TIME DISTRIBUTION RATIOS FOR TRAIN SERVICES

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ABSTRACT

In this paper, several time-distribution aspects are investigated. From available patronage data (Metrorail Census, Gautrain, BRT patronage, and Household Travel Surveys), ratios are determined for peak period and busiest peak hour (both AM and PM), and off-peak compared to an average workday, as well as for weekend days.

The pre-determined peak periods are often set at 06:00–09:00 and 16:00–19:00. However, it is found that the actual peak periods are often earlier. Additionally, due to daylight times, the actual peak periods in Cape Town are approximately half an hour later than in Durban.

The patronage ratio for the 3-hour peak period (and top hour) is 40% (and 20%) of the workday total for Metrorail, and 35% (and 15%) for Gautrain. The PM peaks are slightly lower than the AM peaks.

A decent off-peak service frequency will result in relatively higher off-peak ratios, at 20-25% of the workday in the 7-hour off-peak period. However, with a poor service frequency, the off-peak period is below 15%, and subsequently the peak ratios are higher.

These ratios can assist in designing public transport and train corridor operations, where the peak demand determines the required capacity and most of the operational costs, and the daily plus weekend patronage determines the passengers' revenue. A higher off-peak and weekend ratio will result in a better use of operational assets and improves the financial viability of the system.

1 INTRODUCTION

1.1 Problem statement

Transportation is derived from economic and social activities. Many of peoples' activities are fixed in time and place and therefore lead to peaks in the transportation system. In public transport (PT) systems' operational planning, peak hour patronage determines the required capacity and supply of assets (e.g. infrastructure, vehicles, staff, etc.), and therewith determines required capital costs and most of the operational costs. On the other side, the revenue of a PT system is based on all passengers during the workdays and weekends.

Therefore, the week to peak hour ratio is a measure of the financial viability of a PT system.

To cater for the daily fluctuations of passenger demand, the operator adjusts its operations with higher or lower capacity, mainly by adjusting the service frequency. This often results

in a limited service in off-peak. As a response, some off-peak passengers would try to avoid the off-peak and travel in peak periods. This increases the week to peak imbalance, adding to the inefficiency of PT systems.

1.2 Objective of this paper

The scope of this paper is to determine the time distribution, i.e. the patronage ratios per hour compared to an average workday, and its influence factors. First, an analysis is given on activities and travel behaviour (Section 2). From different data sources, the 3-hour peak periods, both AM and PM, are determined (Section 3). Then, the ratios of patronage per peak period, top peak hour, and off-peak are analysed (Section 4). Additionally, this is analysed for weekend days compared to an average workday.

These parameters can be used for operational analyses to determine a required peak service and a suitable off-peak service (Section 5). Additionally, the provided service supply would in turn determine demand, and therefore influences the peak and off-peak ratios (Section 6).

These analyses were mainly done for PT train systems, as part of the author's PhD research. In South Africa, there are two different passenger train systems, each providing different Quality Levels of Service (Onderwater, 2017):

- PRASA's Metrorail currently has a poor Level of Service, mainly due to poor maintenance over the last decades, although it attracts vast numbers of lower-income Captive passengers.
- The recently introduced Gautrain is a modern Rapid Rail system, attracting a new market of higher-income Choice Users, which previously would not have considered using 'traditional' PT.

For additional comparisons, two European train systems are included in the analyses, as well as two BRT systems and general PT travel data.

1.3 Methodology

The following data sources are used:

- The Household Travel Surveys (HTS) of the main metros (eThekwini, Johannesburg, Cape Town); other HTS did not have specific peak time data.
- For some PT systems, detailed passenger demand surveys are available, with distribution of passengers over time:
  - PRASA Rail Census in Durban (plus underlying data) and Cape Town. These data are available for some years ago (2008 to 2012). As Metrorail is currently running a sub-standard service, the relatively old data is an acceptable substitute to represent a 'normal' situation.
  - Gautrain patronage data: in Gauteng only.
  - BRT and Feeder systems: MyCiti (Cape Town) and ReaVaya (Johannesburg).
  - For additional comparisons, data from two European train systems are included: the Swiss and Dutch Railways.

