I) Traffic Management

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1. Introduction

Roads, streets and paths are part of the fabric of our communities, facilities for all to use. They enable us to move around in order to do what we want or need to do in our lives. But to ensure that this can happen effectively, and that traffic on these routes is not detrimental to our communities, the whole system of travellers, vehicles and travel routes needs to be carefully managed. This section addresses the process of doing so. Proper traffic management can ensure that:

- traffic flows smoothly and efficiently
- there is fair access for different transport modes, and the more sustainable modes are encouraged
- roads and streets are safe for all users, including pedestrians and cyclists
- roads full of motorised traffic do not constitute barriers blocking movement between areas
- congestion, local pollution and noise are minimised
- neighbourhoods, pedestrian areas and the overall character of localities are protected from the negative impact of high traffic levels
- greenhouse gas is reduced.

These goals, in turn, can be achieved through a range of measures, which can be divided into the following categories:

- the creation of a rational hierarchy of roads and streets that ensures particular street use, and so vehicles tend to be restricted to the most suitable thoroughfares to minimise traffic impacts
- roadways designed to maximise connectivity, with minimal dead-ends, especially for pedestrians and cyclists
- the use of design features and road laws to 'calm' or slow down traffic
- the allocation of road lanes and space to favour more efficient modes
- proper traffic control at intersections, in the interests of safety, fair access for all traffic modes, and smooth flow of traffic
- demand management measures, including pricing mechanisms and restrictions on road space and parking, to ensure that more smoothly flowing traffic does not have the adverse effect of encouraging large numbers of extra motorised vehicles onto the roads
- driver education and the proper enforcement of road laws.

2. Benefits of effective traffic management

Economic

If traffic is well-managed, vehicles travel more smoothly and there are fewer delays. This means time is saved and there is less wear and tear on vehicles. There are fewer costs to health from pollution and

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accidents. And as public transit, walking and cycling gain a bigger share of all travel undertaken, the total cost of transport to society as a whole goes down.[1]

Social

When traffic is well-managed, urban areas are safer, healthier and more pleasant to live in. There is less traffic intrusion into neighbourhoods and other social spaces. Those on low incomes have better transport services because public transit, cycling and walking gain better and safer access to travel space and thus become more viable alternatives to private vehicle use.[2]

Environmental

More smoothly flowing traffic, as long as it is associated with greater use of transit, walking and cycling, will reduce pollution and greenhouse gas production. If it is accomplished by building substantially more road capacity it can just increase the use of private vehicles and hence increase transport carbon. Also, when traffic congestion is reduced by increasing other modes and calming motorised traffic there is less noise and more balanced and sociable use of public spaces (see chapter 3).

3. Greenhouse gas emissions reduction potential

The potential for greenhouse gas savings from traffic management measures is a complex and controversial subject – see chapter 2. Reducing traffic congestion by increasing road capacity will lead to greenhouse gas reductions for individual vehicles, as they can travel more efficiently, but it does not lead to reductions overall as it attracts more vehicles onto the roads.[3] A car travelling smoothly at a moderate speed may be more efficient that one engaged in stop-start travel, but if this smoother traffic leads to an increase in the number of vehicles on the road the outcome is a net increase in greenhouse gas emissions. However if traffic congestion can be eased while at the same time reducing private vehicle use – through traffic calming, reduced road space for these vehicles, and a range of demand management measures – then greenhouse gas reductions can be achieved.

4. Measures to achieve better traffic management

A hierarchy of roads and streets

Users of roads and streets do so for different purposes and have different impacts on those around them and on the environment. Compare, for example, a semi-trailer hauling freight between cities, a car or motor scooter carrying a teacher to and from her school each day, and some children playing on a neighbourhood street. The vehicles mentioned impose certain costs and risks on other road users (such as the children playing), as well as on tax payers and the environment. It would be better if this freight movement and commuting were accomplished on public transit, but if private vehicles are to be used then risks and costs need to be minimised and the trips made as smooth and efficient as possible. Having different kinds of roads for different vehicles, purposes and lengths of trips can help this to occur.[4]

