IMPLEMENTING HIGH OCCUPANCY VEHICLE LANES IN A FREEWAY NETWORK ENVIRONMENT

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ABSTRACT

The South African National Roads Agency Limited (SANRAL) is currently busy with the upgrading of the Gauteng freeway network (the Gauteng Freeway Improvement Project, or GFIP). On completion of the network the user pay principle will be implemented and open road tolling (ORT) will be introduced, i.e. electronic tolling with no physical toll booths or barriers. The GFIP project will also promote the use of high occupancy vehicles (HOV) through the implementation of HOV lanes which in the long term could perhaps evolve into public transport lanes.

High Occupancy Vehicle (HOV) Lanes are lanes on main arterial routes or freeways in a road network which are reserved for vehicles with more than one occupant. The lanes could be reserved for private vehicles in which case it is often referred to as car pool lanes, whilst bus lanes could also be classified as HOV lanes.

This paper provides an overview of the aspects which need to be considered when HOV lanes are implemented in a freeway environment.

1. INTRODUCTION

SANRAL is currently busy with the implementation of the Gauteng Freeway Improvement Project (GFIP) which includes the upgrading of most of the freeway network in Gauteng to a minimum of four traffic lanes per direction. As part of the project, SANRAL will also introduce High Occupancy (HOV) lanes. The purpose of these lanes will be to transport more people at a higher degree of travel time reliability than would have been possible if no HOV lanes are implemented, whilst providing the opportunity for public transport vehicles to make use of the freeway network.

Various aspects need to be considered to ensure the successful implementation of HOV lanes on the freeway network. The fact that the freeway network will be tolled, in essence, does not make a difference to implementation strategies of HOV lanes compared to the scenario where not tolls are levied. Tolling of the freeway does introduce an additional disincentive for single occupant vehicles to make use of the network. It may therefore encourage a shift to HOV vehicles. This paper provides an overview of the aspects which might influence the implementation and management strategies of HOV lanes on the freeway network in Gauteng.

2. HIGH OCCUPANCY VEHICLE (HOV) LANES

High occupancy vehicle lanes are lanes provided on main arterial routes in which only vehicles which comply with the specified vehicle occupancy requirement are allowed. In general, the purpose of these lanes is to transport more persons per hour per lane at a
higher speed than what would have been possible using the same infrastructure without the implementation of HOV lanes.

Various forms of HOV can be implemented. Some of the most common types are:

- **General HOV lane** – a traffic lane dedicated to vehicles which comply with the specified vehicle occupancy.
- **Car pool lanes** – HOV lanes which are restricted for use by private vehicles. This implies that public transport vehicles are not allowed to use such lanes.
- **High Occupancy Toll (HOT) Lanes** – HOV lanes which generally allow HOV vehicles to travel free of charge on the lane, but which is accessible to non HOV compliant vehicles at a specified toll. A non HOV vehicle therefore effectively buys access to the HOV lane and the advantages of the lane.

To date HOV lanes have only been implemented as a pilot project in South Africa and none of the implementation projects were sustained for a long term. Currently there are public transport lanes which have been implemented on the N2 in Cape Town and the N3 in Ethekwini (Durban). The operations of public transport lanes are comparable to that of HOV lanes as problems associated with the implementation of such lanes are also experience when HOV lanes are implemented. These include access to the lane, weaving in and out of the lane, speed differentials, vehicle eligibility etc. However, the enforcement of public transport lanes are less complicated as it is based on vehicle type and not based on the number of occupants of each vehicle.

### 3. ASPECTS TO CONSIDER WHEN IMPLEMENTING HOV LANES ON A FREEWAY NETWORK

#### 3.1 Slow lane vs. fast lane

HOV lanes should ensure that high occupancy vehicles can travel at a higher speed that what is possible on the general traffic lanes of the same facility. This is best achieved when HOV lanes are provided in the fast lane, i.e. adjacent to the median island for the following reasons:

