied.

All afternoon surveys were conducted over a 2-hour period and where outlets were open later in the afternoon, 3:00pm to 5:00pm was chosen to correlate with expected network peak times. The survey for Ziper Drive-Through Coffee outlet in Concord NSW was conducted over a continuous 12-hour period between 6:00am and 6:00pm on six days. The other six-day survey was conducted at Espresso Lane in Biggera Waters, Queensland between 6:00am and 10:00am. Both outlets were closed on Sunday. The times for the six-day surveys are considered to be suitable to achieve the project objective of assessing the degree of daily variation, particularly in conjunction with analysis of the other morning and afternoon peak surveys.

3.2 Data Collection

3.2.1 Site Information

Site data and operational information were gathered prior to the on-site survey to record details relating to the outlet's physical structure and outlet operation including building area, number of employees on a typical shift and years of operation with the objective of establishing relationships between various site operational characteristics and trip generation.

3.2.2 On-site Surveys

A range of data was collected during the on-site surveys to achieve the study objectives. To facilitate analysis and presentation of data in the appropriate time segmentation a number of pro forma survey data collection sheets were used for the on-site surveys. The following data was collected during the on-site surveys:

- number of site entry and exit points;
- frontage roads' AM and PM peaks;
- drive-through lane capacity (length available for queuing);
- on-site parking availability (including for bicycles);
- number of waiting bays;
- seating provision - internal and external;
- number and type of ordering booths or terminals and collection points;
- record of the time that a vehicle enters the site;
- record of the time that the same vehicle exits the site;
- number of entering and exiting vehicles (cars/HVs) (15 minute blocks);
- number of vehicle occupants (15 minute blocks);
- number of pedestrians and cyclists (15 min blocks);
- number of queued vehicles (every 5 minutes); and
- number of on-site parked vehicles relevant to the site (every 15 minutes)

3.2.3 Passing Trade

Selected customers were asked three brief questions aimed at determining trip origin, percentage of passing trade and establishing a relationship between order size and service time. Customers were asked if the trip was just for coffee or whether they had dropped in on the way somewhere else, what they were ordering and their postcode.

4. Preliminary Analysis

A large volume of data was collected on-site and to facilitate efficient tabular and graphical referencing, drive-through coffee outlets (DCO) were numbered DCO1 to DCO10.

Comparison of the daily totals for the two sites surveyed over six days show that there is no clear indicator of which weekday is the busiest though mid to late week days are typically busier than earlier in the week. It is however clearly evident that Saturday is less busy than the week days, with both outlets closed on Sunday.

Survey data and key derived statistics were cross-checked against data contained in the Guide, Land Use Traffic Generation – Data and Analysis 22: Drive-Through Restaurants (1993), Land Use Traffic Generation – Data and Analysis 5: Fast Food (1980), and ITE Trip Generation Rates – 8th Edition. The purpose of this comparison was to check for expected consistencies and variations and to identify any erroneous data. All survey data reviewed were within expected ranges and considered to be reasonable and error free.

The average DCO trip generation of 105 trips during the site AM peak hour was considered to be reasonable when compared to previous studies of fast food outlets. Trip rates contained in the RMS Guide for KFC and McDonalds are 150 and 260 trips respectively during the site peak and 100 and 180 trips during the network peak. Adopting a formula used by the Institute of Traffic Engineers (ITE) for coffee/ donut drive-through outlets, which is based on Gross Floor Area (GFA) of the outlet, the average trip rate for the DCO's for this study is 102 trips in the AM network peak.

5. Data Analysis and Comparisons

5.1 Analysis of Independent and Dependent Variable Relationships

Relationships between variable independent and dependent data were tested to determine statistically relevant linkages between various parameters and the drive-through trip generation.

Based on initial analysis of the survey data and recognition that there was not a significant association between variables it was decided that multiple linear regression analysis would not be useful and therefore in order to determine the degree of relationships between dependent and independent variables a simple linear regression analysis was conducted to derive R^2:

$R^2 = A/B$

Where:

A is the variation in the dependent variables explained by the combined linear influence of the independent variables; and

B is the total variation in the dependent variables.

R^2 represents the percentage of variation in the dependent variable and therefore how much of the variation is based on the independent variables. For example, a R^2 result of 1.0 indicates that 100% of variation in the dependent variable is associated with the independent variable, therefore as the R^2 value approaches 100% the more accurate the results become. Values less than 80% are not considered accurate enough in this case to indicate a significant relationship between the dependent and independent variable.

5.2 Data Analysis

Initial data analysis indicated that the AM period produced significantly more trips than the PM, and as such it was not considered necessary to undertake a detailed analysis of the PM period. The key relationships tested were designed to establish what the key influences on trip generation and queue lengths were as a priority. Therefore, in the analyses, generally trip generation and queue length were tested as dependent variables, with the exception of testing those two variables against each other to establish what their relationship may be.

Table 1 below lists the analyses conducted and includes the R^2 results of the linear regression tests, with the more significant relationships highlighted. Adopting the generally accepted principle that any R^2 values less that approximately 80% are indicative of insufficient accuracy in defining the dependent and independent variable relationships, it can be concluded that the analyses for all survey datasets analysed indicate that the level of association of dependent and independent variables is not sufficient to draw any accurate relationships or conclusions.