Freeways, highways and arterial roads can take longer distance traffic and almost all freight. Vehicles travelling on lesser roads can carry those travelling shorter distances, for example, to shops, local workplaces and schools. Inner city areas and neighbourhood streets can be mainly reserved for public and non-motorised transport, for pedestrian or non-transport uses of public space, and for vehicles leaving or returning to residences. Physical barriers and calming devices, pricing policies such as congestion taxes, regulations barring particular kinds of vehicles from particular roads, and restrictions on parking are all measures that can be used to prevent or discourage the use of roads and streets by the wrong vehicles for the wrong purposes or trip lengths. And freight depots can be kept away from high-density, residential

and commercial areas. This is not an argument for building more roads to accommodate through traffic, long-distance traffic and freight, but rather for keeping this traffic off local and lesser roads, for controlling it better when it is on these roads, and for providing more alternatives to private vehicles. Research across the world has shown that cities with extensive freeways, for example, have just as much traffic congestion as those without such freeway development, because of the increased numbers of private vehicles that freeway building encourage onto the roads.[5] One device to assist in the planning of the location of routes and services for different modes of private and public transport is the origin-destination (or OD) study. This obtains information about origins and destinations of trips from personal interviews, mail interviews, licence plate tracking and a range of other means.[6]

It is important to recognise that, while roads are for travel, streets can also serve a range of other purposes. For example, consider this comment about kampung (urban neighbourhood) streets in Surabaya, Indonesia.

> The paths…are at once front yard, market stall, playground, meeting place and thoroughfare for the thousands of residents of each kampung. Kampung streets express that melding of transportation, social, economic and cultural functions that was common in the pre-automobile cities of the West, but has now been lost in favour of the street as merely a conduit for automobiles.[7]

Fortunately, developed countries are realising their mistakes and starting to change. Some transport experts now recommend designing 'complete streets' which safely accommodate the needs of all users, including pedestrian, cyclists, motorists, public transport and local freight vehicles.[8] Special attention is needed to protect pedestrians.[9]

In Surabaya, also, when it was realised that certain improvements were necessary in kampungs, great care was taken to ensure that the many aspects of street life just described could be retained. Under the Kampung Improvement Plan, there were improvements to streets and pathways, to garbage collection and recycling, to drainage and sanitation and various other facilities and services, but the basic character of street life as a site for many social, economic and cultural activities was carefully maintained, and keeping kampungs as basically car-free areas was an important part of this.[10]

In addition, the cities of Curitiba and Bogotá are both excellent examples when it comes to giving pedestrians safe and fair access to travel space.

Traffic calming measures[11]

'Traffic calming' measures can be introduced to restrict the number and speed of motorised vehicles – especially those vehicles that should be on other roads – and to help ensure that drivers respect other road and street users.[12] Such measures include:

- very low speed limits
- streets that are narrowed and/or have curves added to the lanes (e.g, see Figure 3.38, with the space freed up by these measures then being available to be used for trees, gardens, paths and seats)
- frequent pedestrian crossings (and if they are at the walkway level rather than the slightly lower road level it emphasises that this is 'pedestrian space' and doubles as a speed hump)
- streets shared with pedestrians and non-motorised vehicles (which have very low speed limits and often feature different paving materials and the absence of road camber and curbing, thus suggesting a driveway rather than a road and moderating driving behaviour accordingly)
- speed humps and 'rumble strips' (which make a noise when vehicles go over them)

Figure 3.38 In Brisbane, the narrowing of streets is intended to slow traffic

Picture Credit : Karl Fjellstrom, itdp-china.org.

- perhaps one-way or dead-end streets for motorised vehicles, but if these exist there should be two-way access open at both ends for pedestrians and cyclists.

Through such measures inappropriate traffic can be discouraged from using local streets and can be controlled and made safer if it does.

The allocation of road space to favour more efficient transport modes

When it comes to the allocation of space on particular roads and streets, lanes and space can be assigned to particular kinds of road users, with priority given to the most sustainable ones, including light-rail, buses, people practising car-pooling and other multi-occupant vehicles, taxis, bicycles and pedestrians. The use of distinctive colours and materials for dedicated lanes, as well as raised lane edging or even fencing, can keep inappropriate traffic off them and help to protect legitimate users.

Such measures can also deter private vehicle use on roads by restricting the space available to these vehicles.

Proper traffic control at intersections

In the interests of safety, fair access for all transport modes, and smooth flow of traffic, there needs to be proper control of traffic at intersections. Broadly speaking, there are five design options: uncontrolled intersections, priority controlled ones, staggered-T intersections, roundabouts and signalised intersections (that is, those with traffic lights), not including more expensive options like flyovers or tunnels. Staggered-T

Figure 3.39 In Kunming, these centre lanes are for buses only

Picture Credit: Karl Fjellstrom, itdp-china.org.

intersections are those in which there is a slight 'dog-leg' as a road crosses another road, such that vehicles travelling on the first road need to divert slightly at the intersection. This kind of intersection can bring about significant reductions in accidents, although it can be confusing to navigate for pedestrians and cyclists, and so should only be used in low traffic volume, low growth areas.

