Priority lanes

Introduction

Road space does not have to be allocated to all vehicles for all of the time. Determining which modes of transport are most important, and then reprioritising road space to cater for these modes, can produce a more efficient transport network overall.

Objective

The objective of priority lanes is to enable the efficient movement of people and goods by using the road space available to move the optimal mix of vehicles and modes.

Benefits

Increase efficient road use	As roads become more congested, more road space has been traditionally provided to meet this demand by adding extra lanes or building new roads. If existing road lanes are managed to give priority to cyclists, high-occupancy vehicles or freight vehicles, this enables more people and goods to move faster. Additionally, if modal shift occurs from general vehicles with only one occupant to these high-occupancy vehicles, then the overall amount of traffic will also reduce.
Encouraging mode shift	Reallocating road space so cyclists and/or high-occupancy vehicles can move more people faster than the general traffic will make these high-occupancy modes more attractive to those driving in the general traffic lanes.
Reduced fuel use	Fuel consumption will be reduced for those vehicles using the priority lane, as travel speeds will increase and overall travel time will reduce.
Environmental impacts	Enabling traffic to flow freely, especially trucks and buses, will reduce the amount of harmful emissions and carbon dioxide.
Economic development	Freight vehicles will experience greater reliability and decreased journey times when using priority lanes, thus improving the economic viability of businesses moving freight. Additionally, reliable public transport and cycle priority will allow workers to arrive at work less stressed and therefore more productive.

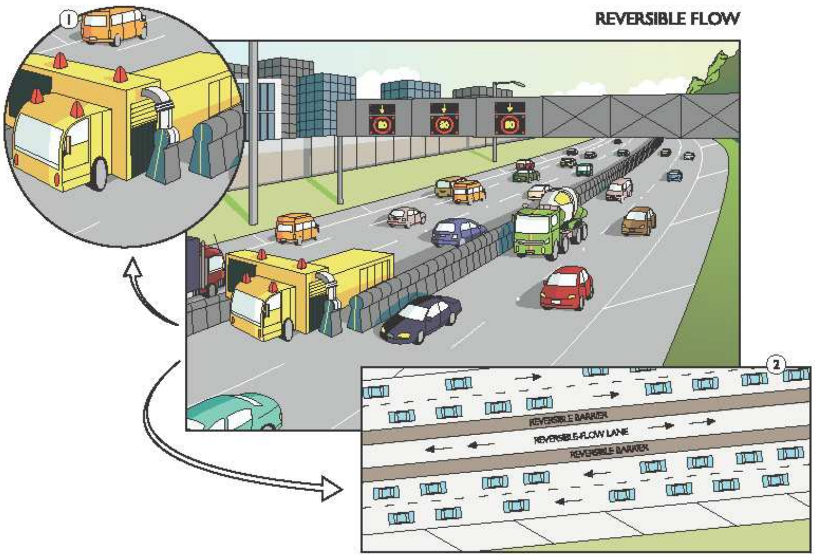
Tools for priority lanes

General requirements	Priority lane facilities tend to be most effective for: • major urban areas • large employment centres • heavily congested roads • arterial roads with the capacity to reprioritise existing road space or to add additional space • areas where soft measures, such as advertising initiatives to encourage mode shift and rideshare programmes, are also being implemented.
Road environment	Priority lanes work best where they: • are long enough to provide significant time savings • do not have turning vehicles using the lane that adversely delay the priority vehicles • do not create excessive delays for the vehicles that cannot use the priority lane • do no have adjacent on-street parking.
Evaluation	In order to maximise the effectiveness of priority lanes, evaluations of the operation should be carried out at regular periods following implementation.
Locations suitable for priority lanes	Given the above conditions, the regions that should consider implementing priority lanes are Auckland, Canterbury and Wellington. In some of the smaller urban areas where significant congestion occurs on key arterials that are also bus routes, priority lanes could also be worth investigating.
Regional agreement	Agreement is needed between all relevant parties that the project will fit in with the regional land transport strategy.
Additional processes	Proposals should be based on robust modelling, cost-benefit analysis and effective public engagement.
Lane conversion	This involves converting a general traffic lane for priority use only. It offers a means of providing a priority lane without the need for potentially expensive and disruptive construction to add an extra lane. Note: under current legislation, a HOT (high-occupancy toll) lane cannot be provided in this way.
Shoulder conversion	Part-time shoulder conversion involves designating the shoulder as a priority lane during certain hours. It reverts back to emergency parking use at all other times. Maintenance implications should be taken into account when considering shoulder conversion – they may require widening, remarking or strengthening as some shoulders are not designed to support regular traffic.

Tools for priority lanes continued

Tidal or reversible flow

Tidal flow (also known as reversible flow) involves one or more barrier-separated lane(s), usually operating in one direction in the morning peak and the opposite direction in the evening peak in line with the peak flow direction.

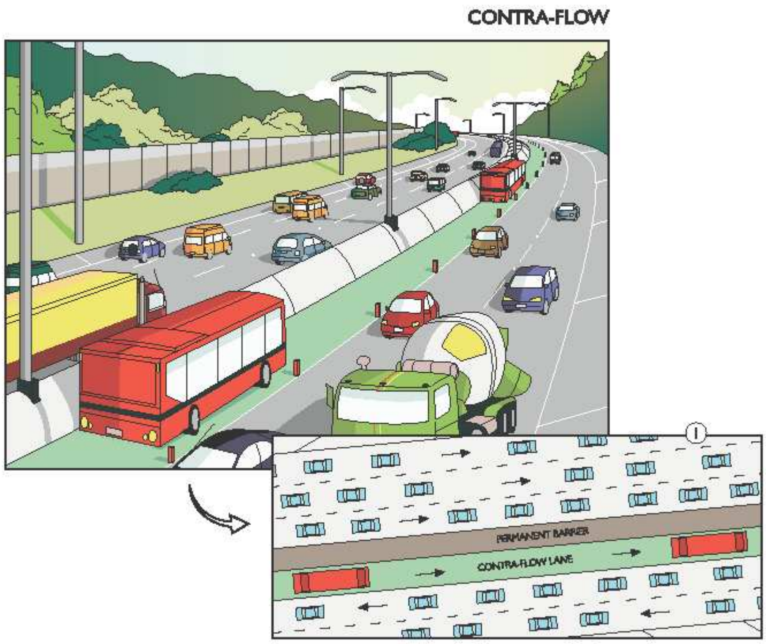


Two-way flow

Two-way flow has one or more lanes operating in both directions of travel during portions of the day.

Contra flow

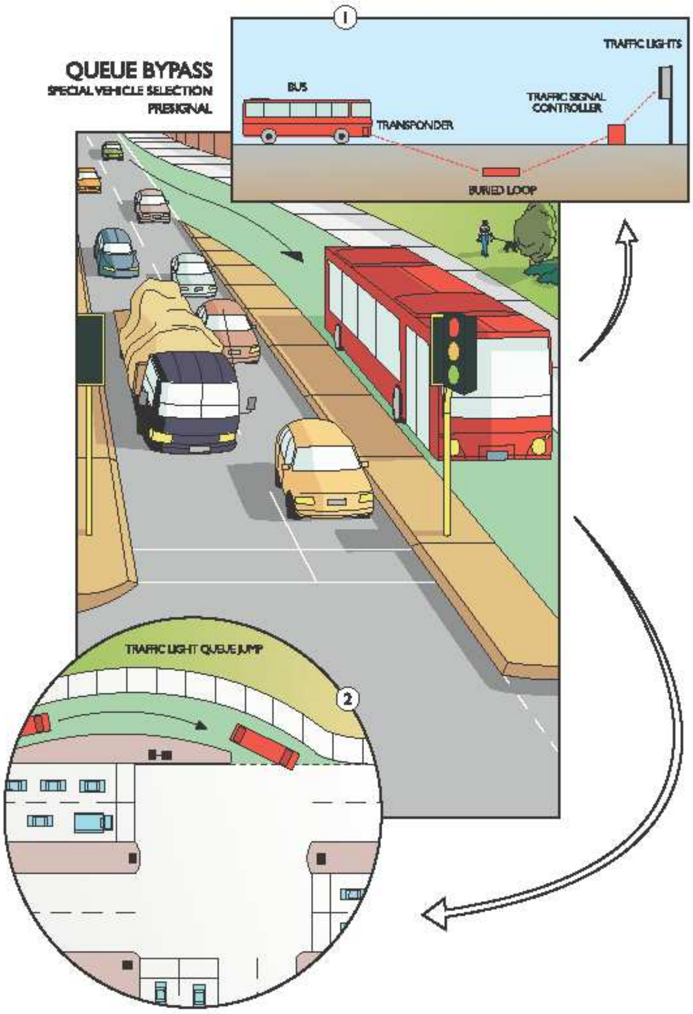
Contra flow means usually one lane is borrowed from the off-peak direction mixed-flow lanes. The direction of travel is usually against the mixed-flow traffic on a one-way road. They can be separated using physical means such as bollards, or visual means such as dynamic road marking.