Table 1 Independent and Dependent Variable Relationships Analysis and Summary

Independent Variable	Dependent Variable	Reference	R^2
Frontage Road Network AM Peak Hour	Trip Generation	Sec. 5.2.1	0.14
Frontage Road Site AM Peak Hour in CBD Direction	Trip Generation	Table 2	0.12
Frontage Road Site AM Peak Hour	Queue Length	Table 3	0.26
Frontage Road Two-Way Network AM Peak Hour	Trip Generation	Sec. 5.2.1	0.12
Gross Floor Area (GFA)	Trip Generation	Table 4	0.10
Site AM Peak Trip Generation	Queue Length	Table 5	0.67
Number of Staff	Service Time	Table 6	0.64
Number of Staff	Trip Generation	Table 7	0.31
Service Time	Queue Length	Sec. 5.2	0.07
Service Time	Trip Generation	Sec. 5.2	0.07
Number of Service Booths	Service Time	Sec. 5.2	0.06
Number of Service Booths	Trip Generation	Table 8	0.61
CBD Inbound / Outbound Site AM Peak Frontage Road Traffic	Percentage of Passing Trade	Sec. 5.3	N/A
CBD Inbound / Outbound Site AM Peak Frontage Road Traffic	Trip Generation	Sec. 5.3	N/A

From the analyses listed in Table 1 above, the results of the following relationship testing have been included in this paper:

- Frontage road site AM peak hour in the CBD direction and trip generation. Similar results and conclusions were drawn when analysing the relationship between trip generation and the network peak frontage road traffic for both CBD-bound and two-way;
- frontage road site AM peak hour and queue length;
- Gross Floor Area (GFA) and trip generation;
- site AM peak trip generation and queue length;
- number of staff and service time;
- number of staff and trip generation;
- number of service booths and trip generation;
- CBD inbound / outbound site AM peak frontage road traffic and passing trade; and
- CBD inbound / outbound site AM peak frontage road traffic and trip generation.

The analyses to determine the influence of service time on queue length, service time on trip generation and the number of service booths on service times showed very low R^2 results and are not discussed further. While it is intuitively surprising that there is not a significant relationship between service time and queue length, service times are consistent throughout the day and queue lengths are more dependent on peak business levels.

5.2.1 Frontage Road Site AM Peak Hour in CBD Direction and Trip Generation

Table 2 and Figure 1 show the data and analysis to test for any influence of the site AM peak hour frontage road traffic volumes travelling in the CBD Direction on trip generation (i.e. in plus out; twice the volume of customer vehicles).

Table 2 Trip Generation Relative to Site AM Peak Traffic Volumes in CBD Direction

DCO	Frontage Road Site AM Peak Hour in CBD Direction (veh)	AM Trip Generation (veh)	% AM Trip Generation of Frontage Road Traffic
1 Fastlane Coffee 1, Dubbo NSW	207	112	54.1
2 Fastlane Coffee 2, Dubbo NSW	68	88	129.4
3 Starbucks, Mt Druitt, NSW	3410	126	3.7
4 Ziper, Concord, NSW	2743	116	4.2
5 Johnny Bean Good, Bathurst, NSW	404	32	7.9
6 Coffee Club, Tingalpa, QLD	1369	108	7.9
7 Di Bella, Bowen Hills, QLD	1410	112	7.9
8 Espresso Lane, Labrador, QLD	897	56	6.2
9 The Brew, Bathurst, NSW	142	70	49.3
10 Tico's Drive Thru, Brooklyn, VIC	1217	234	19.2
Average	1187	105	29.0