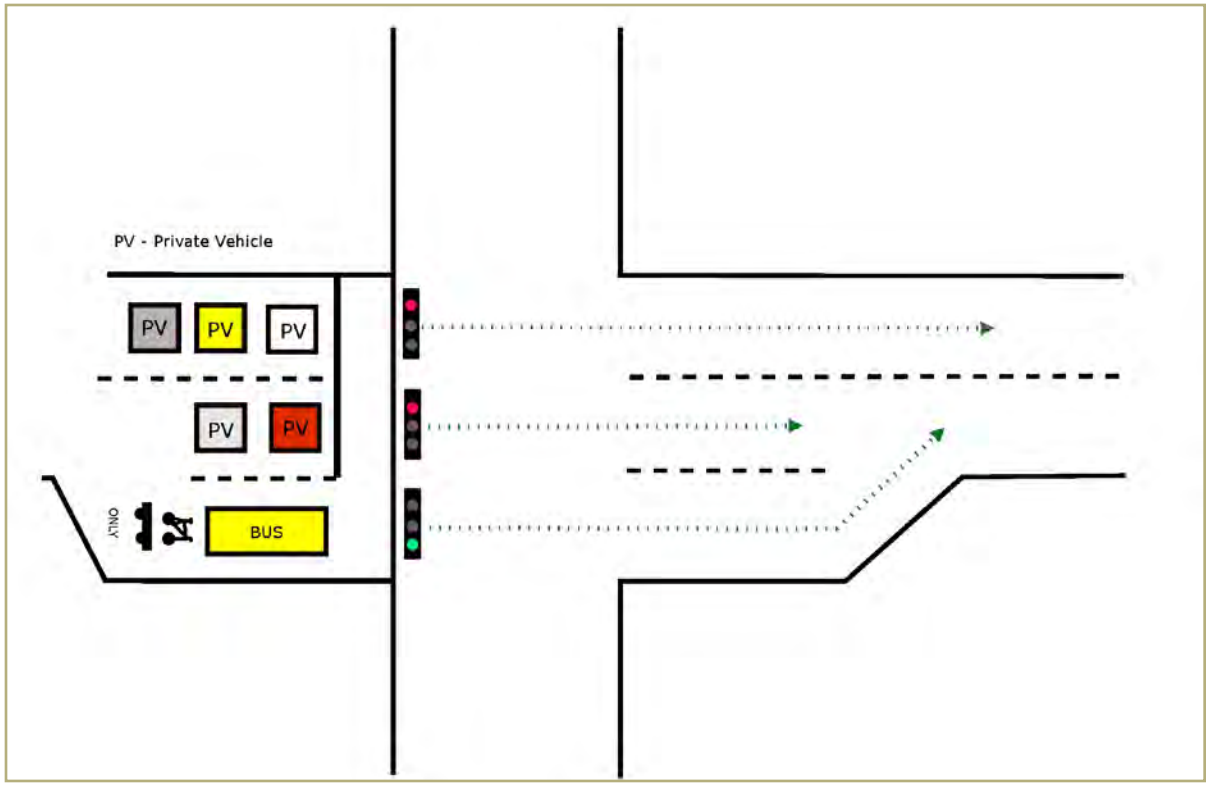
Roundabouts are a rational solution for lesser roads, but two (or more) lane roundabouts are very unsuitable for cyclists and other slow vehicles, as they may need to change lanes in quite fast traffic when turning. They are also undesirable for pedestrians because motorised vehicles are likely to turn without watching or stopping for them.

Signalised intersections are the best solution for pedestrians and cyclists on main roads. It is a good idea if a phase of the signals allows pedestrians to cross in both directions at once. There can also be provisions for a 'bus-jump' or a 'bicycle-jump', allowing these vehicles to take off before other modes (Figure 3.40).

There is also the possibility of bridges or underpasses for pedestrians and cyclists. These are safe if used, but pedestrians and cyclists often ignore them because they require them to travel further and to climb stairs or ramps. They also send a message that motorised vehicles are the 'normal' traffic that should be uninterrupted, with walkers and cyclists going over or under them. These type of facilities should be reserved for special roads, such as wide arterials or expressways. Signalised intersections are recommended for normal streets and arterials.

Slip lanes, which allow vehicles to 'cut the corner' (and often avoid the traffic light), can reduce the bank- up of vehicles at intersections, but they represent an extra hazard for pedestrians. Tight corners at intersections, on the other hand, require vehicles to turn more slowly.

Figure 3.40 This illustrates how traffic signal can give buses a head start at intersections



Source: Andrew Bossi.

Further details of intersection design are available from road design manuals.[13] But however well designed an intersection is, it will not be safe or effective unless drivers obey road laws. For example, pedestrians will not venture onto crossings in the face of oncoming traffic unless they are very confident that the traffic will stop for them. If failing to stop for pedestrians is part of the road culture, then heavy fines, strict enforcement and driver education will be necessary to change this.