- Only HOVs have access to the lane, which is not the case when the HOV lane is provided in the slow lane as all vehicles which need access to the road need to cross the HOV lane.
- The general traffic lane adjacent to the HOV lane would in general be the “fast lane”. Slow moving heavy vehicles should in general be driving in the left lane, furthest away from the HOV lane, which is not the case if the HOV lane is provided on the left hand side of the carriageway.
- The general principle of keep left/pass right is adhered too.
- Although weaving to and from a fast lane HOV lane could be difficult, the impact of slow vehicles weaving through a HOV lane situated on the left hand side of the carriageway is likely to negate the advantages of having an HOV lane.
- Median side HOV lanes can easier be converted to barrier separated lanes than if it is provided in the slow lane.
- Enforcement of slow lane HOV lanes is more complex, since all vehicles need to cross the slow lane when entering or exiting the facility.
3.2 Number of HOV lanes per direction

The number of HOV lanes provided is an important aspect to consider. If at all feasible, consideration should be given to dual HOV lanes, to address slower drivers delaying traffic on single HOV lanes. This aspect is especially relevant if public transport vehicles such as buses will be allowed to travel on a HOV lane and the topography of the road is rolling.

Analyses of some freeway sections in Gauteng using the Highway Traffic Model (HTM) developed by SANRAL indicated that on some road sections the average travel speed of a typical bus could be 30 to 40 km/h slower than that of passenger vehicles for more than 50% of the length of the road section analysed. Minimum speed limits might therefore have to be introduced and enforced on HOV lanes to minimise the impact of such slow moving public transport vehicles.

3.3 Control of Weaving and Access to the HOV Lane

Separating the HOV lane from the adjacent lane by means of physical barriers, painted barrier island or barrier lines can limit access to the HOV lane. Possible advantages could be improved road safety given that weaving to and from the lane is limited only to specific locations. However, in a study by Jang, Ragland and Chang (2009), no evidence could be found that restricting access to HOV lanes results in a reduction in accidents measured by percentage of collisions, collisions per km, collisions per vehicle kilometres travelled, or collision severity. In fact the statistics tend to suggest the opposite.

Figure 1: Buffer Separated HOV Facility in the USA– Merging Only Allowed at Specific Points
3.4 **Access to interchanges to and from HOV lanes**

The most effective method to address weaving for HOVs is provision of direct ramps, particularly if connected to HOV lanes on the arterial network. The costs associated with this approach, particularly if a retrofit, are very high. If direct access ramps cannot be constructed, it is recommended that appropriate signage be provided to notify HOV users of upcoming exits. In addition, consideration should be given to only allow entry and exit to the HOV lanes in certain locations.

Best practice is to provide an auxiliary lane at access points to make weaving easier. This also provides a “safety valve” where faster drivers can overtake slower ones under single HOV lane operations.

3.5 **Operational hours**

3.5.1 **Operational time strategies**

Various strategies can be followed in the operational hours of an HOV facility. Full time operation is less confusing to drivers and has lower violation rates. Peak period operation helps to minimise the “empty lane syndrome” effects and provides an opportunity for maintenance to be undertaken on other lanes during off-peak periods.

- **Continuous 24-hour use** - 24-hour use HOV lanes simplify signing and road marking plans for HOV lanes, facilitates easier enforcement, and is easier to understand by the general motorist. Examples of 24-hour use facilities in the USA include US 50 in Maryland and all Southern California HOV lanes.

The Ethekwini Roads Authority’s decision to implement the public transport lane on the N3 in Durban on a 24 hour basis to avoid the issues associated with non-compliance creep with peak period operations, was influenced by specific advice from Prof Vucan Vuchic author of *Transportation for Liveable Cities* (Vuchic, 1999).
• **Peak period only** – Peak period only facilities revert back to general purpose lanes during weekends and off-peak hours. Examples of peak period only facilities include all Northern California HOV lanes. Typical operating hours are 6 AM – 9 AM and 3 PM – 7 PM, although these could vary.

Peak period only operations could also be considered instances where limited funding is available for enforcement and where the enforcement effort required can only be sustained for shorter time periods.

• **Extended morning and afternoon** – Extended morning and afternoon operational hours generally occur with barrier separated reversible HOV lanes. Reversible HOV lanes also require a period of closure after the morning peak hours and after the evening peak hours to switch the flow from one direction to another. USA examples include I-95/I-395 in Virginia outside of Washington, D.C. and I-394 in Minneapolis, Minnesota.