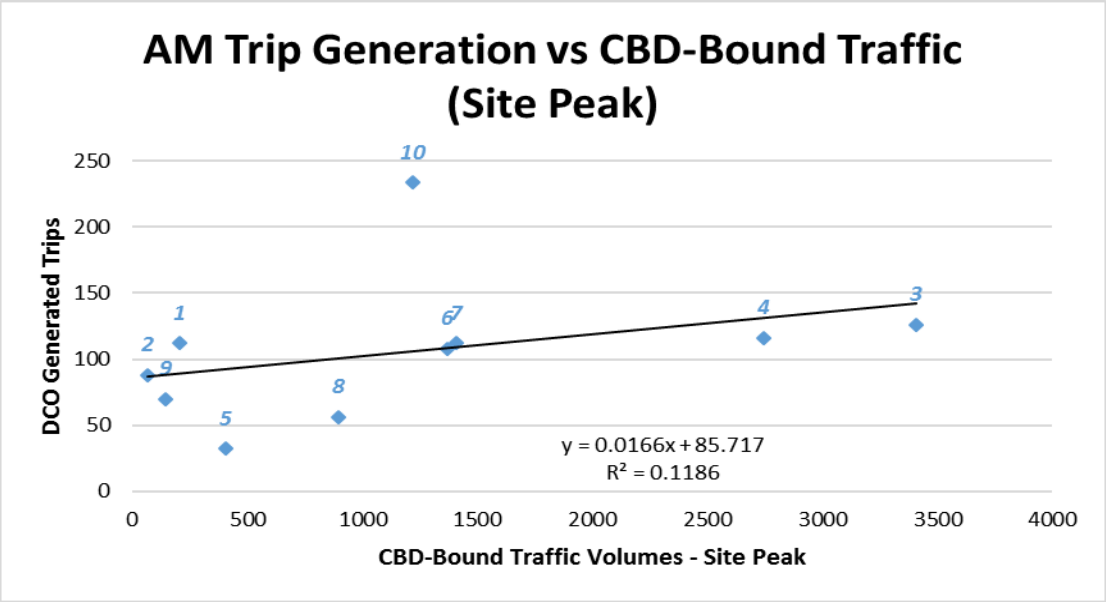

Figure 1 Correlation Between Site AM Peak Trip Generation and CBD-Bound Traffic

While an increase in AM peak frontage traffic does shown a minor trend of increasing DCO trips the trend is not consistent across all outlets. DCO 5, 8 and 10 show that generated trips are not reliant on the total frontage traffic. The calculated R^2 result indicates a 12% association with the independent variable, and as such it is considered that the provided survey results do not have enough consistency to show an accurate and consistent relationship. As such no clear correlation or relationship can be formed, and similar results and conclusions are drawn when analysing the relationship between trip generation and CBD bound or two-way frontage road traffic during the network peak.

5.2.2 Frontage Road Site AM Peak Hour in CBD Direction and Queue Lengths

Table 3 and Figure 2 show the data and analysis to test for any influence of the frontage road traffic volumes on DCO queue lengths.

Table 3 Queue Length Relative to Site AM Peak Frontage Road Traffic in CBD Direction

DCO	Frontage Road Site AM Peak Hour in CBD Direction (veh)	Queue Length (m)	% AM Trip Generation of Frontage Road Traffic
1 Fastlane Coffee 1, Dubbo NSW	207	6	2.9
2 Fastlane Coffee 2, Dubbo NSW	68	6	8.8
3 Starbucks, Mt Druitt, NSW	3410	7	0.2
4 Ziper, Concord, NSW	2743	11	0.4
5 Johnny Bean Good, Bathurst, NSW	404	2	0.5
6 Coffee Club, Tingalpa, QLD	1369	6	0.4
7 Di Bella, Bowen Hills, QLD	1410	7	0.5
8 Espresso Lane, Labrador, QLD	897	5	0.6
9 The Brew, Bathurst, NSW	142	6	4.2
10 Tico's Drive Thru, Brooklyn, VIC	1217	11	0.9
Average	1187	6.7	1.9

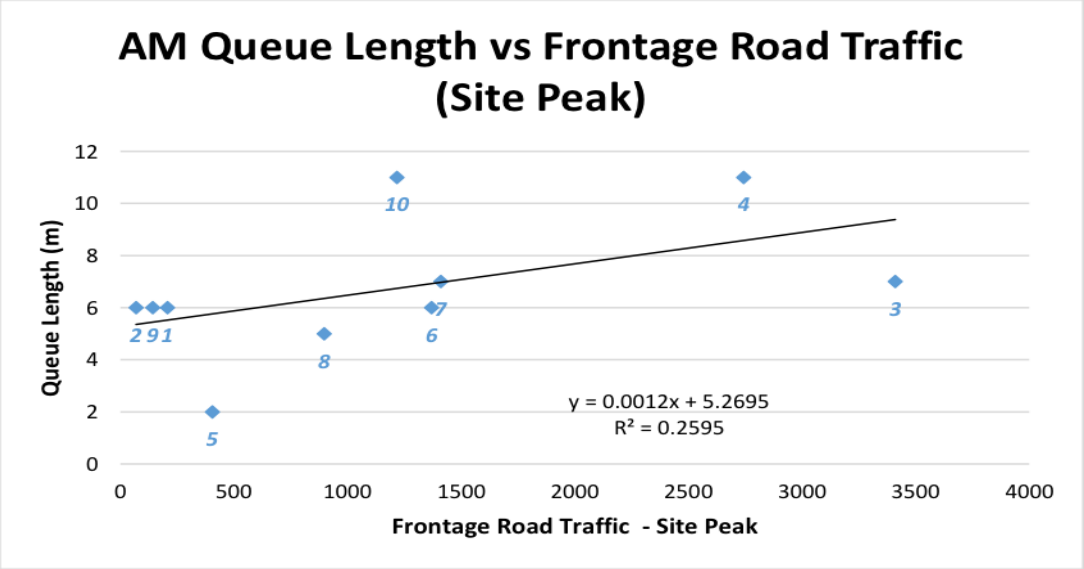

Figure 2 Correlation Between Site AM Peak Hour Queue Length and Frontage Road Traffic

Whilst there seems to be some correlation, the results should be viewed with caution as there are other influencing factors such as accessibility of traffic from both directions of the road, service times and the number of vehicles served. The calculated R^2 of 0.26 is not sufficiently significant to accept a direct relationship.