Tools for priority lanes continued

Queue bypasses

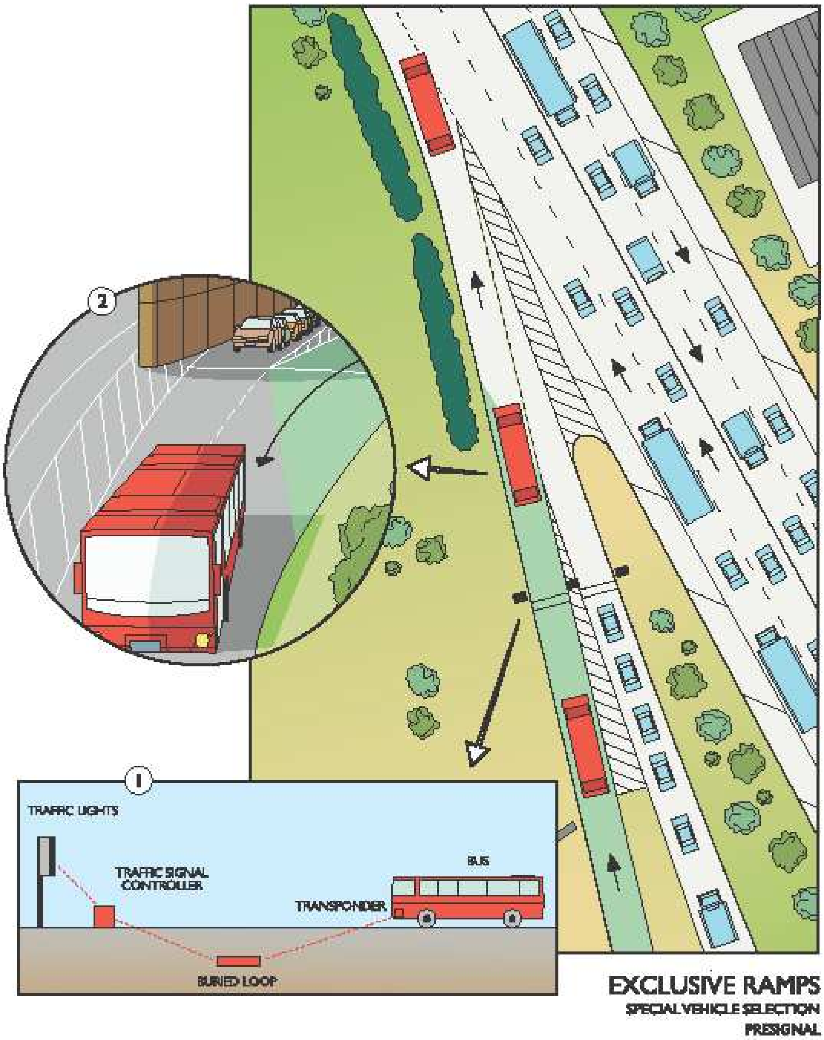
Queue bypasses are usually one or more short-distance lanes where the priority lane enters a highway or intersection separately from general traffic and bypasses queuing traffic.



Tools for priority lanes continued

Exclusive ramps

On limited access roads, some on- and off-ramps may be dedicated to priority vehicles. These can save users additional travel time, aid enforcement and incident handling, and improve the overall operating efficiency of the associated priority lane. These can either be controlled (signalised) or uncontrolled.



Tools for priority lanes continued

Part-time operation	Using part-time operation (usually peak periods) can avoid the perception that the priority lane is underused during low-volume periods. The lane can revert to: • another type of priority lane that allows extra vehicles • a general vehicle lane • a parking lane • a road shoulder for emergency parking only.
Safety issues with part-time operation	There can be safety issues with part-time use if drivers are confused as to when the lane can be used. This can be overcome by traffic management systems and appropriate signage.
Managed lanes	Managed lanes refer to priority lanes that are dynamically managed using intelligent transport systems. Changes are made to the time the priority lane is operating, or the type of priority lane that is operating, depending on traffic volumes or vehicle speeds. Additionally, the position and number of lanes can be changed dynamically using lights to define the lane lines.
Public information	Getting the right information out to the public in a timely manner is critical for the successful introduction of priority lanes. A communications strategy is required so the public is consulted, informed and kept up to date as an investigation and implementation project progresses. See the communication and marketing topic for more information on how this can be done.
Queue length	Where high-occupancy lanes rejoin the main carriageway, queues will form. Queue lengths can be assessed both in the high-occupancy lane and in the main traffic stream. Queues may also increase in the non-priority traffic lanes if the means by which prioritised traffic rejoins the highway is vehicle detection based (eg traffic signals).
Average speeds	Capacity issues can also be identified by monitoring travel speeds and travel time reliability. For example, the Washington State Department of Transportation uses as a guide that vehicles should maintain an average speed of 45 miles per hour (72km/h) or greater at least 90 percent of the time. This is within peak hours and is measured for a consecutive six-month period.
Types of priority lanes	The types of priority lane are listed below: • cycle lanes • bus lanes • heavy vehicle (freight) lanes (see the freight topic) • no car lanes • HOV (high-occupancy vehicle) lanes • HOT (high-occupancy toll) lanes.

Tools for priority lanes continued

Hierarchy

The types of priority lane can be considered hierarchical because each lane type has more vehicle types added to it than the previous type. This is shown in table below.

Lane type	**Cycles**	**Motorcycles**	**Buses**	**Heavy vehicles**	**Vans**	**HOVs**	**SOVs**
Cycle	✓	1					
Bus	2	2	✓				
Heavy vehicle	1	2	✓	✓			
No car	1	✓	✓	✓	✓		
HOV	2	✓	✓	3	3	✓	
HOT	1	✓	✓	3,4	3,4	✓	4

1 In rare cases, depending on location

2 In most cases

3 Depending on number of occupants

4 Depending on paying toll

Cycle Lane in Denver, USA

Tools for priority lanes continued

Cycle lanes	The principle behind providing cycle lanes is to encourage more cycling and therefore reduce the use of cars. In most cases current cycle volumes will not be enough to justify the inclusion of a cycle lane. However, it is likely that there is a latent demand for cycling as the current traffic environment is perceived as unsafe. Note: unlike other priority lanes, cycle lanes should also be considered in non-congested conditions on the grounds of travel demand management (TDM) and safety.
Road space for cycle lanes	Cycle lanes need 1.5–2.5m of road space. They should be terminated at traffic signals in the form of an advanced stop line or advanced stop box.
Network	It is desirable to have a network of cycling facilities, including on-road cycle lanes, to get the biggest benefit from providing cycle lanes. Hence, in isolation, it may seem like some proposed cycle lanes will be underused. However, as other planned network connections are developed, the relevance and use of the cycle lane will increase.
Low use conditions	Where cycling, parking and traffic volumes are light, then it can be possible to combine a cycle lane and parking lane. However, care must be taken so drivers can clearly see when a cyclist might be trying to use the general traffic lane to pass a parked vehicle.
Related TDM measures	See the cycling topic for more information on cycle lanes and other cycling initiatives.

Contra flow cycle lane in Boulder, USA

Tools for priority lanes continued

Bus lanes	The principal reason for providing bus lanes is to enable vehicles containing a high number of passengers a faster journey than vehicles with low passenger numbers, particularly cars. Bus lanes provide a number of benefits to bus services: • greater timetable reliability • higher patronage due to faster journeys than driving • services are more viable as patronage grows.
Road space for bus lanes	Unless designated as 'bus only', bus lanes can also be used by cyclists and motorcyclists. Therefore, unless it is unlikely that cyclists will be present in the bus lane, such as on motorways, bus lanes should be wide enough so buses can pass slower cyclists and cyclists can pass stopped buses. This requires a lane width up to 4.5m.
Network	Generally, bus lanes should be part of an identified bus transport network designed to provide at least adequate public transport access to both residential and employment areas.
Bus volumes and options	Bus volumes should be high enough to justify delaying general traffic if road space is reprioritised. The table below shows what should be considered depending on bus volumes.

