Examination of the Effect of Driver Population at Freeway Reconstruction Zones

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ABSTRACT

This paper presents an investigation into the effect of the driver population factor on the capacity of long-term freeway reconstruction zones. A major reconstruction project in Ontario, Canada provided an opportunity to conduct this investigation. Comprehensive data on traffic, weather and work activity were used. Three different analyses were conducted which compared mean capacity flows during different times of day and days of week to estimate the effect of the non-commuter driver population during weekdays and weekends. The study found that the effect of the driver population factor on the capacity of the reconstruction site was highly significant. Based on a factor of 1.0 for commuter traffic, a driver population factor of 0.93 was estimated for the afternoon peak period and 0.84 for weekends. Also, the driver population factor is likely responsible for a capacity reduction on weekends when compared to weekdays. This capacity reduction was 12 percent in one direction of travel and 17 percent in the other direction. Both the driver population factors and the capacity reductions on weekends found in this study are considered conservative given that these data were collected in April and early May, and that there is a higher proportion of tourist drivers during the summer season at this site. Nonetheless, the numbers are consistent with empirical observations from previous studies and provide further guidance for using the driver population factor that appears in the current HCM procedures.

Keywords: *capacity, driver population, freeways, work zones*

1. INTRODUCTION

Driver population is one of the traffic stream characteristics that has an important effect on a freeway capacity according to the current Highway Capacity Manual (HCM) procedures *(1)*. Using these procedures, capacity is normally estimated under a set of geometric and traffic conditions labeled as "ideal." Practically, traffic and geometric conditions are less than ideal in many instances, and therefore, several adjustment factors are provided in the HCM to account for the deviations from that pre-defined set of ideal conditions.

Among those ideal conditions is the stipulation that the traffic stream is composed predominantly of commuter or regular weekday drivers who possess adequate familiarity with the freeway facility and its environs. The HCM adjustment for this factor is based on the fact that traffic streams with different driver characteristics (weekend, recreational, perhaps even mid-day) use freeways less efficiently *(2).*

Despite the significant impact driver population may have on capacity estimates as suggested by the wide range for the adjustment factor included in the HCM procedures, minimal guidance if any is provided for using that range. A literature search showed that very limited information is available to quantify this impact based on empirical observations. The importance of such investigations becomes even more critical at freeway work zones for two main reasons. First, none of the limited number of investigations found in the literature dealt exclusively with freeway work zones. Second, drivers' familiarity with a highway facility is more important at work zones where temporary traffic control strategies can be quite unfamiliar to many drivers.

The research presented in this paper is a part of an ongoing research at McMaster University to investigate the different factors that affect freeway capacity at long-term reconstruction zones. It examined the effect of the driver population factor on freeway capacity at those areas. A major reconstruction project on the Queen Elizabeth Way (QEW) freeway in Burlington, Ontario, Canada, in the spring of 1999 provided an excellent opportunity to conduct this investigation.

2. BACKGROUND:

2.1. Composition of Driver Population

In the context of this research, driver population refers to the mix of driver types in a traffic stream by trip purpose. Personal attributes such as gender, age, or education are considered beyond the scope of this research. The use of the trip purpose as a basis for classifying drivers is consistent with the HCM procedures where two categories of drivers are identified: commuters, and recreational drivers. Two aspects of driver characteristics are viewed as being related to the trip purpose. The first is the familiarity of drivers with the facility and its environs, which is thought to affect the efficiency of facility use by drivers. The second and less evident aspect is the value of time perceived by drivers for a specific trip purpose and its potential effect on driver behavior and consequently on the efficiency in using a highway facility.

Commuter drivers are believed to be the most familiar with the road, and therefore they tend to use the highways in the most efficient way during their commutes to and from work. On the other hand, tourists (recreational drivers) who are not familiar with the road and the region tend to use freeways in the least efficient way. Drivers for other trips, such as shopping or social, are thought to fall between the above two main categories in terms of their familiarity with the road and the effect on freeway capacity.

2.2. Factors Affecting Driver Population

Two factors help to identify the driver population: the time of day, week, or season that the trip is made; and the location of the freeway facility.

Most trip types by purpose are associated with a specific time of the day, day of the week, or a specific season. The vast majority of work trips typically take place on weekdays in the morning peak (for home-to-work trips) and in the afternoon peak (for work-to-home trips). Recreational and social trips of local drivers tend to take place more on weekends than on weekdays. Recreational trips made by tourists (non-local drivers) typically have a seasonal variation throughout the year.