5.2.3 Outlet Gross Floor Area (GFA) Relationship to Site AM Peak Trip Generation

Table 4 shows the data and analysis to test for any influence of the Gross Floor Area (GFA) on trip generation in the site AM peak period. This relationship was tested due to the fact that, for many developments, trip generation is influenced by GFA. In this study however, the vast variation in trip rate based on GFA, together with a very low R^2 result of 0.10, demonstrates quite clearly that there is no correlation between generated trips and GFA for DCO's.

Table 4 GFA Impact on Site AM Peak Hour Trip Generation

DCO	GFA (m^2)	Generated Site AM Peak Hour Trips	Trip Rate Based on GFA (Trips / m^2)
1 Fastlane Coffee 1, Dubbo NSW	24	112	4.67
2 Fastlane Coffee 2, Dubbo NSW	24	88	3.67
3 Starbucks, Mt Druitt, NSW	200	126	0.63
4 Ziper, Concord, NSW	7	116	16.57
5 Johnny Bean Good, Bathurst, NSW	150	32	0.21
6 Coffee Club, Tingalpa, QLD	140	108	0.77
7 Di Bella, Bowen Hills, QLD	117	112	0.96
8 Espresso Lane, Labrador, QLD	54	56	1.04
9 The Brew, Bathurst, NSW	80	70	0.88
10 Tico's Drive Thru, Brooklyn, VIC	60	234	3.90

5.2.4 Trip Generation Relationship to DCO Queue Lengths

Table 5 and Figure 3 show the data and analysis to test for any influence of each DCO's generated trips in the AM peak on maximum queue lengths.

Table 5 Maximum Queue Length Relationship to Trip Generation

DCO	Generated AM Site Peak Trips	Maximum Queue Length	% Queue Length of Trip Generation
1 Fastlane Coffee 1, Dubbo NSW	112	6	5.4
2 Fastlane Coffee 2, Dubbo NSW	88	6	6.8
3 Starbucks, Mt Druitt, NSW	126	7	5.6
4 Ziper, Concord, NSW	116	11	9.5
5 Johnny Bean Good, Bathurst, NSW	32	2	6.3
6 Coffee Club, Tingalpa, QLD	108	6	5.6
7 Di Bella, Bowen Hills, QLD	112	7	6.3
8 Espresso Lane, Labrador, QLD	56	5	8.9
9 The Brew, Bathurst, NSW	70	6	8.6
10 Tico's Drive Thru, Brooklyn, VIC	234	11	4.7
Average	105	6.7	6.8

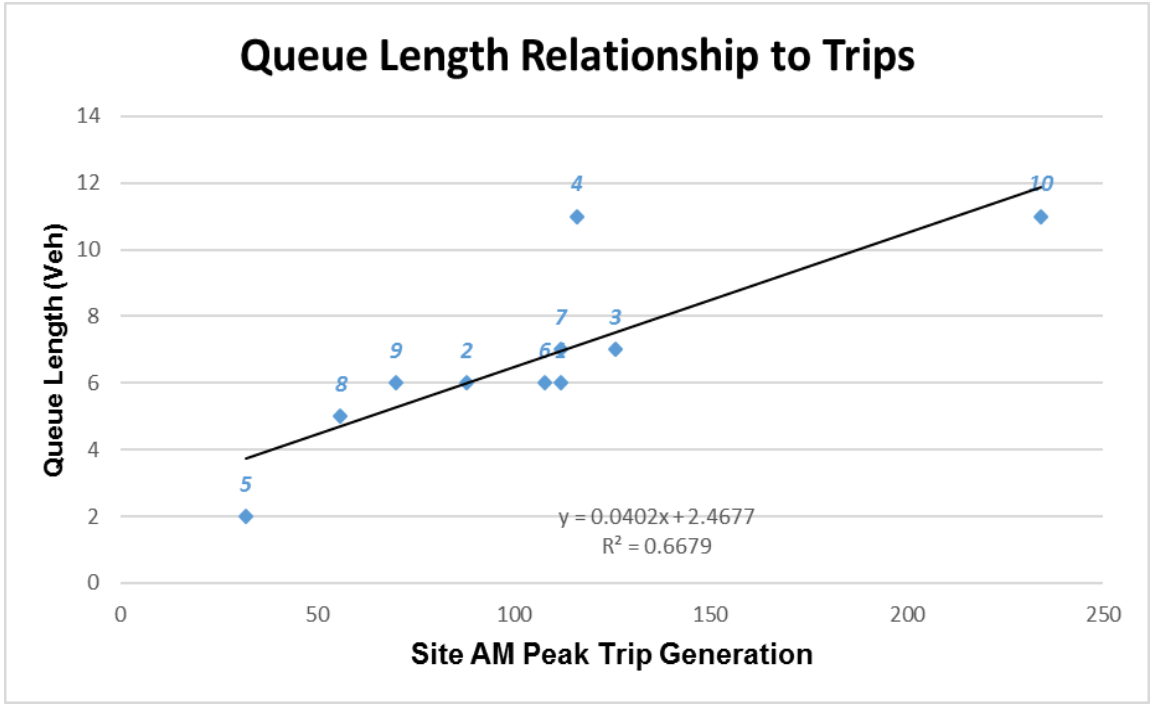

Figure 3 DCO Queue Lengths in Relation to Generated Trips

The results of this analysis shows a relationship between queue lengths and trip generation, however there are other contributing factors that influence trip generation as a dependent variable. The calculated R^2 result indicates a 67% association with the dependent variable and whilst indicating a clear relationship, it is not considered sufficiently significant to establish an associated specific rate.