If bus volumes are …	**then** …
high most of the time	install full-time bus lane
high during certain times	install part-time bus lane
moderate to low	consider other priority lane type
low	bus lane not appropriate

Support for bus lane	Regional councils and bus operators must be in full support of any bus lane scheme to ensure its success. Support should also, where practical, involve bus infrastructure improvements and vehicle investment to give added value to the priority network.
Related TDM measures	See the public transport topic for more information on bus lanes and other bus-related initiatives.

Tools for priority lanes continued

Heavy vehicle lanes	Heavy vehicles have a gross vehicle mass (GVM) of 3.5 tonnes or more. The principal reasons for heavy vehicle lanes are: • to assist the economic development of a region by improving the movement of freight • to remove heavy vehicles from the general traffic where road geometry makes them slower than the general traffic • to remove heavy vehicles from the general traffic where their size and the road geometry creates particularly unsafe conditions.
Heavy vs other freight vehicles	Although all freight vehicles should be targeted to improve freight movement, heavy vehicles are specifically targeted as they: • have operational characteristics that means separating them from the general traffic will also assist general traffic movements • are not likely to claim they are carrying freight – even when they are not – just to use the lane • include buses, so they can also benefit from the lane.
Road space	Heavy vehicle lanes will generally be for heavy vehicles only so that a lane width of 3.3m or more will be required.
Network	Generally, heavy vehicle lanes should be part of an identified freight network designed to move freight efficiently within an urban area. However, where speed or safety is an issue, short heavy vehicle lanes, including bypass lanes, can be used.
Not appropriate for urban arterials	An urban bus route that requires buses to stop and pick up passengers within the lane cannot be combined with a heavy vehicle lane. Additionally, urban arterials will have cyclists who will not be able to mix with heavy vehicles in a priority lane.
General requirements	Roads should do one of the following: • carry above-average numbers of heavy vehicles • provide access to a major freight hub • have national significance for freight movements.

Tools for priority lanes continued

No-car lanes

The principal reason for no-car lanes is to discourage car use.

Vehicles that are not cars

Vehicles that are not considered to be cars include:

- bicycles
- motorcycles
- vans
- buses
- heavy vehicles.

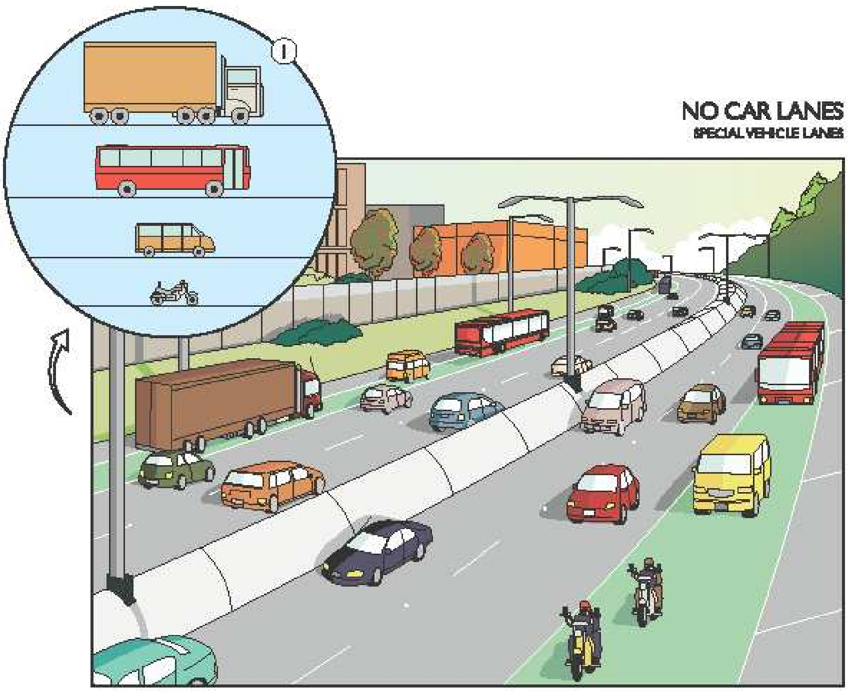
General requirements

A viable alternative public transport option should exist, to cater for motorists wanting to transfer from cars.

Complementary TDM strategy

As this lane has a pure TDM function, a complementary TDM strategy is required. This is to ensure the public can clearly understand the reason for the implementation of a no-car lane.

The illustration below shows how a no-car lane may look.



Tools for priority lanes continued

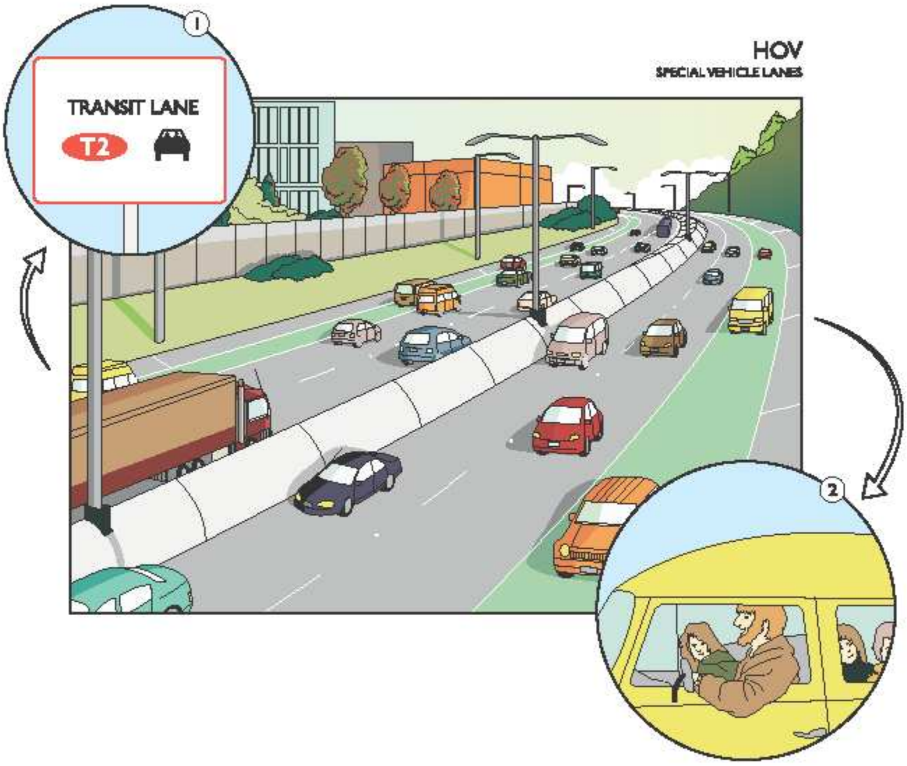
High-occupancy vehicle (HOV) lanes

HOV lanes are reserved for vehicles with a minimum number of occupants and may also allow motorcyclists, cyclists and taxis.

The principal reason for HOV lanes is to encourage car sharing.

HOV lanes reduce the number of single-occupancy vehicle trips on the network, therefore reducing congestion and emissions.

The illustration below shows how an HOV lane may look.



Strategies for under-used HOV lanes

A number of options can be considered in order to utilise any spare priority lane capacity, eg:

- alter hours of operation – eg reduce to peak hour operation only and allow general traffic use during off-peak periods
- allow use by other categories of vehicles – eg permit use by heavy vehicles if operational characteristics of the lanes will allow this
- lower vehicle occupancy requirements – eg if the lane is 3+, vehicles with 2+ may also be allowed
- allow use by designated public transport vehicles – public transport vehicles that do not meet the occupancy levels, eg if they are returning to the terminal, could be allowed to use the spare capacity in the HOV lane.

Complementary TDM strategy

As this lane has a pure TDM function, a complementary TDM strategy is required. This is to ensure the public can clearly understand the reason for the implementation of a HOV lane. Additionally, other TDM initiatives, such as car-sharing programmes, will benefit from the implementation of HOV lanes.