The other factor associated with the trip purpose and therefore with the driver population is freeway location. Urban freeways usually witness a high proportion of commuter drivers on weekdays during peak hours. Those freeways are normally located near major employment and residential centers and are mainly intended to serve the high demand of work-related trips. On the other hand, inter-urban freeways, and particularly those near major tourist attractions, usually witness a driver population with a high proportion of non-local and recreational drivers.

2.3. Driver Population and the HCM Capacity Analyses

The U.S. Highway Capacity Manual (HCM) published by the Transportation Research Board (TRB) has been the guidance for capacity analyses since its first edition in 1950. However, the effect of the driver population factor was not included in capacity analysis procedures until the third edition in 1985 *(2).* Since then, the driver population factor has been included in the subsequent HCM updates in 1994 and 1997 *(1, 3)* as well as in the drafted fourth edition of the HCM 2000.

In the 1985 HCM procedures *(2),* capacity estimates (or a maximum service flow) under ideal conditions are adjusted to account for the driver population using an adjustment factor. This adjustment factor assumes a value of 1.0 for weekday or commuter drivers but could range from 0.75 to 0.9 for other drivers. The procedures state that engineering judgement and/or local data must be used in selecting the exact value within this range. A similar procedure is provided in the 1994 HCM update *(3)*, except that the adjustment factor for recreational or other drivers varies in the range between 0.75 and 0.99.

In the 1997 update *(1)*, an adjustment factor to account for the driver population effect is applied to the estimated free-flow speed under ideal conditions. This adjustment factor varies in the range between 0.85 (for recreational traffic) and 1.0 (for commuter traffic). Also in this update, the use of judgement is required to determine the exact value of the adjustment factor. This same procedure is included in the draft of the HCM 2000.

The effect of driver population on freeway capacity might well exceed the effects of non-ideal lane width and/or lateral clearance or even the effect of heavy vehicles on capacity estimates. While adjustment factors are provided in sufficient details to account for non-ideal geometric features or the presence of heavy vehicles, only minimal guidance is provided to account for the effect of the driver population factor on capacity estimates. Much of the determination of this effect is left to the judgement of the HCM capacity analysis users. Hence additional information about it will be valuable.

2.4. Reconstruction Zones and Driver Population

In general, freeway capacity at long-term reconstruction zones has not been adequately investigated. HCM guidance in this regard involves only generic capacity estimates for two lane-closure types without a means to estimate the effect of the driver population or other factors that may affect the freeway capacity at those areas. In a recent study (4), limited capacity observations from a freeway reconstruction zone in Toronto, Canada revealed that mean capacity during a weekend day (Saturday) was significantly lower than that during three different weekdays. The study suggested that part of this capacity reduction might be due to the driver population factor, although it recognized that inclement weather was also a factor during that Saturday.

As mentioned earlier, it is reasonable to expect that the driver population effect could be even more important at freeway work zones than at other locations. Regular drivers (such as commuters) will likely gain familiarity with the temporary traffic control plans in the affected areas. However, it usually takes more time for other local but non-commuter drivers to get acquainted with the work site. Specific to the first-time users is that traffic control plans (including route diversion) at the affected areas create driving conditions that often are not expected by drivers.

2.5. Previous Studies

The literature search found very little previous research on the effect of driver population factor on freeway capacity. Nonetheless, the interest in driver population factor is not new as it dates back to studies that were conducted in the early 1970s by the California Department of Transportation *(5).*

Capacities as low as 1500 to 1600 pcphpl were reported on weekends, particularly in recreational areas *(2).* Another study reported a drop in capacity of 17 percent on a Sunday evening in relation to an average weekday on a motorway near Marseille *(6).* However, those empirical observations were sparse and reported results vary substantially *(1, 2, 3).*

After the release of the 1985 HCM, Sharma *(7, 8)* tried to provide extra guidance that would help the capacity analyst estimate driver population adjustment factor based on the two extreme populations (i.e. commuters & highly recreational) provided by the HCM. His approach was to develop a scheme for classifying roadways in terms of their traffic composition of driver types. It should be noted, however, that the driver population adjustment factors developed were based on the writer's "expert" opinion and the range of values provided by the 1985 HCM *(8).*

More recently, the research team in the University of Southern Florida used traffic and tourist data to investigate the impacts of non-local drivers on freeway capacity *(5, 9).* Driver population adjustment factors were developed based on field data collected from Orlando, Florida. However, the use of these adjustment factors requires an estimation of the proportion of non-local driver population which may not be available to capacity analysis users.