However, detailed patronage data is often not publicly available as it contains sensitive information from a business point of view. Therefore, it was agreed with the PT operators and Transport Authorities not to report on the absolute patronage numbers, but merely on the time distribution: the ratio of hours and periods compared to an average workday. For the same reason, the results are rounded.

In most surveys, the time to enter the PT system was recorded. A trip starts while entering the station or the train (in theory, these times will differ by a few minutes; but this is not considered in this analysis). Train and PT commuter trips will be on average up to one hour long, prolonging the peak period with another hour as capacity should be provided until passengers alight.

If all passengers would be evenly spread over a 15- to 16-hour service period, an average hour would have some 7% of daily patronage and an average 3-hour period would consist of some 20%. Any hour or period with a substantially higher ratio could be considered peak, e.g. >15% per peak hour and >30% per peak period.

1.4 Financials

A good indication of the financial viability would be the week to peak ratio: the index of all passengers (indicating revenue) per week (= 5 workdays (5x 100%) plus the ratios of the 2 weekend days), divided by the peak hour ratio (indicating capacity and max operating costs). This week to peak ratio would vary between theoretical bands:

- With a workday peak service only, the ratio is = (5x 100, +0 +0) / 50 = 10.
- With a perfectly equally spread use, this is = (5x 100, +100 +100) / 7 = 100.

Other financial aspects would also play a role, like trip distance, average speed and round-trip time; fare level differentiation in peak, off-peak and weekend, etc., but these aspects are left outside the scope of this paper.

2 ACTIVITY PATTERNS LEAD TO TRANSPORT PEAKS

Transportation is a derived activity: a means to get involved in economic and social activities. Each person has an average standard activity pattern of going to work, school, shopping, social and/or leisure, depending on his/her position in the household. There are two groups of travel purposes (Onderwater, 2017):

- Commuter trips to work or school, mainly in peak hours. These economic activities are more-or-less fixed in time and place, and must be attended, irrespective of the transport service quality; at best one could choose another travel mode.
- Social trips, for shopping, visits or leisure, mainly in off-peak. These social activities are less fixed. If the quality of transport is not good, one can decide to travel elsewhere, at another moment, with another mode, or skip the activity.

There are five periods over the day determined: early morning, AM peak, mid-day off-peak, PM peak, and evening; with each peak consisting of a 3-hour peak period and one top peak hour, often the middle hour in the 3-hour period.

2.1 Peak periods

Trip times will depend on start- and end-times of the activities. As the most important trip purposes (work and school) have more-or-less the same peak times, there are two main peak periods per working day: the AM and PM peak.

In the AM peak, the work and school peaks mostly overlap. However, as not all schools or work places start at the same time, and some learners and workers will take a shorter or longer time to get there, peaks are spread over a wider peak period, often a 3-hour period.

In the PM peak, the schools end somewhat earlier than work. Shopping and leisure workers would see a somewhat later peak than office and industrial workers. For that reason, the PM peak would generally be wider, and the PM top peak hour somewhat lower, compared to the AM period.

2.2 Off-peak

Shopping, social and leisure trips are lower in numbers, more spread in time, and often in off-peak. The mid-day off-peak period is often quite evenly distributed. Afternoon social trips could overlap with the PM peak and would increase PM peak patronage, close to a similar level as the AM peak.

2.3 Early/late hours

In the early morning, the AM commuter peak builds up, while in the evening the PM commuter peak slows down. In these periods, shift workers in the industrial sector with different start/end times are accommodated, plus some social trips in the evening hours.

2.4 Weekends

On weekends, other trip purposes occur. On Saturdays there is hardly any education, less working, and more shopping activities. Sunday is mostly considered a rest day, with some work, shopping and more social activities. Therefore, peak times and peak ratios will be different on weekends.