3.5.2 Aspects to consider when developing a operational time strategy

When developing the operational hours of a facility, items to consider include:

• **Goals and objectives of the facility** – Some locations desire 24-hour operation of HOV lanes based on the premise that an incident could occur at any time blocking the general purpose lanes, and priority should be given to HOV vehicles. Other locations are mainly concerned with moving HOVs during peak commute hours on their facilities.

• **Type of HOV facility (exclusive/barrier separated, contra flow lanes, or concurrent flow)** – The type of facility can dictate the operational hours of the HOV lanes. Contra flow lanes generally operate with extended morning and afternoon hours and require a closure after the AM and PM peak commute hours to switch the direction of flow. Exclusive/barrier separated HOV lanes generally operate with 24-hour continuous use.

• **Congestion in the corridor** – High levels of congestion spread throughout the day requires and supports 24-hour use of an HOV facility.

• **Demand** – If high volumes are recorded on HOV lanes throughout the day, 24-hour use should be considered. Likewise, if high volumes are only recorded during peak periods, peak period only use should be implemented.

• **Enforcement** – In some instances, it may be too costly to enforce HOV lanes during off-peak times; therefore, agencies allow the lanes to become general purpose lanes during off-peak times.

3.6 HOV lane occupancy strategies

Implementing the correct HOV occupancy strategy is critical to ensure that the HOV lane operates at an acceptable level of service. The following example will illustrate this aspect:

• Based on surveys conducted by TolPlan on behalf of SANRAL, it was concluded that the number of vehicles on sections of the Ben Schoeman freeway (N1 between Pretoria and Johannesburg) with an occupancy of two or more is approximately 35% of all vehicles during the peak period.

• The peak hour flow (in the peak direction) is approximately 6200 vehicles per hour, which implies that 1735 vehicles comply with a 2+ HOV occupancy.
• If all of the HOV vehicles were to drive in the HOV lane, the average number of vehicles in the three general traffic lanes will be approximately 1490 vehicles/hour/lane (with 1735 vehicles in the HOV lane).

• This implies that the HOV lane will operate at a worse level of service than the general traffic lanes (there is more vehicles in the HOV lane than in the general traffic lanes).

In practice this scenario will not occur, since not all HOV vehicles will be driving in the HOV lane and drivers will shift to the lane which will provide the perceived best level of service. However, the perceived advantage and success of HOV will be negatively affected by the potentially high volumes of HOV vehicles in the HOV lane and the lack of a definite speed advantage of driving a high occupancy vehicle.

For the same example, if the HOV occupancy requirement is set to 3+ and 90% of these vehicles travel in the HOV lane, the HOV lane will have ±950 vehicles/hour/lane, whilst the general traffic lanes will have ±1865 vehicle/hour/lane. The general traffic lanes will therefore operate close the upper limit of level of service D, whilst the HOV lane will operate at approximately 50% of the LOS D service flow.

Any increase in traffic demand without an increase in the number of 3+ HOV vehicles, will result in the general traffic lane operating at unacceptable service levels. This might encourage a single occupant vehicle to HOV shift, but this is likely to require a significant public education campaign regarding the advantages of HOV.

The required HOV occupancy strategy therefore need to be managed carefully to ensure that that the service levels of the HOV lane is maintained without impacting negatively on the operations of the tolled general traffic lanes.

3.7 Enforcement

Enforcement is a key factor in HOV success. A lack of enforcement may result in high levels of violation and excess traffic in the HOV lane, reducing the effectiveness of the lane. The “failure” however is in the public perception and in particular the message being delivered that the responsible agency doesn’t view HOV compliance as important, thus that HOV is not important.

As a general rule, the goal should be to keep violations to less than 10%. “Manual” enforcement is most common, in which police visually check for occupancy and subsequently pull-over violators and issue a ticket. Manual enforcement has many issues including difficulty in identifying violators, safety and traffic disruption in pursuing and pulling over violators and difficulty in pursuing violators nested in a platoon of vehicles.