There were also a few recent studies that were conducted to investigate the effect of the driver population factor at signalized intersections *(10, 11).*

3. STUDY LOCATION AND RESEARCH DESIGN

The opportunity for this study was provided by lane closures necessitated for expansion joint replacement on the Burlington Bay Skyway (BBS), which took place in the spring of

1999. This bridge is located on the Queen Elizabeth Way (QEW) in the City of Burlington, around 50 km west of Toronto. The QEW freeway connects the Greater Toronto Area with the Niagara region, which is known for its major tourist attractions, and with several crossing points on the Canadian-American borders. Generally the freeway runs in an East-west direction, along both the north and south shores of Lake Ontario, but at the Skyway it runs north-south, at the west end of the Lake. Because of its change of direction at this location, traffic is usually referred to as Niagara-bound or Toronto-bound.

The BBS is a bridge with a large span and height to allow the navigation of commercial ships to and from Hamilton Harbor. This bridge is composed of a four-lane roadway in each direction, and has a 3 percent upgrade and a 3 percent downgrade with an approximate length of 1 km each. For the expansion joint replacement, two of the four lanes in each direction were closed at a time (4-to-2 lane closure). In each direction, the expansion joint replacement work involved active work on the closed lanes for 2-3 days followed by 8-9 days for curing concrete. The work in the Niagara-bound direction started on April 5 and ended on April 26 1999, while Toronto-bound, the work started on April 11 and ended on May 5 1999.

Because the BBS is fed on both sides by 3 or 4 lane freeway sections, the reduction to two lanes over the span led to extensive congestion on the approaches, regularly exceeding four hours in both the morning and afternoon in the heavier direction of travel. This congestion provided assurance that a sufficient supply of traffic was present to ensure that the bridge was experiencing capacity flow during these periods. That in turn allowed for an investigation of differences in capacity at different times of the day or week. Since all other factors were essentially constant, any differences in capacity would almost certainly be due to differences in the population of drivers.

The study attempted to identify the traffic that consisted primarily of commuters, in order to set that as in essence a driver population factor of 1.0, consistent with the procedures in the HCM. Based on land-use patterns in the surrounding area, and the traffic volumes, the AM peak Toronto-bound traffic was identified as most likely to be commuters, and the analysis was restricted to the data during 0600 to 0900 to focus on commuters, although the congestion extended for a longer time period. Capacity for these data is compared with capacity Toronto-bound during the afternoon congested period, which could be as long as 1300-1900, and with weekend capacity data.

4. DATA DESCRIPTION AND PROCESSING

Traffic counts from detector stations at the downstream end of the Skyway in each direction as well as queue presence observations were available. Those counts were recorded using 15-min intervals and were classified by vehicle type. Besides traffic counts and queue observations, other information was used in data screening, such as incident reports, weather conditions, and work activities on the site. All the data were made available by the Ministry of Transportation of Ontario (MTO) except for weather data, which was obtained from Environment Canada.

A total of 215 hours of capacity observations were used. These observations were extracted from detector counts during 39 days of lane closure in both directions. The observations were distributed over 44 data sets, 31 Toronto-bound and 13 Niagara-bound. A data set is defined as a single sustained occurrence of congestion (queuing) upstream of the lane closure at either end of the bridge. The data sets had a typical duration of 3-7 hours. Although work started at the site on April 5 1999, traffic counts and queue observations were recorded starting April 12 1999. Capacity was calculated in passenger car units (PCUs); heavy vehicles were converted to PCUs using table 3-3 of the 1997 HCM *(1).* The percentage of heavy vehicles varied in a wide range, with values as low as 4 percent during weekends and as high as 16 percent during weekdays in the afternoon.

5. DATA ANALYSIS

Three investigations were conducted. The first compared the Toronto-bound weekday 0600-to-0900 capacities with the Toronto-bound weekday PM peak capacities: same roadway, same construction conditions, but different drivers (with perhaps a very few exceptions). The second compared weekend mean capacity flows with the Toronto-bound 0600-to-0900 capacity flows. Finally, the third investigation compared mean capacity flows on weekends with those on weekdays in general (combining total AM and PM capacity flows).