5.2.5 Staff Number Impact on Service Times

Table 6 and Figure 4 show the data and analysis to test for any influence of the DCO's number of staff on service times. Average service time is measured by the difference in time from entry to exiting the site.

Table 6 Staff Number and Service Timing

DCO	Number of Staff	Average Service Time (min)
1 Fastlane Coffee 1, Dubbo NSW	3	4.22
2 Fastlane Coffee 2, Dubbo NSW	3	4.38
3 Starbucks, Mt Druitt, NSW	3	4.26
4 Ziper, Concord, NSW	2	3.48
5 Johnny Bean Good, Bathurst, NSW	2	2.68
6 Coffee Club, Tingalpa, QLD	3	3.46
7 Di Bella, Bowen Hills, QLD	3.5	3.93
8 Espresso Lane, Labrador, QLD	2	2.73
9 The Brew, Bathurst, NSW	4	5.48
10 Tico's Drive Thru, Brooklyn, VIC	4	4.08
Average	2.95	3.87

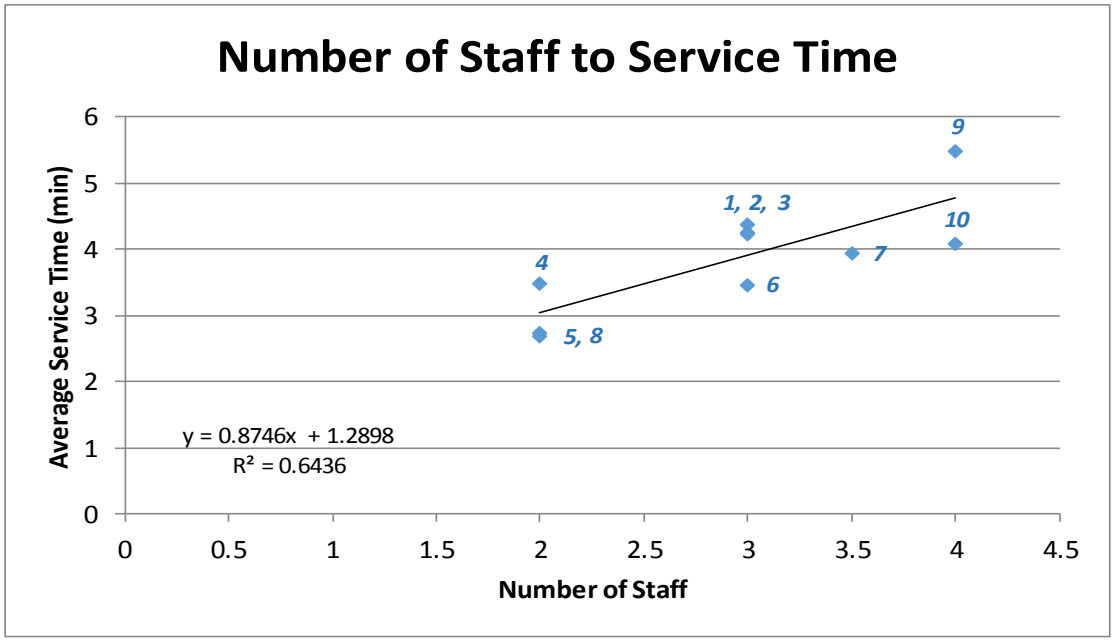

Figure 4 Staff Number Impact on Service Times

There appears to be a correlation between Number of Staff and Service Time, however this should be viewed cautiously as this analysis suggests that a higher number of staff results in an increased service time. Intuitively this does not seem logical. Therefore, a reasonable conclusion is that outlets employ more staff to handle the quantum of customers, and service times naturally increase as business increases, hence the calculated R^2 of 64% indicating that correlation between the two variables is most likely the nature of the relationship rather than dependence.

5.2.6 Staff Number Impact on Trip Generation

Table 7 and Figure 5 show the data and analysis to test for any influence of the DCO's number of staff on trip generation.

Table 7 DCO Staff Numbers and Trip Generation

DCO	Average Number of Staff	AM Site Peak Trip Generation (veh)
1 Fastlane Coffee 1, Dubbo NSW	3	112
2 Fastlane Coffee 2, Dubbo NSW	3	88
3 Starbucks, Mt Druitt, NSW	3	126
4 Ziper, Concord, NSW	2	116
5 Johnny Bean Good, Bathurst, NSW	2	32
6 Coffee Club, Tingalpa, QLD	3	108
7 Di Bella, Bowen Hills, QLD	3.5	112
8 Espresso Lane, Labrador, QLD	2	56
9 The Brew, Bathurst, NSW	4	70
10 Tico's Drive Thru, Brooklyn, VIC	4	234
Average	2.95	105

Table 7 shows large differences and inconsistencies in each DCO's trips generated and number of staff available indicating no clear relationship between the two. For example, DCO 9 and DCO 10 both have four (4) staff but a large difference in trip generation, and DCO 4 and DCO 5 have large differences in trip generation. The relationship between each DCO trip generation and total number of staff is displayed in Figure 5 below.