There have been many attempts to automate the process of enforcing vehicle occupancy. Although various video, infrared and laser technologies can provide reasonable estimates of occupants, all methods too often falsely identify violators, i.e., count only one occupant when there is more than one. In-vehicle methods, such as using the systems that detect occupancy primarily to support safe airbag deployment, may have some potential in the future but the technology does not yet appear to be sufficiently widespread.
3.7.1 Enforcement methodologies

Manual Law Enforcement is used to enforce occupancy rates along HOV facilities in the United States. The general enforcement strategy is to use special enforcement for the first six months of operation followed by routine enforcement. If occupancy violations are on the rise, the law enforcement agency should provide increased enforcement.

Some degree of manual enforcement will likely be required even if automated technology becomes available and reliable. Certainly, in the near-term, manual enforcement will be essential. The Virginia Transport Research Council (2009) compared violation rates before and after an enforcement “blitz”, and found that this type of saturation enforcement had little to no impact on violation rates. In Toronto, it was found that a program of varied frequency and level of effort was effective. Therefore, while continuous enforcement is not necessary, a regular police enforcement program is required.

The table below summarises the various existing and potential enforcement methods. The most important requirement of automatic enforcement systems is accuracy, given that in South Africa equipment used for enforcement should obtain accuracies exceeding 99%. All of the systems in the table seem to have some short coming, either with the occupants of the vehicle being able to manipulate the system or the system not being accurate enough for enforcement purposes.

Table 1: Existing and potential enforcement methods (Virginia Transport Research Council, 2009)

<table>
<thead>
<tr>
<th>Method</th>
<th>Category</th>
<th>Description / Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Police Visual Checks</td>
<td>Manual</td>
<td>• Difficult to determine occupancy (e.g. People below window level)</td>
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<tr>
<td></td>
<td></td>
<td>• Safety and traffic disruption related to stopping violators</td>
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<td></td>
<td></td>
<td>• Difficulty in stopping violators in a platoon of traffic</td>
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<tr>
<td>Toll Transponder Assisted</td>
<td>Semi-Automated</td>
<td>• Users of the HOV lane required a transponder which assists in vehicle identification</td>
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<tr>
<td></td>
<td></td>
<td>• Transponder helps to identify the violator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Determination of vehicle occupancy remains a visual assessment</td>
</tr>
<tr>
<td>Safety Belts</td>
<td>In-Vehicle</td>
<td>• Occupancy is measured by use of seat belts with existing technology in vehicles</td>
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<tr>
<td></td>
<td></td>
<td>• Subject to errors related to non-compliance with seatbelt law and use of “pseudo-occupants” placed in a seat with the seatbelt fastened.</td>
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<tr>
<td>Weight Sensors</td>
<td>In-Vehicle</td>
<td>• Measures force exerted to a seat, which allows the system to determine characteristics of the occupant (designed for airbag deployment)</td>
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<td></td>
<td></td>
<td>• Required in all new vehicles in the USA, but not internationally and not for older vehicles</td>
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<td></td>
<td></td>
<td>• Can be easily “tricked” by placing a large object on the seat</td>
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<tr>
<td>Optical Systems</td>
<td>In-Vehicle</td>
<td>• Camera located in the roof liner or on the rear-view mirror and a near-infrared illuminator extracts a human body from the raw image and an algorithm is</td>
</tr>
<tr>
<td>Method</td>
<td>Category</td>
<td>Description / Issues</td>
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<tr>
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<tr>
<td>Capacitive Sensors</td>
<td>In-Vehicle</td>
<td>• Reads the change in electromagnetic field between sensors to detect a human body which is mostly water&lt;br&gt;• Highly conductive metals and incapacitate the system&lt;br&gt;• Requires significant in-vehicle installation</td>
</tr>
<tr>
<td>Ultrasonic/Radar Sensors</td>
<td>In-Vehicle</td>
<td>• Use acoustic sound with frequencies above the audible range to detect people&lt;br&gt;• Accuracy levels appear to be acceptable for HOV monitoring purposes&lt;br&gt;• At least four sensors are required&lt;br&gt;• Some concerns about exposure levels&lt;br&gt;• Significant installation of system in-vehicle</td>
</tr>
<tr>
<td>Smart Cards and Readers</td>
<td>In-Vehicle</td>
<td>• Could use personal items such as identify cards, drivers licenses, cell phones, etc, which would be read in-vehicle then communicated with the roadside&lt;br&gt;• Vehicle occupancy would be determined by counting identities&lt;br&gt;• Requires installation of in-vehicle readers&lt;br&gt;• Potential for identity “surrogate” to be carried without the person</td>
</tr>
<tr>
<td>Video</td>
<td>Roadside</td>
<td>• Has been some testing, but generally proven inadequate for HOV monitoring&lt;br&gt;• In Southern California, false identification of violators ranged from 21% to 51%&lt;br&gt;• A system tested in Texas captured images of 97% of vehicles, but occupancy could only be measured on 85%&lt;br&gt;• Not effective in poor light</td>
</tr>
<tr>
<td>Infrared</td>
<td>Roadside</td>
<td>• Can operate in all light conditions&lt;br&gt;• Same disadvantages as video with regard to small children, sleeping adults or objects blocking view&lt;br&gt;• Some success with more advanced system such as Dtec, however, the accuracy is less than 90%.&lt;br&gt;• Minnesota field test was successful, but only for front seat occupants; testing in Leeds yielded 95% accuracy, but no independent testing has yet been completed</td>
</tr>
<tr>
<td>Passive Microwave</td>
<td>Roadside</td>
<td>• Uses systems that exploit the signature of human skin&lt;br&gt;• Can detect through plastic and thin non-conductive material&lt;br&gt;• Cost and slow image processing speed are shortcomings</td>
</tr>
</tbody>
</table>
3.7.2 Pitfalls of manual enforcement strategies