5.1. Capacity 0600 to 0900 Weekdays Versus PM peak Weekdays

Toronto-bound, there were often two periods of congestion during a normal weekday; the first during the morning peak and the second during the afternoon peak. Niagara-bound there was only one occurrence of congestion during the afternoon peak of a normal weekday, and none in the morning. Therefore, only Toronto-bound capacity data was used in this comparison. A total of 26 Toronto-bound data sets were utilized, 15 during the morning peak period and 11 during the afternoon peak period. As mentioned earlier, the time from 6:00 to 9:00 AM was used in order to best represent commuters.

Using all 26 of these data sets, the mean capacity in the morning peak was 1980 pcphpl with a standard deviation of 94 pcphpl and a 95 % confidence interval of 1933-2027 pcphpl. The mean capacity during the afternoon peak hours was 1828 pcphpl with a standard deviation of 88 pcphpl and a 95 % confidence interval of 1775-1880 pcphpl. A t-test confirmed that the difference in the mean capacity between the AM and PM peak periods was significant at the 95 % confidence level. These numbers support our assumption that the AM peak traffic has the highest value for the driver population factor, which in subsequent analysis we will set equal to 1.0.

Frequency distributions for the AM and PM data sets, using the 15-min capacity observations (pooled across data sets) are plotted in Figures 1 and 2, showing the frequency histograms and the cumulative percentile distributions respectively. Tests of normality confirmed that both distributions generally follow the normal curve.

The mean capacity during the AM peak was found to be very close to that during the PM peak Niagara-bound (1962 pcphpl), as traffic likely contains a high proportion of the morning commuters Toronto-bound. This supports the assumption that different capacities observed during the AM and PM peaks Toronto-bound are mainly due to different driver populations.

To test the driver population factor while controlling as many other factors as possible, the mean capacities AM (0600 to 0900) and PM for each individual day were compared. First, an F-test on the variances was run. Depending on its result, either the t-test or the t-estimate (t-test for samples with unequal variances) was then run.

As shown in Table 1, the mean capacity at the work zone during the PM peak was significantly lower than that during 0600-0900 in ten weekdays. In only one weekday, the mean capacity during the two time periods showed no significant difference (at the 95 percent confidence level). Note that there were an additional four AM data sets for which there was no PM congestion and therefore not included in this table. Also evident in this table are the low mean capacity values during April 26 (AM and PM data sets) due to the presence of work activity at the site. Clearly this day has different capacity characteristics than do the other ten despite the fact that the PM capacity was also significantly lower than the AM capacity. While the ratio of PM to AM capacity varied in the range of 0.89 to 0.96, it was found that the mean value of this ratio (which is equivalent to the driver population factor if the AM Toronto-bound traffic is in fact primarily commuters) was 0.93 based on the ten data sets with no work activity on site.

5.2. Capacity 0600 to 0900 Weekdays Versus Weekends

Driver population is usually thought of as a main cause for capacity reduction during weekends. A common (and generally accepted) assumption is that the high proportion of non-regular drivers in a traffic stream (mainly recreational) is mainly associated with lower capacities observed during weekends.

Data sets from both directions of travel were used in this comparison. Those involved 15 data sets 0600 to 0900 Toronto bound, 5 weekend data sets Toronto-bound, and 4 weekend data sets Niagara bound.

5.2.1. Toronto-bound

This analysis involved the same 0600-to-0900 data sets from the previous analysis plus 5 weekend data sets in this direction of travel. The mean capacity of the commuter population (0600-0900) was 1980 pcphpl, with a standard deviation of 94 pcphpl. The mean capacity during weekends was found to be 1664 pcphpl with a standard deviation of 55 pcphpl. A t-test confirmed that the difference in the mean values was significant at the 95 percent confidence level. No paired comparison was possible in this investigation and therefore a driver population factor was estimated based on the mean values of the two populations and found to be 0.84.

Two of the weekend data sets and four of the 0600-to-0900 data sets were associated with rainy days or work activity on site. To control the effect of rain and work activity, the previous analysis was repeated while excluding those few data sets. The mean capacity was found equal to 1989 pcphpl for the 0600-to-0900 data sets and 1696 pcphpl for the weekend data sets. The difference in mean values was found significant using a t-test (at the 95 percent confidence level). The driver population factor (ratio of means) was found equal to 0.85 which is very close to that derived previously from all data sets.