Tools for priority lanes continued

High-occupancy toll (HOT) lanes	The principal reason for implementing high-occupancy toll (HOT) lanes is to provide HOV lanes and also to ensure the capacity of the lane is used to its maximum. HOT lanes operate as HOV but also allow single-occupant vehicles to use the lane, provided they pay a fee. The fees charged can rise and fall to keep the HOT lane flowing smoothly, while HOV users and buses enjoy the journey time benefits at no charge. By varying the fee over the congested period, HOT lanes can be well utilised and provide more congestion relief than a HOV lane with unused capacity.
Legal requirement	HOT lanes can only be implemented where existing legislation allows. Under current legislation in New Zealand, the provision of a HOT lane will often require a new lane to be built.
Optimal pricing	The pricing structure is crucial in determining the extent of the benefits. If the price is too low, there is a danger that the lane will experience congestion. If the fee is set too high, the lane may be underused, as motorists are put off by the high cost, resulting in continued congestion in the non-restricted lanes. It is important that HOT lane facilities be managed in favour of optimising HOV use. Traffic management and automated fee collection technologies are highly desirable for enforcement of the HOT lane.
Complementary TDM strategy	As this lane has a pure TDM function, a complementary TDM strategy is required. This is to ensure the public can clearly understand the reason for the implementation of a HOV lane. Additionally, other TDM initiatives, such as car-sharing programmes, will benefit from and provide benefits for the implementation of HOV lanes.

Where to apply these tools

	Centre	Urban	Suburban	Rural
Lane conversion	★★★	★★	★★	★
Shoulder conversion	★★★	★★	★★	–
Tidal flow lane	★★★	★★	★★	–
Two-way flow lane	★★★	★★	★★	★
Contra flow lane	★★★	★★	★★	–
Queue bypass	★★★	★★	★★	★
Exclusive ramps	★★★	★★	★★	★★
Part-time lane changes	★★★	★★	★★	★
Managed lanes	★★★	★★	★★	★
Public information systems	★★★	★★★	★★★	★★
Cycle lanes	★★★	★★★	★★★	★★
Bus lanes	★★★	★★★	★★★	★
Heavy vehicle lanes	★★★	★★★	★★	★★
No car lanes	★★★	★★	★★	–
HOT lanes	★★★	★★	★★	★
HOV lanes	★★★	★★	★★	★

This table is an indication only. Individual projects should consider the unique features of the local environment.

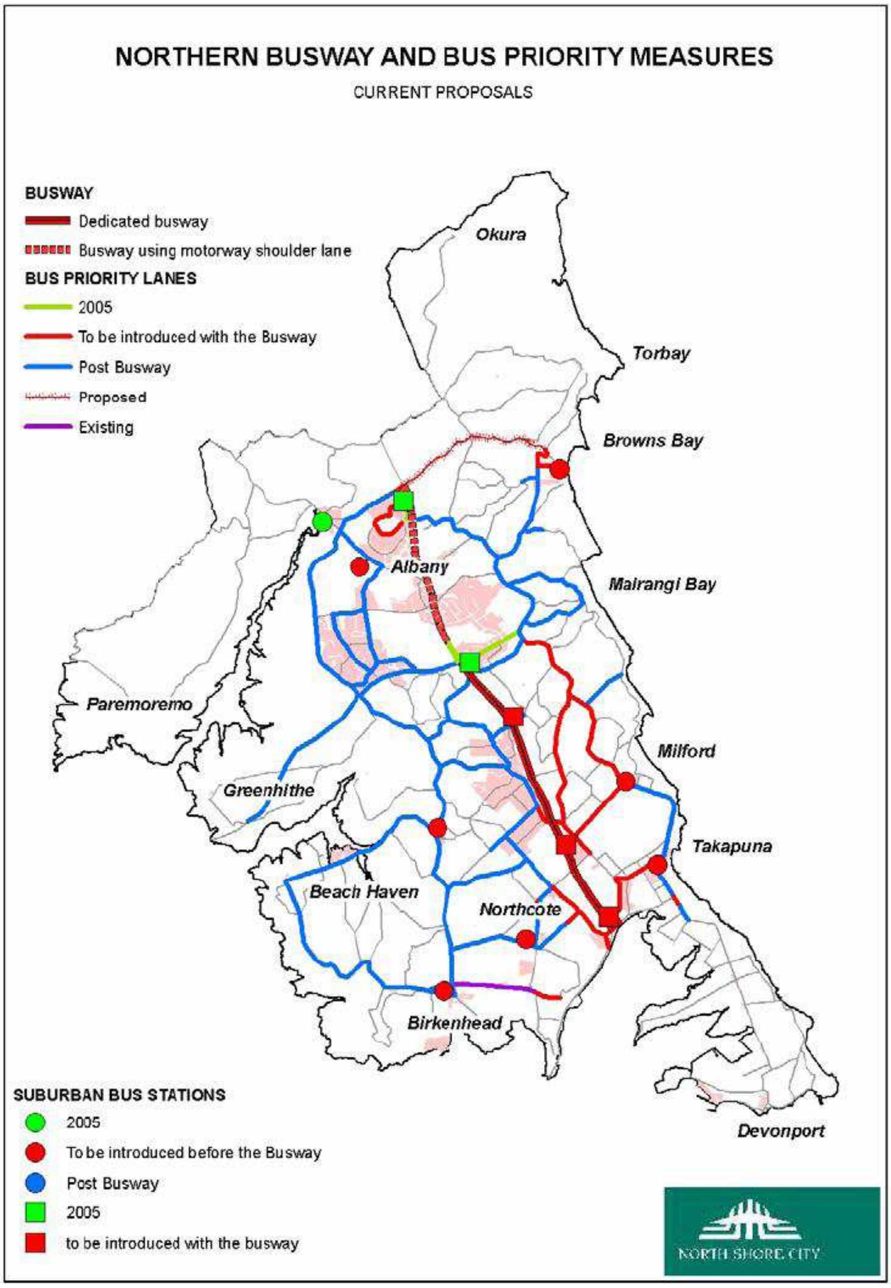
Case study – North Shore City Transport Strategy 2006

Introduction

The North Shore City Council Transport Strategy 2006 (part C) identifies key arterial corridors where managed lanes would provide the most benefit to various user groups such as buses, motorcycles, cyclists and high-occupancy vehicles.

Proposals identified

This map illustrates proposed managed lanes through North Shore City and how such measures complement the NZTA's Northern Busway, which opened in 2007.

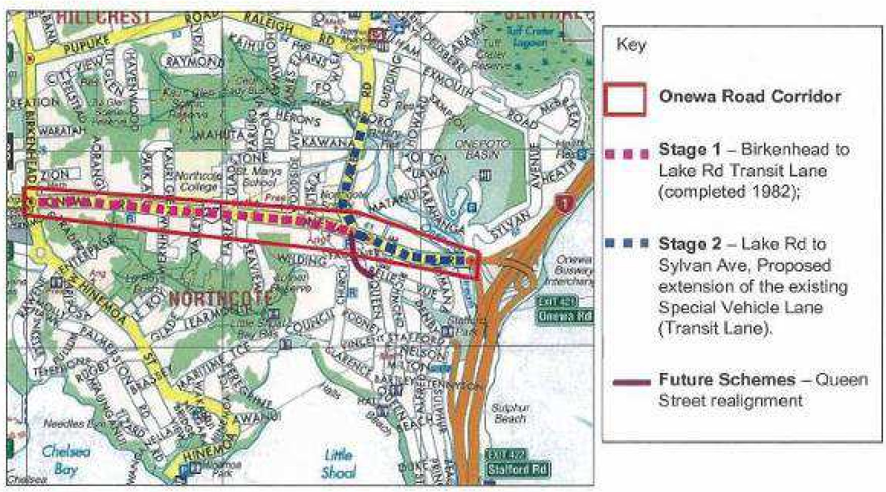


Improvements can relieve identified congestion

Many of the corridors identified for improvements have been and are currently heavily congested during morning peak periods (North Shore City Council Transport Strategy Map C2). Monitoring of existing facilities by North Shore City Council demonstrates that such improvements can significantly relieve congestion on key transport corridors, by providing an alternative means of travel to residents.