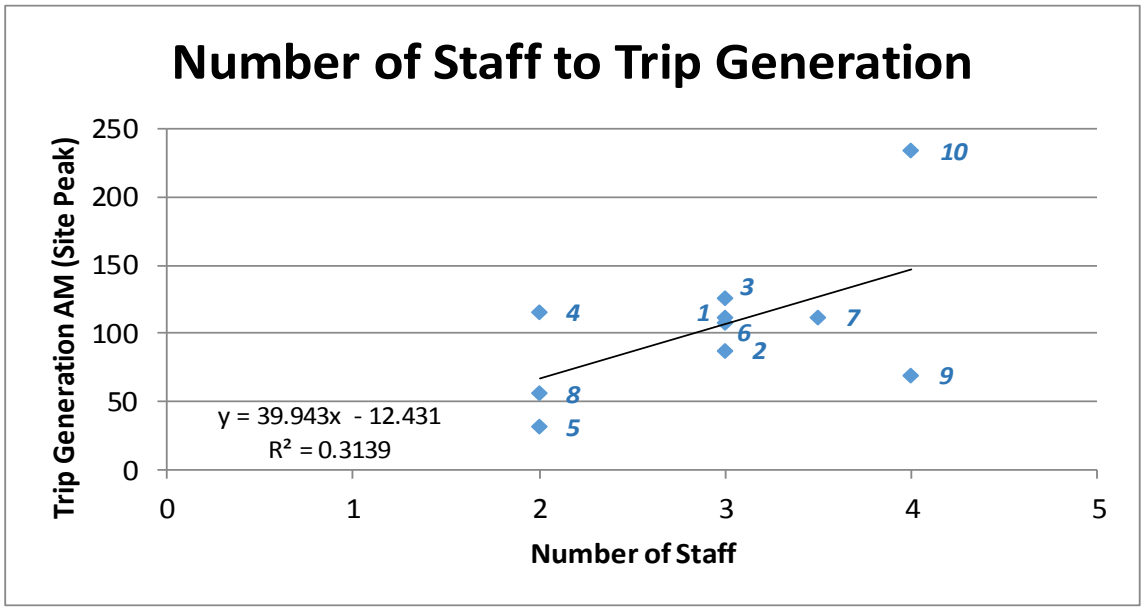

Figure 5 DCO Staff Numbers Vs AM Peak Trip Generation

The graph and R^2 results indicate that there is some relationship between these two variables, however, similarly with the test result comparing queue lengths with trip generation, these results probably indicate correlation rather than dependency.

5.2.7 Service Booth Numbers Impact on Trip Generation

Table 8 and Figure 6 show the data and analysis to test for any influence of the number of Service Booths/Points/Staff on trip generation.

Table 8 Number of Service Booths Impact on Trip Generation

DCO	Number of Service Booths/Points/Service Staff	Site AM Peak Trip Generation
1 Fastlane Coffee 1, Dubbo NSW	4	112
2 Fastlane Coffee 2, Dubbo NSW	3	88
3 Starbucks, Mt Druitt, NSW	3	126
4 Ziper, Concord, NSW	3	116
5 Johnny Bean Good, Bathurst, NSW	3	32
6 Coffee Club, Tingalpa, QLD	3	108
7 Di Bella, Bowen Hills, QLD	2	112
8 Espresso Lane, Labrador, QLD	2	56
9 The Brew, Bathurst, NSW	3	70
10 Tico's Drive Thru, Brooklyn, VIC	6	234
Average	3.2	105