5.2.2. Niagara-bound:

The same 0600-to-0900 data sets were used in this comparison plus four weekend data sets Niagara-bound. The mean capacity of the weekend data sets was 1659 pcphpl and the driver population factor derived from all data sets was 0.84. This factor is the same as the corresponding driver population factor Toronto-bound. Two of the weekend data sets were recorded while there was ongoing construction activity on site.

To control the effect of work activity, the analysis was repeated while excluding these two data sets. The mean capacity during the weekend (with no work activity) was 1628 pcphpl and the driver population factor calculated from the mean capacity values was 0.82. The limited number of weekend data sets (only two in this case) might have contributed in part to this lower driver population factor. Again, in both previous comparisons, t-tests showed that the mean capacity during weekends was significantly lower than that during 0600 to 0900 weekdays.

5.3. Capacity Weekdays Versus Weekends

The mean capacity on weekends at the reconstruction site was examined relevant to that during weekdays in each direction of travel. This comparison was deemed useful as it shows the effect of day of week on driver population and therefore on mean capacity at the reconstruction site. It provides an idea on how the effect of the driver population factor on a typical weekday is compared to that on weekends. The fact that this comparison is not associated with commuter traffic (reference population) will not allow an estimation of a driver population factor similar to those estimated in the previous analyses.

Data sets from both directions of travel were used. Those involved 26 data set on weekdays and 5 data sets on weekends Toronto-bound versus 9 data sets on weekdays and 4 data sets on weekends Niagara-bound.

5.3.1. Toronto-bound

Mean capacity, weather, and work activity information for all data sets used in this analysis are provided in Table 2. The morning data sets during weekdays used in this analysis included the whole duration of congestion and not only the 0600-to-0900 period.

The mean capacity during weekdays was 1894 pcphpl with a standard deviation of 109 pcphpl and a 95 percent confidence interval ranging between 1839 pcphpl and 1949 pcphpl. Expectedly, the variation in the mean capacity during weekdays was higher than its variation during AM and PM periods when treated separately in the previous analyses.

The mean capacity during weekends was considerably lower than that during weekdays as it was 1664 pcphpl with a standard deviation of 55 pcphpl. A t-test confirmed that the difference in mean capacity between weekends and weekdays was significant at the 95 % confidence level. This suggests that there was an approximate capacity reduction of 12 percent on weekends when compared to weekdays. It is expected that the driver population factor mainly lie behind this reduction in mean capacity.

In order to have a more accurate estimate of the effect of driver population, data sets from rainy days or days with work activity on site were excluded and the previous analysis was repeated. The resulting mean capacity value during weekdays and weekends were 1910 pcphpl and 1696 pcphpl respectively. A t-test confirmed that the difference in mean capacity was significant at the 95 percent confidence level. This means that there is a capacity reduction of 12.4 percent on weekends when compared with that on weekdays due to the high proportion of recreational drivers using the Skyway on weekends.

Figures 3 and 4 show the frequency histograms and the cumulative percentile distributions of capacity observations during weekdays and weekends using the 15-min capacity counts (pooled across data sets). Those observations represent data sets from dry days in the absence of work activity.

5.3.2. Niagara-bound

Similar analysis was conducted Niagara-bound using the PM peak data sets for “weekdays.” The mean capacity at this site was found to be 1962 pcphpl during weekdays versus 1659 pcphpl during weekends. A t-test confirmed that the difference in mean capacity was significant at the 95 percent confidence level. These figures suggest that mean capacity at the reconstruction site during weekends was around 15.4 percent lower than that during weekdays.

Again, data sets from rainy days or days where an active construction work was taking place at site were excluded from further analysis and the previous statistics were recalculated. The resulting mean capacity on weekdays and on weekends were found to be 1962 pcphpl and 1628 pcphpl respectively. This suggests that there is a capacity reduction of 17 percent at this site Niagara-bound mainly due to the different driver population on weekends.

This capacity reduction is higher than that observed Toronto-bound (12.4 percent). Two possible reasons may lie behind the different capacity reductions in the two directions of travel. First, all “weekdays” data sets investigated Niagara-bound involved "commuter traffic" as part of the data set. Toronto-bound, only AM data sets involved "commuter traffic." This explains the higher mean capacity during weekdays Niagara-bound as compared to Toronto-bound. The second possible reason is the higher proportion of recreational drivers Niagara-bound on weekends during the times investigated (mid-day and afternoon periods), which may explain the lower mean capacity on weekends in this direction of travel.