- Man-power requirements for enforcement can require a substantial amount of resources, often from agencies that are not directly linked to the transportation operations/management agencies. Police agencies that will be expected to provide enforcement need to have a role in the planning and implementation of the HOV system.

- It is difficult to see inside moving vehicles, especially if adequate enforcement observation areas are not included in the design of the facilities.

- There can be a safety risk associated with pulling vehicles over if adequate shoulder width or enforcement areas do not exist. There is also a risk of a vehicle that has been pulled over and cited, then having to enter and merge back in to the fast lane.

3.7.3 Pitfalls of automated enforcement strategies

- Automated enforcement options are limited and current methods are difficult to implement with non-barrier separated lanes and electronic toll collection where no physical toll booths are provided where the vehicle occupancy can be confirmed visually.

- One of the major pitfalls of electronic enforcement is that there is a limited ability to detect if a passenger is in the back seat of a vehicle. Enforcing 3+HOV strategies therefore become increasingly difficult.

- Problems associated with most automated systems include difficulty to detect during darkness, ability to see all seats in the vehicle, single point of monitoring versus entire network monitoring, high installation costs and the need for accuracy.

- Video detection is not as reliable as live visual inspection; although, it is useful for performance monitoring (i.e., obtaining usage/compliance data, but not reliable enough to issue citations).

- Infrared and multi-band infrared systems experience heat blocking, have problems with some types of window tinting and are expensive.

3.7.4 Impact of fines

Fines for violations appear to have little impact on violation rates. A study conducted in the U.S. showed that the highest violation rates were in regions with some of the highest penalties. In situations where there is a high probability that a fine could be reduced or negated by a judge, the effect of the penalty is reduced.

3.7.5 Lane utilization and violation rates

Tichauer (2008) evaluated the implementation of the public transport lane on the N2 in Cape Town and found that towards the end of the peak period when the number of public transport vehicles reduces and the perceived occupancy of the lane is very low, the violation rate increases significantly. Perceived under utilization of a dedicated lane therefore results in increased violation rates.
3.8 Toll and HOV

In 1998, the United States Congress established the Value Pricing Pilot Program as part of the Transportation Equity Act for the 21st Century. This program allowed for the tolling of single occupant vehicles in the HOV lanes.

When HOV lanes are underutilized, or excess capacity on HOV lanes exists, tolling or increased tolling is recommended as a strategy to increase the lane use and encourage a shift from single occupant vehicles to high occupant vehicles.