3 PEAK TIMES

From the available data, the peak period times are analysed. However, many PT records and Household Travel Surveys (HTS) gave no indication of the actual peak times and/or have set them as pre-determined. For some transportation systems, detailed patronage data was available, and the actual times of the peak periods were determined. A summary of the peak times of train systems (*and other PT in italics*) is presented in Table 1 below.

The stated peak period times are somewhat later than the actual times, which could be explained by the fact that the actual peak times are determined by the start time of the trip, while the stated peak times would sometimes be covering the whole trip.

It is observed that the peak times in Cape Town are roughly half to one hour later than in Durban. This is most likely caused by the sunrise and sunset times, which in Cape Town are on average 50 minutes later than in Durban, with Gauteng some 10 minutes later than Durban. In summer and winter, the differences are somewhat different (source: www.sunrise-and-sunset.com).

Table 1: PT peak periods (rounded to half-hours)

Train systems ***And other PT***	AM peak period Stated	**AM peak period Actual**	PM peak period Stated	**PM peak period Actual**
Durban HTS 2007	*04:30 – 08:30* *	***05:00 – 08:00***	*15:30 – 18:30*	***14:30 – 17:30***
Durban Metrorail 2008	06:00 – 08:30 *	**05:00 – 08:00**	16:00 – 18:30 *	**15:00 – 18:00**
Johannesburg HTS 2013	*06:00 – 09:00*		*16:00 – 19:00*	
Gauteng Gautrain 2017	05:30 – 08:30	**05:30 – 08:30**		**15:00 – 18:00**
Johannesburg BRT 2015		***05:30 – 08:30***		***15:00 – 18:00***
Cape Town HTS 2013		***05:30 – 08:30***		
Cape Town Metrorail 2012	06:00 – 09:00		16:00 – 19:00	
Cape Town BRT 2018		***05:30 – 08:30***		***15:30 – 18:30***
Swiss Rail 2017		**06:00 – 09:00**		**16:00 – 19:00**
Dutch Rail 2017		**07:00 – 10:00**		**15:30 – 18:30**

* Not all documents use a 3-hour peak period. From the actual data, the busiest 3-hour period is determined

Another explanation could be found in the type of work. Industrial activities have fixed working times and tend to start/end earlier than office work, where the office working times are sometimes more flexible. Durban, being more of an industrial town than Cape Town, would therefore see earlier travel times.

In this respect, it is also noticed that Metrorail in Durban runs till after 23:00 to accommodate shift workers between the port and the main townships; where on other corridors and in other regions, the train service stops much earlier: often around 19:00.

On the other hand, 'institutional arrangements' such as working from 8 to 4 (in Europe 9 to 5), shops closing at 6, etc., would be the same all over the country and would level-out the differences in work and travel times.

Another assumption is that higher-income people would work and travel later than lower-income people, but this could not be validated. There is no significant difference in the peak times between Metrorail and BRT (with mostly lower-income passengers) and Gautrain (mostly higher-income).

4 PEAK RATIOS

In this section the time distribution of passenger trips is analysed and a ratio is determined for the peaks (3-hour period and top hour), off-peaks and weekend days, compared to an average workday. This is summarised in Figure 1.

4.1 Peak periods

According to the general Rail Census data for Metrorail, the pre-determined peak periods each account for 35% of the day's total. However, the actual peak times differ between corridors and the actual busiest 3-hour AM peak periods on each individual corridor are on average some 40% of the day's total (varying between 35 and 45%), with the top peak hour being 20%. The PM peak period is somewhat lower at 35% (varying between corridors). The top hour to peak period ratio is 0.50, which indicates sharp peaks.

The 3-hour AM and PM peak periods for Gautrain have 35% of the daily patronage, with the top peak hour having some 15%. The top hour to peak period ratio is below 0.45, which indicates somewhat wider peaks. Interestingly, the E-W service has a higher peak of 40% and is also more peak oriented than the N-S service.