6. SUMMARY OF FINDINGS

This paper presented an investigation into the effect of the driver population factor on the capacity of long-term freeway reconstruction zones. Two of the four lanes of the QEW at the Burlington Bay Skyway in Ontario, Canada were closed in both directions in the spring of 1999 due to a major reconstruction work. This provided an excellent opportunity to investigate the driver population factor at freeway reconstruction sites.

Three different analyses were conducted. The first compared the mean capacity during the morning commuter peak period (0600-0900) with that during the afternoon peak period. The second compared the mean capacity of the morning commuter period with that during weekends. In the third analysis, the mean capacity during weekdays was compared with that during weekends.

Research results confirmed that the driver population factor has a significant effect on the capacity of freeway reconstruction zones. Based on a reference factor of 1.0 for commuter traffic, the study found that the driver population factor for the afternoon peak traffic was 0.93. This driver population factor was found to be around 0.84 on weekends in both directions of travel. These estimated driver population factors are considered somewhat conservative for two main reasons. The first and the most important reason is that the data used by this study did not represent the tourist season in the study area (June through August). The second important reason is that the reference population of commuter traffic spanned three hours in the morning peak. It is believed that considering a shorter period as representative to commuter traffic would mostly result in higher driver population factors. Nonetheless, those driver population factors are considered consistent with the range of the driver population adjustment factor used by the HCM procedures *(2, 3).*

When mean capacity was compared on weekdays and on weekends, different results were obtained from the two directions of travel. Toronto-bound, there was a reduction of 12.4 percent in capacity due to the high proportion of non-local drivers on weekends. This reduction was found to be more than 17 percent Niagara-bound. Two possible reasons were identified and discussed in the analysis which are thought to lie behind the different capacity reductions in the two directions of travel. Again, it is believed that those capacity reductions during weekends are conservative as the driver population is expected to have a considerably higher proportion of tourists during the summer season, which should be expected to lead to a lower value for the driver population factor. Overall, the capacity reductions found in this study should help to provide better guidance to the analyst, within the range of the driver population adjustment factor provided in the HCM procedures *(1, 2, 3)*.

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TABLE TITLES

FIGURE CAPTIONS

TABLE 1 Mean Capacity and t-test Results for 11 Weekdays with AM (0600-0900) and PM Peak Data Sets, Toronto-bound

Date	Work Activity*	Mean Capacity AM Peak (pcphpl)	Mean Capacity PM Peak (pcphpl)	PM / AM	t Stat.	t Critical**	t-test for means
16 April -99	No	1982	1829	0.922	4.421	1.745	Significant
20 April -99	No	2064	1952	0.945	2.231	1.717	Significant
21 April -99	No	2057	1937	0.941	3.426	1.705	Significant
22 April -99	No	1866	1775	0.950	3.153	1.697	Significant
23 April -99	No	2066	1856	0.898	6.488	1.705	Significant
26 April -99	Yes	1723	1634	0.947	3.513	1.705	Significant
27 April -99	No	1961	1773	0.904	7.591	1.705	Significant
28 April -99	No	1926	1824	0.947	3.130	1.761	Significant
29 April -99	No	2001	1809	0.904	9.185	1.717	Significant
30 April -99	No	2022	1811	0.895	6.094	1.685	Significant
4 May -99	No	1970	1906	0.967	1.639	1.705	Not significant
Mean		1967	1828	0.929			

* Days with "No" work activity at site were those required to cure the concrete.
** For 0.05 significance level, depending on number of observations in the data set.

TABLE 2 Mean Capacity, Weather, and Work Activity for Data Sets Used in the "Weekends versus Weekdays" Analysis