3.9 Variable HOV

Occupancy requirements varying by times of day exist in the United States. For example, The El Monte Busway in California and I-10 West and U.S. 290 lanes in Houston has variable occupancy requirements (2+ during off-peak periods and 3+ during peak hours). In Las Vegas, Nevada the U.S. 95 HOV lanes are restricted to 2+ during peak hours and do not have an occupancy requirement during off-peak periods.

It is important to note that variable occupancies can cause confusion for motorists, resulting in higher numbers of occupancy violations. If variable occupancies are to be included as part of an HOV program, it is important to clearly identify the different occupancies through proper signage, public awareness campaigns, and enforcement. The most common HOV minimum occupancies in the United States are 2+ passengers per vehicle.

In most cases variable occupancy rates are a response to the growth in demand for HOV use to the point where it approaches capacity. Good practice would be to begin HOV operations with a concise and easily enforced single occupancy level, then introduce the more complicated variable occupancy levels strategy later, as required. If and when variable occupancy levels are introduced, it would be preferable to introduce just two occupancy levels – one for off peak and one for peak conditions.

3.10 Ramping up of HOV

Vehicle occupancy requirements are a function of congestion and balancing the “empty lane syndrome”. In many situations, the lane is opened as a 2+ lane, and is maintained as such as long as a free-flow state (say, LOS C) can be maintained. Once the HOV lane begins to reach congestion, the occupancy can be increased to 3+. The predominant vehicle occupancy requirement is 2+. Increasing the requirement to 3+ could reduce HOV lane usage significantly and in fact may have a negative effect, both in terms of public perception and existing 2+ HOVs reverting to SOV if it is too inconvenient to find a third occupant.

The Wisconsin DOT developed specific strategies that could be followed to “ramp up” HOV lanes over time based on actual versus posted operating speeds of the facilities. These strategies are now the national standard in the USA for consideration of modifying the requirements of a HOV facility. The following minimum speed requirements apply for HOV facilities in the United States:

- Minimum operating speeds are 70 km/h for an HOV facility with 80 km/h or greater speed limit.
- Minimum operating speed should not be greater than 15 km/h below the posted speed, if the posted speed is 80 km/h or less.
An HOV facility is considered to be “degraded” if it fails to maintain the minimum average operating speed 90 percent of the time over a consecutive 180-day period during the morning or evening weekday peak hour periods (or both time periods, if it is a reversible facility).

If a HOV facility is considered to be “degraded”, there are several different ways to bring the facility back to optimal operating requirements. This includes increasing the minimum occupancy requirements, evaluating the number of HOT vehicles on the system, or evaluating the number of low emission vehicles on the system. After evaluating the number of different types of vehicles utilizing the system, appropriate measures can be taken to modify the requirements for utilizing the facility (i.e. limit the number of passes given to HOT or low emission vehicles, increase the minimum occupancy requirements for the facility or increase the toll rates.)

3.11 Travel Demand Management and HOV

3.11.1 HOV implemented in support of Travel Demand Management (TDM)

In Australia and the USA the most successful HOV implementations have been part of a broader transportation strategy, allowing other programs to benefit from the HOV lanes. HOV lanes are often used to help promote other TDM initiatives. In particular, a ridesharing program can be promoted as a faster method of transport when HOV lanes are in place. It is really about HOV lanes supporting other initiatives rather TDM supporting the HOV lanes, e.g. HOV lanes can be implemented to encourage a shift to ride sharing, corporate lift clubs and public transport initiatives as opposed to such initiative being implemented to sustain HOV facilities.

HOV lane “success” has more to do with appropriate utilisation, adequate enforcement and connectivity of a broader HOV network than TDM. Certainly, TDM programs will help to achieve the ideal utilisation levels, but vehicle occupancy requirements can also be used to more effectively manage utilisation. The only TDM initiative that is regularly noted as having a strong connection to HOV is ridesharing with support for establishment of employer-based ridesharing being the most effective.