Case study – Onewa Road transit lane (T3), Auckland

Introduction	This description of the Onewa Road transit lane has been taken from a report for the NZTA by Maunsell AECOM titled 'New Zealand managed lanes (workstream 1): a review of existing and proposed practices'.
History	The Onewa Road transit lane became the country's first bus and HOV lane due to the passing of the Urban Transport Act 1980 and the new urban transport responsibilities conferred on the then Auckland Regional Authority (ARA).
Purpose	The ARA was keen to develop low cost traffic management schemes that maximised existing road space by encouraging HOVs and public transport.
Selection	Onewa Road was selected as a potential candidate due to its high morning peak congestion and relatively high existing travel on buses.
Working party	The establishment of a joint working party with members from ARA, Ministry of Transport, the then Ministry of Works & Development, Northcote Borough Council and Birkenhead City Council and Birkenhead Transport Ltd was established to oversee the development of the scheme.
Trial and extension	The implementation of a priority lane on Onewa Road was initially introduced as a six-month trial. Based on its success the lane has been extended from its original operation to State Highway 1 (Traffic Design Group, 1991). After assuming responsibility for the full length of Onewa Road in 1989, the North Shore City Council between 1991 and 2007 undertook a number of further investigations into the extension of the existing transit lane to State Highway 1. The proposed extension of the Onewa Road transit lane to State Highway 1 will mean priority users of the lane will be able to gain significant benefits on this corridor. Currently, HOVs and buses must merge with general traffic downstream, thus eroding some of the benefits gained upstream.
Transit lane development	This figure illustrates the development of Stage I and II phases of the Onewa Road transit lane.



Source: Maunsell AECOM (2006)

Case study – Onewa Road transit lane (T3), Auckland continued

Public education and promotion

The Council has undertaken a significant amount of public education and promotion of its managed lanes including the Onewa Road transit lane. It uses a variety of media to inform people about the function of the lanes and operational hours.

Enforcement and monitoring

In addition the success of the lane has been dependent on enforcement and monitoring for compliance which has enabled the Council to maintain the efficient operation of the lane and advocate for the lane's extension.

Success referenced

The success of the lane's functionality and ability to serve is demonstrated in the schemes ongoing reference by other RCAs within New Zealand and internationally (Faber Maunsell, 2007).

Signage

Information and enforcement signage are posted along the corridor to provide visual reference to motorists of a managed lane ahead, the permitted users of the lane and operational times.

Signage and enforcement officers

This image shows the signage and enforcement officers on Onewa Road.

Non-compliance dropped with enforcement

Monitoring of the lane showed that non-compliance users dramatically dropped when regular enforcement was introduced, with the average number of complying cars more than doubling from around 150 per day in January 2002 to 314 per day in March 2003 (Murray, 2003). Non-complying vehicles average less than 5 percent of all transit lane users.

Improved travel time

The removal of non-complying vehicles from the lane enhanced free flow on the lane for permitted users, reducing travel time between Birkenhead Ave and Lake Road to between four and seven minutes during peak hours. This is a significant travel time saving when compared to travel times in the general traffic lane which take between 30 and 40 minutes to cover the same section of road (Murray, 2003).

Enforcement is key

Enforcement is a key management tool for effective operation of the lane and wider network. Enforcement has not only reduced non-compliance but has also given impetus to increased use of the lane.

Case study – Onewa Road transit lane (T3), Auckland continued

Enforcement increased carrying capacity	Evidence indicates that the carrying capacity on Onewa Road increased in both the transit lane and the general traffic lane, while the transit lane patronage on buses dramatically increased, as did the HOVs' use of the lane. As such, the transit lane carried 68 percent of all commuters in 27 percent of all vehicles on Onewa Road (Murray, 2003).
Funding for enforcement and education	Funding to provide an appropriate level of enforcement is necessary throughout the whole life of a scheme. Included within this budget is the need for ongoing public education and promotion material to gently remind users of the lane intent and penalty for non-compliance.
Layout	The Onewa Road transit lane developed from the removal of the kerbside parking and remarking of road space to accommodate two eastbound lanes.
Operation	The Onewa Road transit lane has been operational since 1982 during the morning peak period and operates over a 2.5km kerbside (or nearside) stretch of the Onewa Road corridor.
Example of success	The implementation of the T3 lane is a prime example of how such a transit lane can successfully operate in an urban environment where peak hour flows are reaching capacity.
Needs to be long enough	As previous research indicates, the length of the lanes needs to be long enough within the context of the network to ensure sufficient journey time savings and encourage modal shift and carpooling (Maunsell AECOM, 2008).
Location	This nearside transit (T3) lane currently operates from Birkenhead Road to Lake Road, with current works underway to extend the operation of this lane from Lake Road to State Highway 1 interchange.
Travel time savings	Current travel times in the Onewa Road transit lane have been reduced by 80 percent – saving car poolers and bus commuters half an hour travel time.
Bus patronage	Bus services are keeping to timetables, with patronage rising by 25 percent (North Shore City Council, 2004).
Lane width	North Shore City Council (NSCC) has established guidelines on the width of transit lanes within its city. A copy of this can be requested from the Council. However, the existing transit lane on Onewa Road is not up to these standards, operating with a kerbside lane width of 3.5m, while the offside general traffic lanes are 3m wide. This standard differs from NSCC's new standard for special vehicle lanes of 4.2m to 4.5m wide. Typically, 4.2m wide lanes have been adopted for new schemes within NSCC for bus and transit lanes.

Case study – Onewa Road transit lane (T3), Auckland continued

Standard for special lanes	The standards for special vehicle lanes have been used for the design of the pavement markings and signage of transit lanes within NSCC. These were prepared for the Auckland Bus Priority Initiatives Steering Group which included: • Auckland Regional Council • Auckland City Council • Manukau City Council • North Shore City Council • Waitakere City Council • New Zealand Police • Transit New Zealand (now the NZTA) • Bus and Coach Association • Land Transport New Zealand (now the NZTA).
Permitted vehicles	The kerbside lane was marked and signed as a T3 lane reserved for use by buses, HOV3+, emergency vehicles and cyclists during peak periods. Historically, the permitted users of the Onewa Road transit lane are buses, high-occupancy vehicles (specifically as a T3 lane, meaning that cars with three or more persons per vehicle can use the lane), motorcycles and cyclists. In earlier 2000s taxis were also permitted users of the T3 lane.
Vehicle occupancies	The T3 lane carries approximately two thirds of the inbound commuters on Onewa Road – 28 percent of the total high-occupancy vehicles and 40 percent in buses – HOV account for only 27 percent of all vehicles on Onewa Road. This gives an average of 2.7 persons per vehicle across both lanes as opposed to Auckland's overall average of 1.1 persons per vehicle (Murray, 2003).
Enforcement	Manual enforcement by the Council's Wardens is via detection of a moving violation using videoed images where determination of non-compliance is detected. The owner of the vehicle is fined $150. Infrared detection technologies are being developed to detect the number of people travelling in each vehicle in managed lanes.
Road environment	Side friction along Onewa Road corridor is limited with the majority of adjoining lane use activities being residential, and side road junctions well spaced. Minor access roads are uncontrolled, while Lake Road, Birkenhead Road/Glenfield Road and Sylvan Ave are signalised.

Case study – Esplanade bus and taxi lane, Petone, Lower Hutt

Introduction

A bus lane was established on The Esplanade, in Petone, Hutt City, in 1995. The bus lane became operational in August 2004.

Site location

The Esplanade runs along the Petone foreshore from Seaview Road to the Petone interchange in Hutt City. It is the main link for commuters to State Highway 2, travelling from Eastbourne and Wainuiomata to Wellington City.

A number of side streets along the eastbound side of The Esplanade provide access to and from Jackson Street, the main shopping street in Petone.

This figure shows a map of the area.

Road type and layout

The Esplanade is a major district distributor with a 50km/h speed limit, with one lane available for eastbound traffic, and several turning bays for left-turning traffic, interspersed with kerbside parking. The westbound lane is a single traffic lane until just prior to the Victoria Street intersection, where a second lane (central lane) is utilised as a special vehicle lane.

Investigation

The establishment of a bus lane on The Esplanade arose out of work undertaken by Hutt City Council officers from as early as 1992 (Hutt City Council, 1992). Investigations identified that significant queuing delays on Hutt Road and The Esplanade were due to insufficient capacity on State Highway 2 to absorb entering traffic flows. Travel time delays can be as high as 20 minutes. Investigations indicated that the provision of a bus lane along The Esplanade would save up to five minutes or more on average journey times along The Esplanade for buses bypassing queued vehicles.