The Airport patronage is more equally spread over the day without a real peak period. The 'busiest' 3-hour periods have some 25-30% of all passengers, and 10-12% in the busiest hour. The Gautrain Airport Service peak periods would be in line with air schedules, which have their peaks at different times (e.g. also around lunch time).

In Europe, the AM and PM 3-hour peak periods each account for some 25% of the daily patronage, with the top peak hour being 10-12% of the day's total. The top hour to peak period ratio is close to 0.40, which indicates wider peaks. However, these are network averages, where each individual corridor will have somewhat higher peaks.

4.2 Off-peak

The off-peak period is mostly 7 hours long, in between the AM and PM peak periods. As the pre-determined peak times are not always set accurately in the general Rail Census data, the presented off-peak ratios are a bit too high, as they would include a part of the actual peaks. Where the actual data were available, the lowest 7-hour off-peak period was determined which is sometimes different per corridor.

For Durban Metrorail, the 7-hour off-peak period on average has 15% of the daily patronage, however, with a wide spread per corridor of between 10 and 25%. An average off-peak hour is 2% of the day's total, although often with some fluctuation with some off-peak hours being 4-5% of the day's total. These fluctuations are often caused by the irregular supply of train services in off-peak (Section 6).

Cape Town's Metrorail off-peak period is set at 09:00 - 16:00, which would include some early PM peak period trips. The off-peak ratio is 20-25%, with an average off-peak hour of 3-4% of the day's total. If corrected for the actual peak and off-peak periods, the off-peak would be somewhat lower at 15-20%.

Gautrain's 7-hour off-peak period is 25% of the day's total, with an average off-peak hour of 3-4%, with hardly any fluctuation within off-peak hours. It is noticed that this off-peak ratio has been increasing slightly over the years, possibly due to people starting to use Gautrain for trips other than commuter trips, or experiencing an increase in traffic with unpredictable congestion in off-peaks.

In Europe, the 7-hour off-peak period is some 35% of the day's total, with an average off-peak hour of 5%, and hardly any fluctuation between off-peak hours. In Europe, there are more social activities and trips, as well as a good PT service supply in off-peak.

4.3 Early/late hours

The other periods outside the peak periods are in the early morning before the AM peak and in the evening after the PM peak. As indicated before, the pre-determined peak times are not set accurately in the general Rail Census data or HTS. Therefore, the patronage ratios for early and late hours could be somewhat too high.

The early and late hours at Metrorail Durban account for some 5-10% of the day's total. This varies between corridors, with the highest numbers more than 10%. These high ratios are mostly between the port and townships, with relatively more shift workers and longer service hours (i.e. the Umlazi – Durban – KwaMashu corridor runs from 03:30 to 23:30).

At Metrorail in Cape Town, 10% of the patronage is in the (pre-determined) early and late hours. However as mentioned before, these pre-set hours would include some peak times.

The early and late patronage at Gautrain is 5% of the day's total. This ratio has declined slightly over the years, possibly due to safety concerns while traveling to/from the stations in the evening.

In Europe, the early and late patronage is over 15% of the day's total, mainly because of the many social activities and trips, and subsequent extended train service period till after midnight. An evening hour is up to 3% of the day's total.