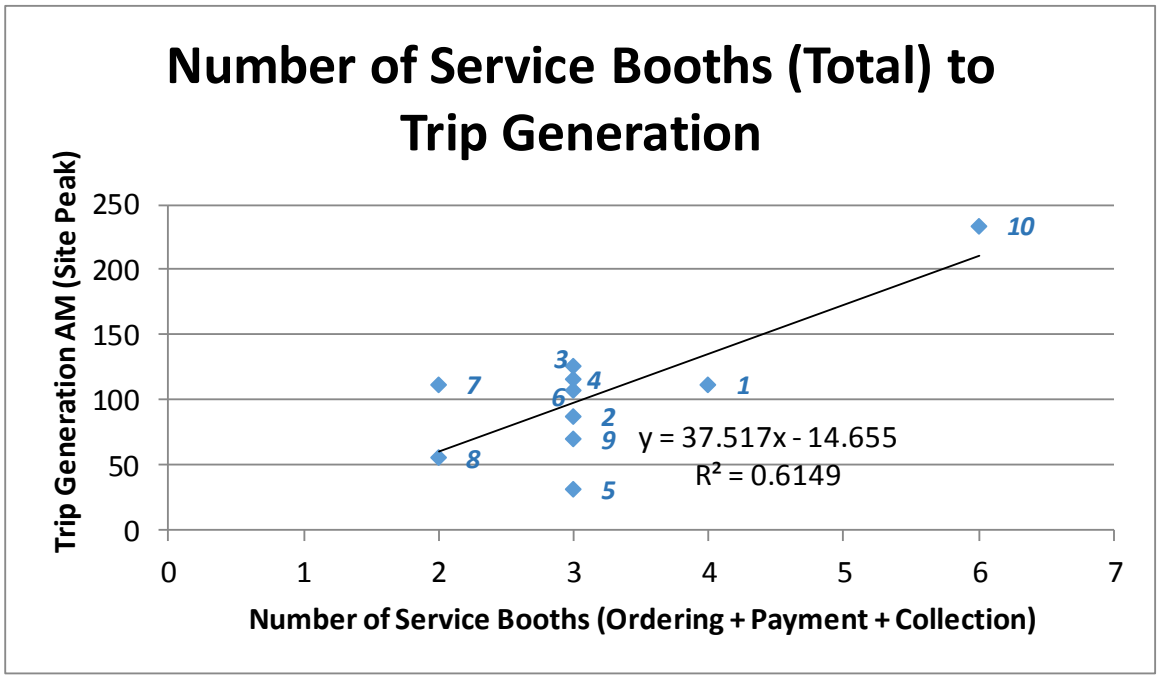

Figure 6 Number of Service Booths Impact on Trip Generation

Whilst the R^2 calculation of 61% association with the dependent variable is not sufficiently high enough to assert an accurate statistical relationship, it can be reasonably concluded that a higher number of service points are operated by outlets to cater for the business's generated trips. Therefore, the relationship is probably more correlation than dependency, that is, the number of service points are driven by the business requirements (trip generation).

5.3 DCO Location Relationship with CBD Inbound Vs Outbound Traffic

Survey data was analysed to determine possible relationships between the accessibility of each DCO location to capture customers from *CBD inbound* and *CBD outbound* traffic. *CBD inbound* refers to outlets located to service a majority catchment of vehicles heading towards the nearest CBD and *CBD outbound* refers to outlets located to service a majority catchment of vehicles leaving the nearest CBD. All data is during the AM peak period.

Given the nature of DCO business that provides a service to customers predominantly in the AM peak, it was a reasonable expectation that the location of DCO's that were best suited to capture the AM *CBD inbound* traffic would attract higher trip generation rates, including passing trips than those situated at locations with predominant accessibility to AM *CBD outbound* traffic. Analysis however, showed no distinct differences in the average DCO's trip generation or passing trips based on location indicating no clear relationship based on *inbound* or *outbound* catchments, therefore no clear advantage in a location on the AM *CBD inbound* side of the road.

6. Conclusions

6.1 Summary and Key Statistics

The survey data shows that there are key operational characteristics associated with drive-through coffee outlets as follows:

- There are significantly more trips generated in the AM peak than PM peak;
- based on the six-day surveys, there were a very low number of customers on Saturday and the outlets were closed on Sunday, which would explain why most drive-through coffee outlets do not elect to open on weekends;
- based on the outcomes of the customer interviews there is a high proportion of passing trips throughout the day, also verified by postcode data;
- while there is some correlation between road frontage traffic volumes and the number of drive-through coffee customers the R^2 relationship is not statistically significant;
- there does not appear to be a correlation of GFA to trip generation;
- there appears to be some correlation between trip generation and queue lengths;
- the queuing capacity of the sites were sufficient to avoid queued vehicles from spilling out into the adjacent roadway, which could be an indicator of customers' limited tolerance to waiting times;
- the number of staff serving is increased during site peak times in an endeavour to reduce service times, which is also designed to manage queue lengths;
- only three outlets have internal or external seating, therefore parking analysis is unreliable;
- service times across all outlets were generally consistent, with a range of 2:41(min:sec) to 5:29 and average of 3:53; and
- maximum queue lengths ranged from 2 to 11, although only one outlet's maximum queue was 2, two outlets maximum queue was 11 and the remaining seven outlet's maximum queue was between 5 and 7 with an overall average maximum for all outlets of 6.7 vehicles.

In the absence of accurate statistical relationships between independent and dependent variables, the following other influencing factors, although difficult to quantify, could be considered:

- visible exposure to passing traffic;
- ease of access to the site;
- ease of site egress;
- quality and visibility of signage;
- reputation;
- advertising; and
- quality of beverages, food and service.

It is noted that a number of operational features of DCOs are relatively consistent, such as service times, queue lengths, number of staff and service booths, all of which are demonstrated in the analyses to have some inter-relationships.

There are some possible operational relationships that may provide some explanation for these consistencies, including the type of coffee machines used by outlets that have the capacity to produce a maximum rate of coffees, which would govern the number of staff required to operate and serve customers which influences service time. It may also be that customers are prepared to wait up to 5 minutes and if service times are longer they could change their morning purchasing regime, meaning that there is a "levelling out" of the number of trips that an outlet can accommodate based on the coffee making equipment they have.