Case study – Esplanade bus and taxi lane, Petone, Lower Hutt continued

Objectives

The implementation of The Esplanade bus lane sought to achieve the following objectives:

- reduce the time for bus travel to Wellington
- meet the objectives of Wellington Regional Council and Hutt City Council to promote greater use of public transport
- help reduce CO_2 and other greenhouse gas emissions.

Cost

The estimated cost of implementing this bus lane within the existing road reserve in 1993/4 was $15,000. This cost was for a stage one and two approach to the implementation of a bus lane as follows:

- stage 1 – a special vehicle lane for buses, taxis and right-turning vehicles to be introduced on The Esplanade between Buick Street and Armidale Street
- stage 2 – extension of the bus lane from Armidale Street to Hutt Road depending on the monitoring and operation of stage 1.

Assessed benefits

An assessment of the lane's benefits was identified as $10,000 per year to buses and passengers while the non-benefits to motorists were estimated at $1500 per year.

Delays to buses targeted

However, the initial implementation of the bus lane was deferred pending further detailed monitoring of delays to bus traffic over an eight-week period on The Esplanade. This found the average delay in peak hours was 7.2 minutes.

The delays to buses, airport shuttle services and taxis were such that a separate bus lane was warranted during the morning peak period of 7am to 9am, with provision also available for right-turning vehicles only into side streets.

Stages

In August 1994, stage one of the bus lane was implemented, followed by stage two in 1995.

Enforcement

As early as 1992, council officers acknowledged that enforcement of the lane was likely to be necessary to ensure compliance due to the relatively low number of buses.

Prior to 2005, this lane operated without pavement colouring or enforcement by council officers. This is in part due to difficulties experienced across the country in obtaining council officers' warrants for enforcement of managed lanes. Hutt City Council relies on the Police to monitor compliance.

Performance

The lane has performed well over the last 13 years, with improved travel times for buses and taxis.

Non-compliance

Periodical non-compliance issues arising from the illegal use of the lane varies. Surveys in 2005 (MWH Wellington, 2005), arising from public complaints of illegal vehicle use, indicate that 13 percent of vehicles using the lane are non-compliant, compared with an average of 11 percent using unpainted bus lanes in Auckland.

Case study – Esplanade bus and taxi lane, Petone, Lower Hutt continued

Pavement colouring and extra signage needed to reduce non-compliance

Recommendations of the 2005 survey concluded that colouring the Esplanade bus and taxi lane would reduce the level of non-compliance. The council recommended that green pavement colouring be installed on the lane and signage identifying lane users and operational times be upgraded. Pavement colouring, surfacing and signage follow the Auckland Bus Priority Initiatives Steering Group guidelines.

Design

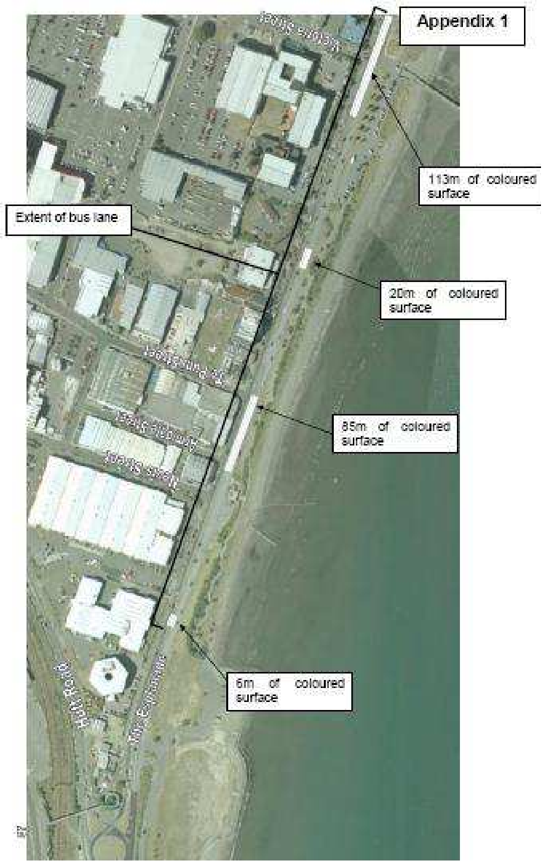
The carriageway width on The Esplanade between Victoria Street and Te Puni Street comprises 2.2m parking with one 4.3m wide lane in the eastbound direction separated by a 3.7m wide median from the two westbound lanes. In the westbound direction, the right lane (special vehicle lane) is 2.9m, and the left lane is 3.6m with a 0.6m shoulder.

Operation

The establishment of this westbound bus and taxi lane operates in the right lane between 7am and 9am Monday to Friday for use by buses, taxis and right-turning traffic only.

Location

The lane is approximately 700m long, starting just prior to the signalised pedestrian crossing east of the Victoria Street intersection, and ending 200m from the roundabout at Petone interchange. Two side streets, Victoria Street and Te Puni Street, can be accessed over this length by right-turning traffic only, as can be seen in this figure (MWH Wellington, 2005).



References

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Case study – HOV lanes, Houston, US

Description

Houston, Texas has 105 miles of HOV lanes. They can be used by buses, carpools, vanpools and motorcycles.

Performance

They move between 96 percent and 228 percent more people per lane than general access lanes, and account for 5 percent of the travel by the workforce.

Tidal flow

On weekday mornings, HOV lane traffic moves toward the city (inbound) and on weekday afternoons and evenings, HOV lane traffic moves in the opposite direction (outbound).

Occupancy requirements

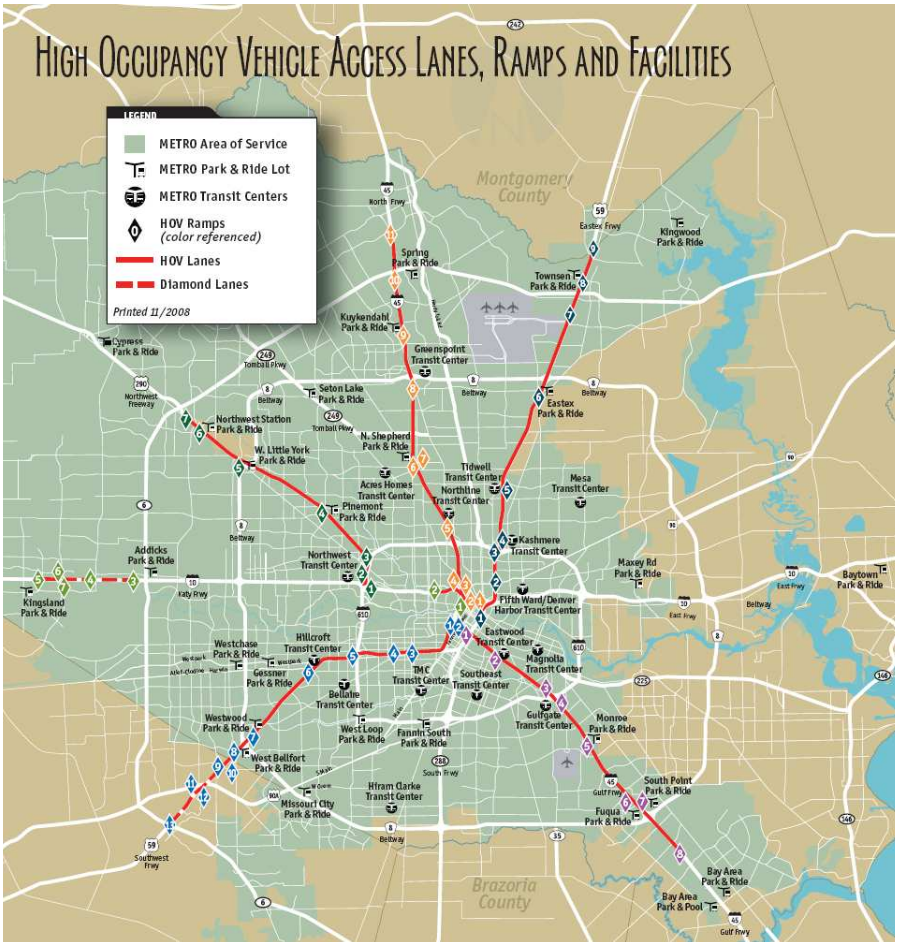
On the Katy HOV lane, minimum occupancy increases to three persons from 6:45am to 8am and 5pm to 6pm on weekdays. A minimum of three passengers per vehicle also is required on the Northwest HOV lane from 6:45am to 8am. At other times, the minimum occupancy requirement is two.