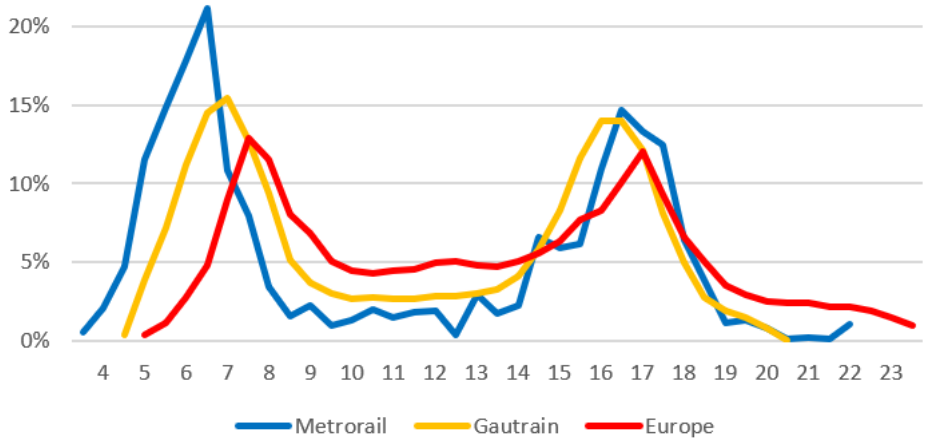

Figure 1: Workday time distribution of train patronage

4.4 Weekends

Metrorail weekend patronage is lower than workday patronage, on average at 50% on Saturdays and 30% on Sundays. On weekends, the AM peaks are somewhat similar in time, but the afternoon peaks are mostly earlier, from lunch-time onwards, and wider. The 3-hour weekend peak period ratio is somewhat lower, mostly around 25-30%, with the top peak hour around 10-15%. This indicates that the weekend patronage is more evenly spread over the day.

Gautrain's weekend day patronage is 25-30% of an average workday, almost equal for Saturdays and Sundays. The 3-hour weekend peak period ratio is some 25%, with a busiest peak hour of some 10%.

Dutch Rail has 50-60% patronage on weekend days. The reason for this difference is a more active social and leisure activity patterns. There is even a peak on Sunday evenings with many students returning to their residences.

5 PASSENGER DEMAND DETERMINES PT SUPPLY

In Table 2, the results of the hour ratio, as discussed in the previous section, is summarised per train system (*and other PT in italics*).

As a result, peak operations would differ from off-peak operations, which is discussed below.

Table 2: PT patronage ratios per period, relative to workday's total (rounded)

Train *and PT* system	AM 3-hr period	(AM top 1-hr)	off-peak 7-hr	PM 3-hr period	(PM top 1-hr)	Early + Late	Sat	Sun
Metrorail	40 %	(20 %)	15 %	35 %	(17 %)	10 %	50 %	30 %
Gautrain	35 %	(15 %)	25 %	35 %	(15 %)	5 %	30 %	25 %
Europe	25 %	(12 %)	35 %	25 %	(12 %)	15 %	60 %	50 %
BRT	*35 %*	*(15 %)*	*25 %*	*30 %*	*(12 %)*	*10 %*	*40 %*	*25 %*
All PT (HTS)	*40%*	*(20 %)*	*15 %*	*35 %*	*(15 %)*	*10 %*		

5.1 Required service supply

In demand-driven PT systems (like the minibus-taxi), passenger demand would 1-on-1 determine PT supply. If the peak hour is 20% of the day's total, and an off-peak hour is 2% (as per HTS data), supply in off-peak would also be 1 : 10 of that in peak.

However, in supply-driven PT systems (like train and BRT), the service supply is set to provide a certain minimum Quality Level of Service (QLoS), in terms of provided seating and standing quality and a minimum service frequency.

In peaks, the capacity of train and BRT systems is provided by seating and standing space, while in off-peaks preferably by seating only.

For Metrorail, the peak hour ratio is 20% of the day's total, with an off-peak hour of some 2%. Therefore, off-peak demand is about 1 : 10 of peak demand. However, service supply in off-peak would be some 1 : 5 to 1 : 4 of the peak's supply.

For Gautrain, these numbers are less imbalanced with 15% of patronage in a peak hour and 3% in an off-peak hour, which is 1 : 5; whereas the provided frequency in off-peak is 1 : 2 of the peak's frequency with the trains being half the length.