Other TDM measures that have been implemented successfully in conjunction with HOV on freeways include:

- Park and ride facilities for mass transit as well as car pools and van pools. (park and ride, park and pool, transit stations, intermodal facilities, and bus stops/shelters)
- Guaranteed ride home programs for motorists that carpool or vanpool
- Telecommuting and alternate work schedules
- Growth management, land use policies, and zoning
- Parking management
- Trip reduction ordinances
- Traveller information systems
3.11.2 Park and ride

It is recommended that park and ride facilities are located in close proximity to HOV lanes. These park and ride facilities can include a combination of functions such as automobile to transit/bus or automobile to carpool/vanpool.

Houston has 28 park and ride/park and pool lots located near HOV lanes. These park and ride/park and pool lots contain over 30,000 parking spaces. The major park and ride/park and pool lots have direct access ramps to the HOV lanes. Transportation officials noted that the use of the parking lots and HOV lanes increased after construction of the direct access ramps.

There are over 300 park and ride facilities located within the Washington, D.C./Baltimore, Maryland metropolitan areas. These facilities contain over 135,000 parking spaces. Approximately 1/3 of the facilities contain commuter bus service, 1/3 of the facilities have rail service, and 90 percent contain free parking. Many of the facilities are located in close proximity to HOV lanes.

As indicated above, “Park and ride” facilities are typically constructed to support public transport. HOV lanes should generally function as major bus routes and therefore “park and ride” should support the public transport function. There are several international examples where “park and ride” facilities are promoted in conjunction with ridesharing and HOV lanes, but in almost all (no exceptions could be found) they are tied to public transport functions.

It would seem that the requirements to support public transport would be greater than those for ridesharing. A drop-off/pick-up area would be the most critical element of the “park and ride” site associated with ridesharing and HOV. It should be noted that informal ridesharing meeting locations are often noted away from the formal “park and ride” sites. These generally are not planned or formal, and likely emerge due as a location with inexpensive parking or are a well-known landmark with easy pick-up and drop-off.

3.11.3 Jurisdictional control over TDM and HOV

Lack of jurisdictional coordination is one of the key elements of HOV lane failure. The HOV management strategy could influence the level of service on the HOV and general traffic lanes, whilst public transport vehicles might need exclusive use of the HOV lane. Congestion charging might also be implemented as a tool to manage the demand. Therefore, although not directly related to TDM initiatives, it is critical that there be an authority that has some jurisdiction or at least influence over public transport, highway operations, tolling, enforcement, “park and ride” operation and ridesharing in order to successfully coordinate the HOV implementation.

3.12 Public awareness campaigns

An important aspect of the implementation of HOV lanes is the education of the users of the facility. Public awareness campaigns need to take place throughout the life of the project, beginning long before the project is in the design phase. In the beginning, the public and decision makers should be introduced to the concept and be provided with general information on the HOV lanes. As the project moves towards completion, additional public awareness campaigns should be created to educate the public on how the HOV lanes operate and what the restrictions are for the facilities. This can be accomplished through public service announcements, brochures, and through the media.
Throughout the life of the facilities, public awareness campaigns should continue, as needed, to address issues (such as an increase in violations) as they arise with the HOV lanes.

4. CONCLUSIONS

The implementation of HOV lanes on a freeway network requires the evaluation of a number of aspects which might influence the success of such lanes. These include infrastructure requirements, operational and enforcement strategies as well as efficient public awareness campaigns. Enforcement strategies relating to compliance to the occupancy requirements, maintaining relatively high speeds on the HOV lane as well as implementing the correct occupancy eligibility strategy seems to be key to the success of implementing HOV lanes in a freeway network.

5. ACKNOWLEDGEMENT

The content of this paper is based on project reports submitted to SANRAL for the development of an HOV implementation strategy for the GFIP project in Gauteng, South Africa. A team led by Mr Stephen Power of Aurecon’s Christchurch office in New Zealand, as well as a team led by Mr Pierre Pretorius of Kimley Horn in Arizona, USA, provided input to these project reports. The content of this paper is therefore based on the combined effort of the team of Aurecon South Africa, Aurecon Asia Pacific, Kimley Horn as well as the officials of SANRAL Northern Region.

6. REFERENCES