HOT access

QuickRide, a pilot programme started in January 1998, allows carpools with two people per vehicle to use the Katy HOV during weekday peak periods for a fee. QuickRide commuters are tracked and billed using a transponder attached to their windshields.

Map of HOV network

This map shows the extensive HOV lane, Park & Ride and associated transit centre network in the Houston METRO area.



Case study – HOV lane, Leeds, UK

Introduction

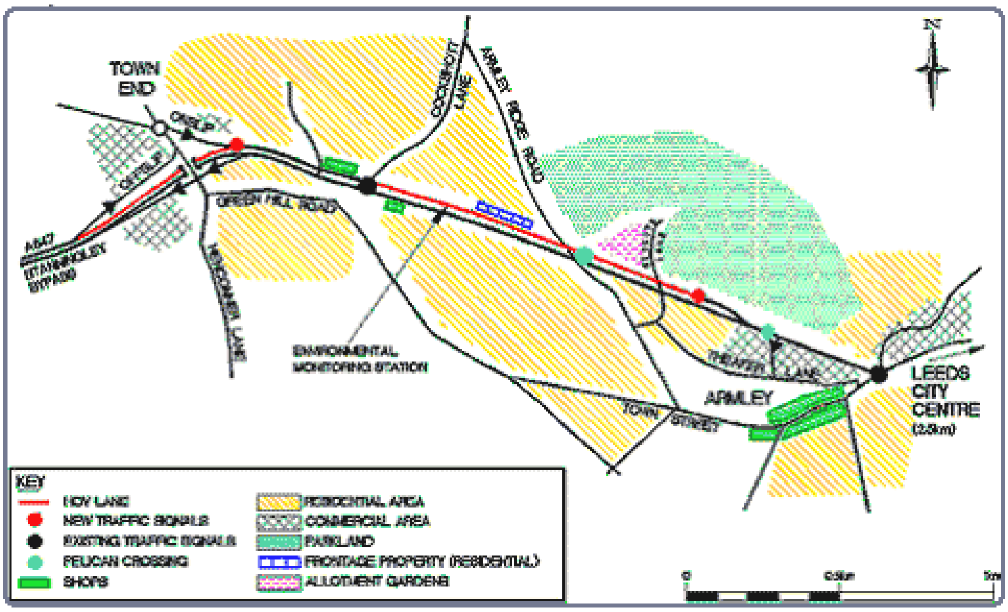
The following information is taken from the Department for Transport's 'Bus Priority: The Way Ahead' initiative (case study on HOV Lanes) (DfT, 2004), Leeds City Council's HOV Fact Sheet (2002) and ICARO (1999) and can be found at: www.konsult.leeds.ac.uk/private/level2/instruments/instrument029/l2_029c.htm

Context

In 1998, the UK's first HOV lane was introduced on the A647 Stanningley Road and Stanningley bypass, which form the principal radial route to the west of Leeds city centre and are part of the route linking Leeds and Bradford (see the figures below). The scheme was experimental at first but has become permanent. The road experienced severe congestion and there were few public transport priority measures.

The £450,000 HOV lane scheme covers a total of 1.5km, in two sections, over 2.0km of dual carriageway. They operate in the morning (7–10am) and evening (4–7pm) peak periods on Mondays to Fridays. Only buses, coaches, other vehicles carrying two or more people, motorcycles and pedal cycles are allowed on these lanes.

Location



Location of the A647 HOV scheme in Leeds

Illustration of HOV lane

Case study – HOV lane, Leeds, UK continued

Illustration of HOV signage

Pre-HOV lane conditions

Prior to implementation of the HOV lane, 30 percent of cars on the A647 (Stanningley Road) had two or more occupants. With the inclusion of buses, one-third of all vehicles carried two-thirds of all people (2225 of 3645) in the morning peak period. The journey that in free flow conditions could take about 3 minutes regularly took over 10 minutes. Therefore, a priority lane such as an HOV lane would benefit the majority of the travellers in terms of journey times. However, single-occupant drivers (total of 1420) would be expected to suffer some additional delay due to capacity reduction caused by the HOV lane.

Traffic surveys

Surveys took place in May and June 1997 and then after the HOV lanes were implemented in May and June 1999. Data collected included:

- traffic counts in the morning and evening peak periods
- vehicle occupancy
- journey times
- queue lengths
- personal injury accidents.

Additional surveys

In addition to this, public attitudes and driver behaviour information were analysed from household and roadside interview surveys. Air quality was monitored by an environmental monitoring station on the route.

Results summary

It was reported that, after an initial reduction, traffic levels gradually increased to their previous levels with about 5 percent increase in HOVs. This might indicate that there was an exchange of HOV and non-HOV traffic between the A647 and parallel routes. On the other hand, 26 percent of HOV interviewees were apparently new carpools and cited the HOV lane as the reason for forming them. Relatively low support amongst HOV drivers (about 66 percent) might have resulted from the fact that these drivers also made peak period journeys as non-HOV drivers. When doing so, they did not benefit from the journey time savings observed.

Case study – HOV lane, Leeds, UK continued

Table of results This table shows the results form the Leeds HOV lane study.

Indicators	**Results**
Morning peak traffic flows (07–10am)	• Immediately after opening 20 percent traffic reduction (due to driver avoidance) • By late 1999, traffic flows returned to prior levels • Slight increase in scheduled bus services, motorcyclists and cyclists
Evening peak traffic flows (4–7pm)	• 10 percent reduction at scheme inception • By June 1999, traffic flows returned to the 'before' level • By June 2002, traffic flow increased by a further 14 percent
Occupancy and mode share	• Between 1997 and 1999, HOVs in morning period increased by 5 percent • Average car occupancy rose gradually from 1.35 in May 1997 to 1.43 by June 1999 and 1.51 in 2002 • Bus patronage increased by 1 percent in the first year of operation (there are indications of further growth in bus patronage since 1998 but no real data available to analyse)
Journey times	• Morning peak journey time savings for buses and other HOVs were 4 minutes (comparing 1997 with 1999 data) • Reduction of 1½ minutes in non-HOV journey times in the same period
Queue lengths	• By giving priority to HOVs, two queues of equal length have been transformed into a long queue in the non-HOV lane and a short queue in the HOV lane • No evidence of non-HOV queues extending
Accidents	• Reduction of 30 percent in casualties in a period of three years after scheme implementation
Enforcement	• Lane violation levels were low in the months following implementation • In 2002, lane violation levels were still less than 6 percent despite a relaxation of enforcement
Public attitudes	• An increase from 55 percent to only 66 percent in HOV drivers' support for HOV lane (results from roadside interviews in 1999)
Air quality	• Little change in air quality • A noticeable noise reduction coinciding with both the morning and evening periods of HOV lane operation

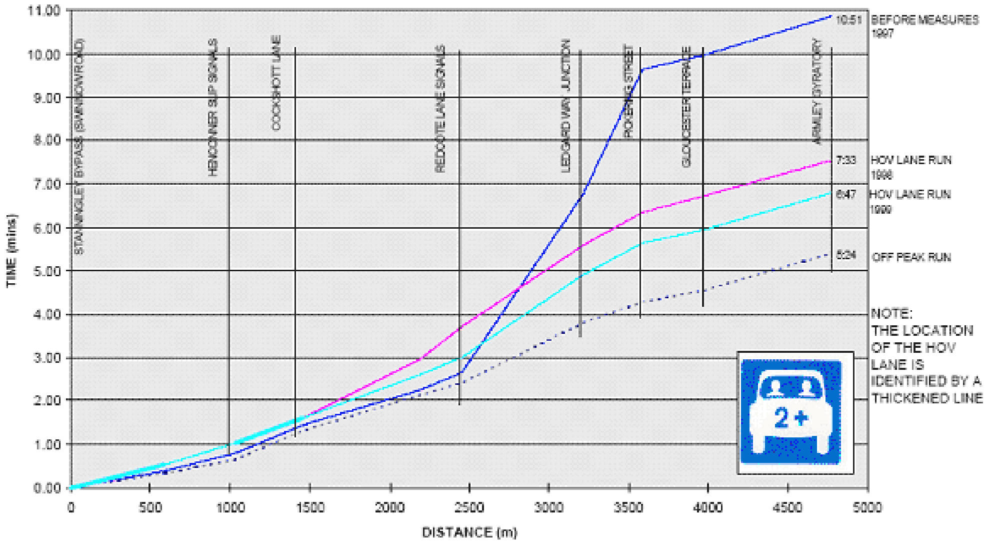
Case study – HOV lane, Leeds, UK continued

Summary of HOV lane journey time changes

In 1998, morning peak HOV journey time savings were 3½ minutes for a 5km trip from the Leeds Outer Ring Road to the Inner Ring Road. In 1999, the time saving increased to just over 4 minutes. The figure also indicates that the journey time savings starts after the first 2.5-3km and changes sharply from time lost to time gained.