Data Set	Date	Time	Capacity (pcphpl)	Weather	Work Activity
1	13 April-99	Weekday-AM	1967	Dry	Yes
2	14 April-99	Weekday-AM	2013	Dry	Yes
3	15 April-99	Weekday-AM	2038	Dry	No
4	16 April-99	Weekday-AM	1930	Dry	No
5	20 April-99	Weekday-AM	2021	Dry	No
6	21 April-99	Weekday-AM	1998	Rainy	No
7	22 April-99	Weekday-AM	1850	Dry	No
8	23 April-99	Weekday-AM	2052	Dry	No
9	26 April-99	Weekday-AM	1657	Dry	Yes
10	27 April-99	Weekday-AM	1900	Dry	No
11	28 April-99	Weekday-AM	1879	Dry	No
12	29 April-99	Weekday-AM	1991	Dry	No
13	30 April-99	Weekday-AM	1952	Dry	No
14	3 May-99	Weekday-AM	1933	Dry	No
15	4 May-99	Weekday-AM	1952	Dry	No
16	16 April-99	Weekday-PM	1829	Dry	No
17	20 April-99	Weekday-PM	1952	Dry	No
18	21 April-99	Weekday-PM	1936	Dry	No
19	22 April-99	Weekday-PM	1774	Rainy	No
20	23 April-99	Weekday-PM	1856	Dry	No
21	26 April-99	Weekday-PM	1633	Dry	Yes
22	27 April-99	Weekday-PM	1773	Dry	No
23	28 April-99	Weekday-PM	1824	Dry	No
24	29 April-99	Weekday-PM	1809	Dry	No
25	30 April-99	Weekday-PM	1811	Dry	No
26	4 May-99	Weekday-PM	1905	Dry	No
27	17 April-99	Weekend	1745	Dry	No
28	18 April-99	Weekend	1685	Dry	No
29	24 April-99	Weekend	1634	Dry	Yes
30	25 April-99	Weekend	1598	Dry	Yes
31	2 May-99	Weekend	1659	Dry	No

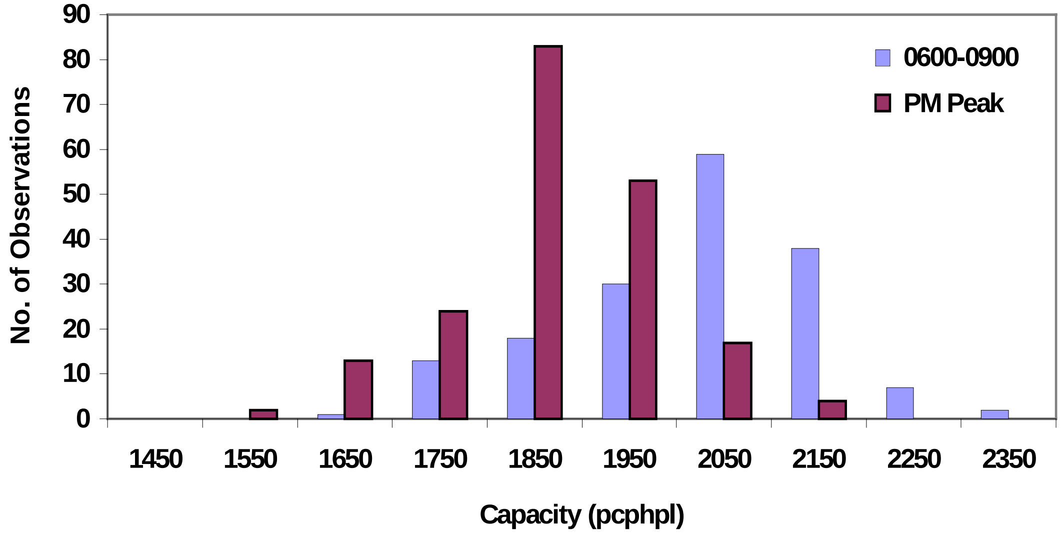

FIGURE 1 Frequency histogram for capacity observations during 0600-to-0900 period and PM peak.