7. Recommendations

The highlighted inter-relationships identified in Table 1, whilst indicative of some dependence, can be explained by reasoning of normal operations of a business such as DCOs. The mere presence of the road-side outlet together with the influencing factors described in Section 6 including signage and advertising creates the market for the outlets. The customer demand (generated trips) then requires an optimum number of service booths and staff to ensure that customers are served quickly to encourage repeat business. Ensuring fast service also manages the queue lengths and long queue lengths themselves are likely to discourage customers; hence a 'levelling out' of patronage.

The graph shown in Figure 7, duplicated from the analysis of frontage road AM network peak hour traffic against trip generation, shows that with the exception of a small number of outlets surveyed, due to local circumstances and excluded as "outliers", it appears that a range of trip generation rates could be reasonably adopted between 70 and 130 AM peak hour trips, with consideration given to other potentially influencing factors. The lower than average trip generation of DCO5 and DCO8 can possibly be explained by their location. DCO5 is a regional outlet with a low volume of passing traffic. DCO8 is a sub-metropolitan outlet on a frontage road that does not have a clear peak AM direction and is relatively low. Additionally, DCO8 only captures traffic in one direction. DCO10 on the other hand has very high trip generation possibly due to a highly visible location to passing traffic, its unique operation of having two service lanes, has an open 'veranda' style of service with staff attending directly to vehicles in the queue and the outlet has been operating for a number of years and has built up a strong patronage.

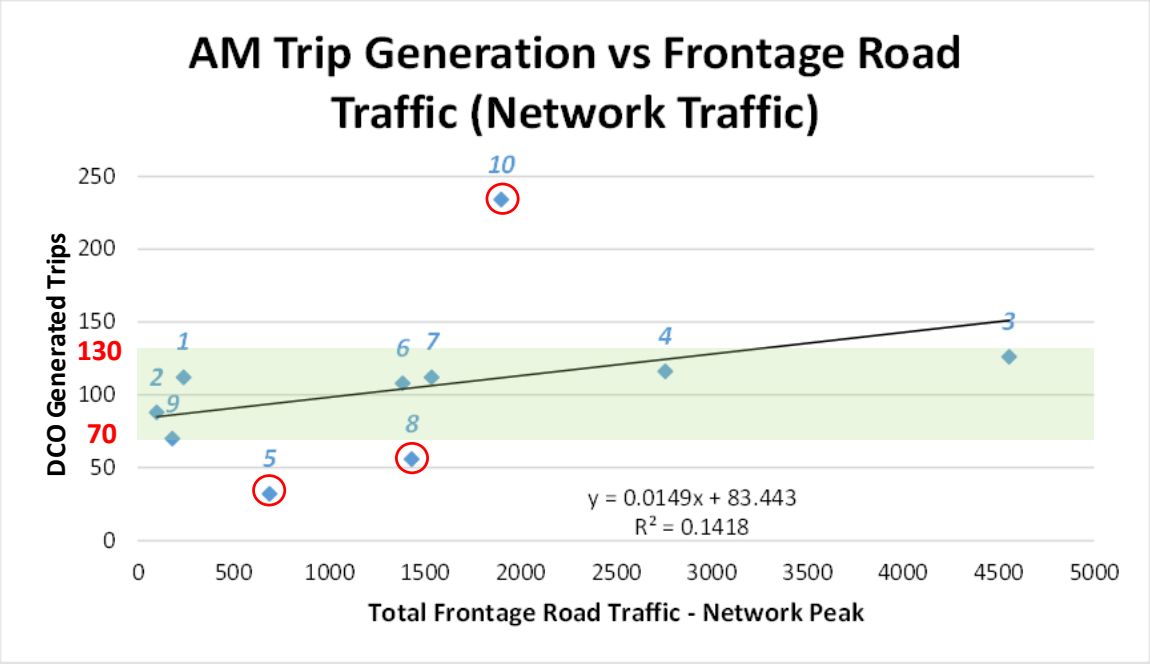

Figure 7 Trip Generation Range

It was recommended that a range of values between 70 and 130 trips in the AM peak hour be adopted as a baseline estimate for trip generation of drive-through coffee outlets. The average trip generation for the AM site peak calculated for all DCOs of 105 falls within this range.

Given the analyses demonstrated some relationships between outlet characteristics albeit not statistically significant, it was recommended that when assessing proposed DCO developments, selection of an appropriate traffic generation rate should consider the range of variable influencing factors itemised in Section 6.

The information gathered from customer interviews relating to 'pass-by' purchases was considered to be robust and consistent across all outlets surveyed. It was therefore recommended that the average passing trip percentage of 83% is adopted in calculations of the trip generation impacts on the surrounding road network when assessing traffic impacts of proposed drive-through coffee outlets.

8. Acknowledgements

Bitzios Consulting would like to acknowledge:

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Fastlane Coffee 1, Dubbo NSW
Fastlane Coffee 2, Dubbo NSW
Starbucks, Mt Druitt, NSW
Ziper, Concord, NSW
Johnny Bean Good, Bathurst, NSW
Coffee Club, Tingalpa, QLD
Di Bella, Bowen Hills, QLD
Espresso Lane, Labrador, QLD
The Brew, Bathurst, NSW
Tico's Drive Thru, Brooklyn, VIC