HOV lane journey time changes

This illustration shows the changes in the A647 AM peak HOV lane journey times.

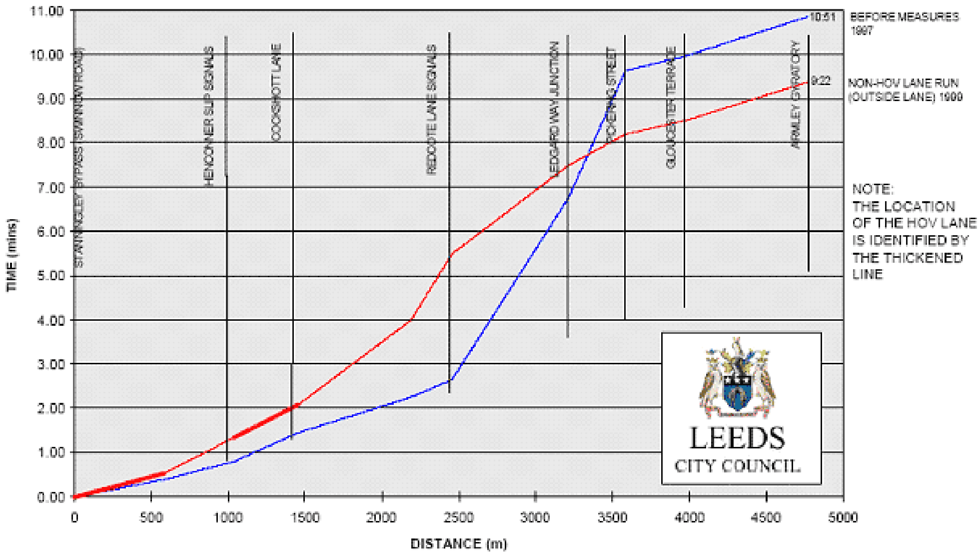


Summary of non-HOV lane journey time changes

In 1999, overall inbound non-HOV journey times did not increase and were a total of 1½ minutes shorter in the morning peak for the same 5km long journey.

Non-HOV lane journey time changes

This figure shows the A647 AM peak non-HOV lane journey times.



Case study – Edinburgh Greenways, Scotland

Background	Greenways are bus priority lanes, introduced as part of Edinburgh's transport strategy, Moving Forward. A Traffic Regulation Order bans general traffic from Greenways, restricting access to buses, taxis and cycles. Greenways differ from conventional bus priority lanes in a number of ways: • Lanes are surfaced in green tarmac. • Red lines prohibit stopping, replacing traditional yellow lines. • A dedicated team of wardens strictly enforces Greenways. • Side streets off Greenways have traffic calming measures. • There is better provision for cyclists and pedestrians. • Greenways operate throughout the working day. • There are better bus shelters with comprehensive bus information.
Problems	Greenways are an attempt to remedy a problem with traditional bus lanes. Although many were very successful, buses still suffered congestion at a number of junctions that lacked yellow lines to prevent on-street parking.
Objectives	The Greenways scheme aimed to: • improve bus reliability • reduce bus journey times • reduce car traffic growth by the year 2000 • reduce car traffic by 30 percent by the year 2010 • meet European guidelines on nitrogen dioxide (NO_2) concentrations in the air by 2000.
Scheme details	This study looks at two Greenways corridors. The A8 is 6.7km long and 55 percent of its length is inbound bus lane, while 54 percent is outbound bus lane. The A900 is 2.2km long and 23 percent of its length is inbound bus lane, while 41 percent is outbound bus lane. These two Greenways are compared with the A7/A701 corridor, which has conventional bus-only lanes on both sides for most its 3km length.
Schemes launched in 1999	The local authority consulted with bus operators, residents and businesses in the core scheme area. Public consultation following experimental introduction of Greenways in 1999 showed strong support. The two Greenways in the study were introduced in 1999. Lothian Region Transport and First Edinburgh operates buses every 12 minutes along the two Greenways.

Case study – Edinburgh Greenways, Scotland continued

Illustration of scheme

Surveys

The following surveys were carried out in 1999.

Element	Description
PERFORMANCE	
Journey time	Number plate surveys and analysis of Wayfarer data.
Reliability	Timetable adherence information supplied by bus operator.
Patronage analysis of Wayfarer data.	600 passenger interviews conducted at bus stops.
Infringement and enforcement	Information supplied by The City of Edinburgh Council, Lothian and Borders Police and Scottish Executive survey.
Junction capacity and block back	Video survey.
SECONDARY EFFECTS	
Traffic flows	Pre and post Greenways flows
Cycle flows	Pre and post Greenways flows.
Accident analysis	Information supplied by The City of Edinburgh Council
Property values	Discussions with property handlers to obtain general opinion.

Case study – Edinburgh Greenways, Scotland continued

Traffic flows

Corridor	Location	Before count date	After count date	Inbound 07:00-10:00 Pre	Inbound Post	Inbound % Diff	Outbound 16:00-18:00 Pre	Outbound Post	Outbound % Diff
A8 Greenway	Shandwick Pl	04/06/97	20/05/98	2256	2067	-8	1962	1821	-7
A8 Greenway	Shandwick Pl	13/02/97	29/04/99	N/A	N/A	-	2451	2214	-10
A8 Greenway	West Coates	04/06/97	02/06/99	2854	2934	+3	1982	1798	-8
A900 Greenway	McDonald Road	04/06/97	13/05/98	1256	1229	-2	1473	1413	-4

Journey times

The surveys showed that, in most cases, both Greenways and conventional lanes protected buses from the congestion that affected other traffic. Greenways that were lined with shops provided better protection from congestion than the equivalent stretch of conventional bus lane. The introduction of Greenways on the A8 corridor seems to have improved bus reliability. The conventional corridor did not show any obvious changes over the same period.

Patronage

Surveys showed that there was an increase in bus use, with approximately 11 percent of the sample claiming to use the bus more. However, 7 percent of interviewees claimed to use the bus less. Overall, there was a 4 percent increase in bus use.

Other effects

The count data for both Greenways corridors shows that traffic volumes have decreased slightly. It is not possible to attribute any change in cycle use to Greenways from the data available.

Enforcement issues

Greenways are constantly patrolled but conventional lanes merely receive visits and these are generally after 8am. An illegal parker is typically 15 times more likely to encounter a warden on a Greenway than on a conventional bus lane.

Possible scheme amendments

Greenways design could be improved by avoiding:

- bus lanes which are carried straight through junctions without any setback
- starting bus lanes immediately downstream of junctions as this can result in traffic being unwilling to use the inside lane, which also reduces capacity
- unnecessarily reducing the queuing space available and thus increasing the frequency with which queues block back to upstream junctions, causing more frequent congestion there. This is particularly important at the start of the Greenway where upstream buses have no priority and therefore get caught in the congestion.

Conclusions

The Edinburgh Greenways scheme is successful and has been extended.

References

Scottish Executive CRU, *A Comparative Evaluation of Greenways and Conventional Bus Lanes*, Report number 83. Obtainable from: www.scotland.gov.uk

Complementary measures

Cycling	Cycling benefits greatly from priority lanes. Dedicated space for cycling avoids the conflict with motorised vehicles and reduces the barriers to start cycling.
Public transport	Priority measures that speed up and ensure reliability of public transport services create a more desirable service. Situations where public transport can bypass congestion on priority lanes will generate behaviour change away from private vehicles to the public transport service.
Travel planning	Awareness of priority lanes and the opportunity to improve journeys by using them (e.g. by cycling or car pooling) is a key part of travel planning.

What other polices may this address

Congestion	By providing lanes that enable congestion to be avoided, people who value time may consider mode shift ,
Efficient freight movement	Freight lanes and freight priority provide a significant improvement in the efficiency of fright movement.

Further information

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