In both European train systems this is even more balanced, with 12% of patronage in peak hours and 5% in off-peak hours, which is close to 1 : 2.5. Train services hardly differ between peak and off-peak, with only a few additional peak trains and shorter trains in off-peak.

Another QLoS aspect would be to provide a clock-face service, with service frequencies being consistent throughout the day, only differentiating between peak and off-peak.

Weekend patronage is lower than workdays at 30-50% and is more evenly spread with weekend hours equally busy as workdays' off-peak hours. It could be recommended to provide a consistent service throughout the weekend, with a similar service frequency as in workdays' off-peak.

Table 3: PT service frequency (peak frequency is index 1)

Train *and PT* system	Top peak hr	Off-peak hr	Weekend hr
Metrorail	1	0.25	0.25
Gautrain	1	0.5	0.5
BRT	*1*	*0.2*	*0.2*
Minibus-taxi	*1*	*0.1*	*0.1*

In conclusion, in Table 3 above, are the (indexed) service frequencies presented for supply-driven PT systems (Metrorail, Gautrain, BRT), as well as supply-driven PT systems (minibus-taxi). This would be a first indication; local circumstances could lead to variation.

In low-utilised train corridors, with a peak frequency of say 2 trains per hour, the off-peak and weekend frequency could drop below 1 train every 1 or 2 hours. This is considered a very poor LoS, and it would not attract many passengers. Therefore, in many PT systems, a minimum LoS is determined by the Transport Authority. In metropolitan train systems, this could be set at 2 (or more) trains per off-peak hour.

5.2 Financials

As indicated, a good indication of the financial operational viability would be the week to peak ratio, defined as the index of all passengers per week (5 workdays (5x 100%) plus the ratios of 2 weekend days), divided by the peak hour ratio. For the different train systems, this week to peak ratio is:

- For Metrorail, the week to peak ratio is = (5x 100, +50 +30) / 20 = 29.
- Gautrain is more efficient with a ratio of = (5x 100, +30 +25) / 15 = 37.
- As comparison, Dutch Rail scores = (5x 100, +60 +50) / 12 = 51.

These ratios are mostly determined by the peak ratio. The lower the peak ratio, the more viable the train system can be.

However, with a minimum set service frequency in off-peak and weekends, this could reduce the financial viability of the system, as the required level of supply could be set above the available demand. To further improve viability, one could implement measures to increase the off-peak and weekend patronage by for example fare level differentiation for peak, off-peak and weekend. This would not only attract new patronage but could also persuade some peak passengers to shift to off-peak.

6 PT SUPPLY DETERMINES PASSENGER DEMAND

Not only does demand determine the service supply (Section 5), in turn the provided supply will determine passenger demand. This impact for off-peak and weekends is discussed below.

6.1 Off-peak

As mentioned in Section 4, the peak and off-peak ratios vary per corridor. On average the off-peak ratio for Metrorail is 15%. Two types of corridors show higher off-peak ratios of up to 20-25%:

- A-Corridors (e.g. to the main townships of Umlazi and KwaMashu in Durban; and Khayelitsha and Kapteinsklip in Cape Town, plus the corridors to Bellville and Simonstown) have high patronage and subsequently a high service frequency: some 60 train trips per day, often with 1 or 2 trains per off-peak hour.
- Multi-nodal corridors (e.g. the B-Corridors to the North and South Coast in Durban), attracting passengers in peak and contra-peak with different trip purposes; and a decent service frequency: 20 train trips per day, with mostly 1 train per off-peak hour.

The corridors with the lowest off-peak ratios are the corridors with the lowest service frequency: less than 15 train trips per day, often with just 1 train per 2 hours in off-peak.

This can be explained by the travel behaviour of passengers. If there is a very poor off-peak train service, people will try to travel with another mode like minibus-taxi, although these would also have a low service in off-peak and are more expensive than the train service. Alternatively, some people may choose to travel in the peak periods, even when their activity is not peak-reliant. Therefore, peak ratios will become higher.