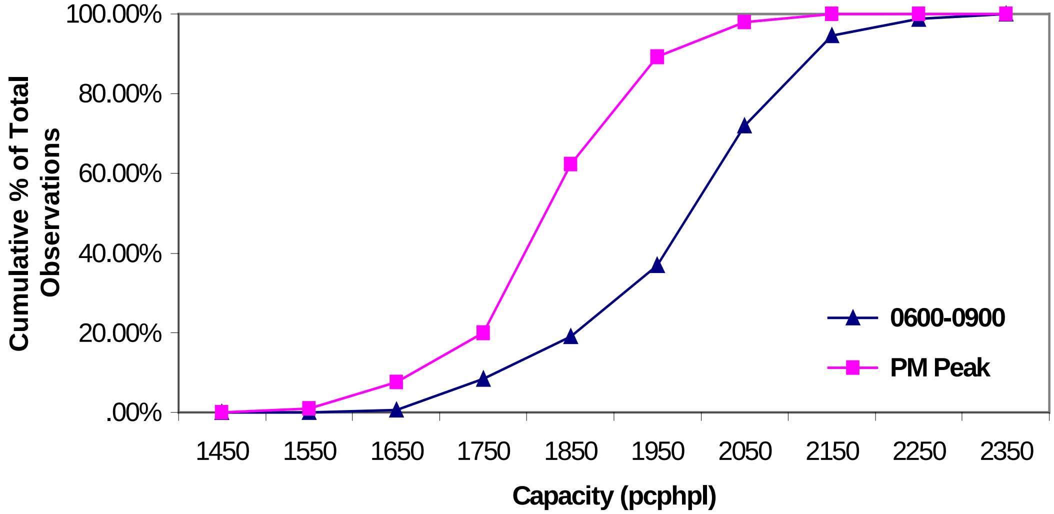

FIGURE 2 Cumulative percentile distribution for capacity observations during 0600-to-0900 period and PM peak.

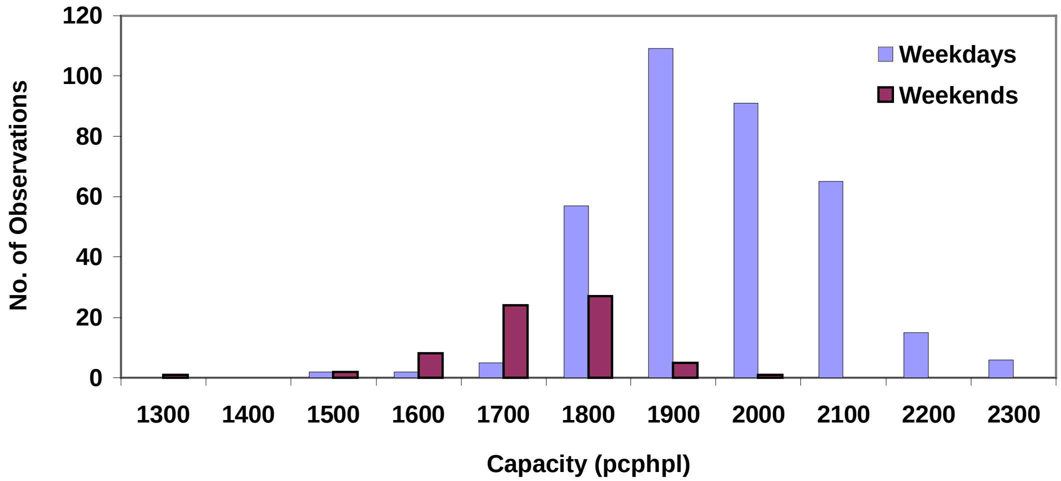

FIGURE 3 Frequency histogram for capacity observations during weekdays and weekends in the Toronto-bound.

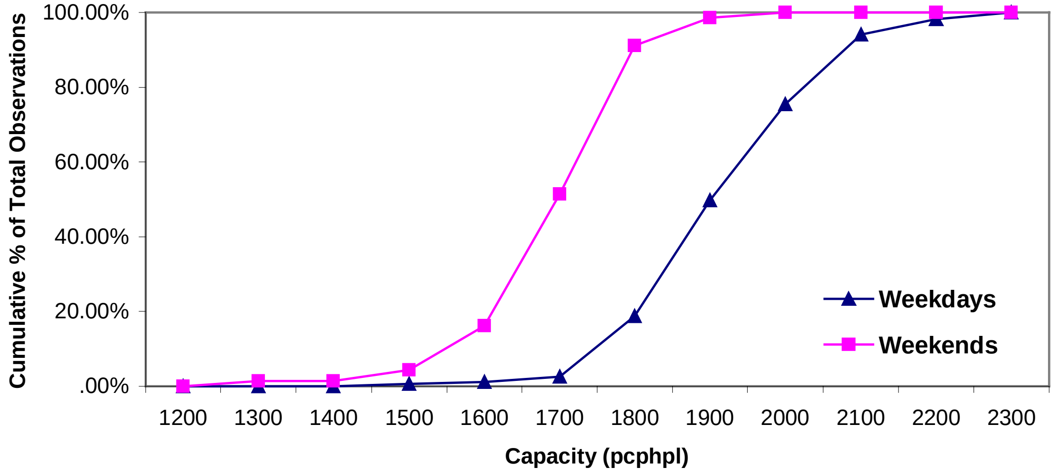

FIGURE 4 Cumulative percentile distribution for capacity observations during weekdays and weekends in the Toronto-bound.