However, if a decent off-peak service is provided, these people can choose to travel off-peak. Additional benefits are that off-peak traveling is less crowded and more comfortable, and people can plan their other daily activities more efficiently.

Even when the total number of passengers would be the same, it would be better to spread them throughout the day. With a decent off-peak service, the train service could also attract new passengers, coming from either another mode or newly induced. This would apply for both the lower-income Captive train users (shift from minibus-taxi to train) and for higher-income Choice Users (shift from car to train and new social trips). This new off-peak patronage could also result in additional peak patronage, where one part of the journey will be in the peaks. The total number of passengers would increase, without unbalancing the peak ratio.

Gautrain is a good example with a decent off-peak service, with 3 trains per off-peak hour. As a result, the off-peak ratio is higher at 25%, and the peak ratios lower at 35%, compared to other PT services. Similar can be seen with BRT services, where the off-peak ratio is 20-25%. European train systems, with a very good off-peak service, even have an off-peak ratio of 35% (although other societal influences play a role).

Similar impacts would apply to the evening service. Many train services currently stop at around 19:00 or 21:00. Late passengers (e.g. shift workers, leisure staff and social visitors) therefore need to look for other transport home or limit their activities.

This passenger market is a bit more difficult to accommodate: the numbers are low and traveling in the evenings would have some safety and security issues. Therefore, for instance Gautrain is reluctant to provide late services.

6.2 Weekends

Similar impacts can be seen for the weekends. The Metrorail corridors with the lowest weekend to workday ratio have the lowest service frequency in the weekends. If weekend trains only run once every 2 or 3 hours, passengers are not prepared to wait for this transport and might decide to use alternative modes, e.g. the minibus-taxi, even if this is more expensive; or not travel at all.

This could also partly explain the relatively low weekend ratios for Gautrain at just 25-30%. On weekends the service frequency is 2 trains per hour, compared to 3 train per hour in workdays' off-peak. This might result in many potential weekend passengers travelling by car. Therefore, Gautrain is currently planning to increase their weekend service frequencies.

6.3 Financials

If Metrorail would be able to provide a better service in off-peak and attract more off-peak passengers (i.e. see some shift from peak to off-peak), the week to peak ratio will improve:

- For Metrorail, the current week to peak ratio is = (5x 100, +50 +30) / 20 = 29.
- With relatively more off-peak patronage: = (5x 100, +50 +30) / 18 = 32

This would result in a better financial viability (without considering any other service or financial improvements).

Obviously, providing a better off-peak and weekend service would increase operational costs, but these are merely marginal cost increases, as most of the fixed operational costs and provision of assets will be determined by the peak operational capacity.

7 CONCLUSIONS AND RECOMMENDATIONS

Actual peak times are often different from the assumed and pre-determined peak times. Generally, peak times are set between 06:00 – 09:00 and 16:00 – 19:00, although the actual peak times are often half to one hour earlier, with some variation between corridors. It is recommended to be aware of this and to apply more correct peak times.

For instance, when doing travel surveys, one should start earlier to cover a greater part of the AM peak. Currently many PT surveys are done between 06:00 and 18:00. It is recommended to lengthen that period to 05:00 – 19:00, or even wider.

The east of the country (i.e. Durban) has an earlier activity pattern than the west (i.e. Cape Town), due to daylight times. Therefore, the actual peak period times are more than half an hour different.

For Metrorail, currently, top peak hours have up to 20% of workday patronage; at Gautrain this is lower at 15%. Off-peak hours are 2-3% for Metrorail and 3-4% for Gautrain. These ratios can be used to determine peak and off-peak service frequency levels.

A decent off-peak service will result in more off-peak passengers and better off-peak to peak to workday ratios. This will improve the financial efficiency of the PT system. Some improvements are planned for the Modernisation of Metrorail, and it will be interesting to see how the first Modernisation Corridor (Mamelodi – Pretoria) performs.

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