Demand management measures[14]

In order to ensure that more smoothly flowing traffic does not have the adverse effect of encouraging large numbers of extra motorised vehicles onto the roads, it may be necessary to introduce countervailing demand measures, including pricing mechanisms, restrictions on road space and parking, and the development of alternative modes and encouragement of their use. These are described in other sections of this guidebook (Private vehicle demand management and Mass transit), so readers should consult those sections for further information.

There has been an unfortunate tendency for policy in many countries to go in a different direction: to build more roads and larger roads, in order to relieve traffic congestion. However, as already noted (and covered in detail in Chapter 2), rather than easing congestion, this policy simply encourages more cars on the roads, longer car trips and more urban sprawl, and over time congestion levels can remain the same (the 'rebound effect').[15]

However, such policies can be reversed. In Seoul, a large highway that completely covered the culturally significant Cheonggyecheon stream and an ancient bridge was demolished in 2003 (see Figure 3.41). The

Figure 3.41 Cheonggyecheon stream: The 6 km stream has now become a modern public recreational space

Picture Credit: Flickr, Wikimedia Commons, http://commons.wikimedia.org/wiki/File:Korea-Seoul-Cheonggyecheon-01.jpg viewed 22 March 2011.

stream its banks and the bridge were restored, an underground rail line and a bus rapid transit service were initiated, and measures were taken to reduce the need for travel. The result has been better transport services, less traffic, a restored river and environs, and a cleaner, less greenhouse-gas-generating locality.

Driver education and effective enforcement of road laws

Road designs and laws are only as good as road users' willingness to obey the rules. In countries where there is widespread flouting of road laws, stricter enforcement and harsher penalties may be needed in order to change this road culture. It is no use giving pedestrians and cyclists certain rights on paper if they are denied these in practice on the roads.

Given that drivers of cars and other motorised vehicles require a licence that involves passing a test, there is an opportunity here for a lot more emphasis to be put onto educating drivers about road laws that protect pedestrians and other road-users. If this is then combined with stricter enforcement and harsher penalties for breaking these laws, then a cultural change can be achieved that makes roads safer for everyone and ensures that pedestrians and cyclists have fair access to public travel space.

5. Costs and sources of finance

Traffic management measures vary greatly, depending on what is done, over what area or length of road or pathway (if it is a physical measure), and the degree of change necessary. Some of the major measures involved, as describe in this section, are alterations to roads for traffic calming, creation of dedicated

lanes for buses and bikes, better controls and safety at intersections, driver education, and stronger enforcement. These could be partly funded out of taxes and charges on private vehicles.

6. Conclusion

Public travel space is for everyone, not just for users of cars and other private vehicles. Achieving smoother private vehicle flows by giving such vehicles priority, or by building bigger and better roads for them, increases their numbers on the roads and the traffic injuries and deaths, air pollution and greenhouse gases they generate. In the end it does not even ease congestion, because vehicle numbers increase as a result. But effective traffic management can give all travellers good access to travel space, substantially reduce the adverse effects of traffic on communities, and contribute to the lowering of greenhouse gas emissions, if the measures described in this section are adopted.

Endnotes

1. P Newman & J Kenworthy, *Sustainability and Cities: Overcoming Automobile Dependence,* Island Press, Washington DC, 1999.
2. Readers are directed to the literature on Crime Prevention Through Environmental Design (CPTED) and the many publications on the VTPI website on the economic and social benefits from improved transport oriented design, as well as R Trubka, P Newman & D Bilsborough, 'The Costs of Urban Sprawl', Parts 1-3, *Environmental Design Guide,* April, GEN 83,84,85, 2010.
3. P Newman, & J Kenworthy, 'The Transport Energy Trade Off: Fuel-efficient traffic versus fuel-efficient cities', *Transportation Research,* 22A (3), 1988, pp 163-174.
4. Robert Cervero, 'Balanced Transport and Sustainable Urbanism: Enhancing Mobility and Accessibility through Institutional, Demand Management, and Land-Use Initiatives' Department of City and Regional Planning University of California, 2004, http://www.uctc.net/papers/770.pdf, viewed 24 Feb 2011.
5. Newman & Kenworthy, 1999; Preston L Schiller, Eric C Bruun & Jeffrey R Kenworthy, An Introduction to Sustainable Transportation, Earthscan, London, 2010.
6. 'Origin-Destination Study', The Traffic Group Inc Services, *www.trafficgroup.com/services/LP_OD_studies.html, viewed 24 Feb 2011.*
7. Schiller, Bruun & Kenworthy, p 292.
8. National Complete Streets Coalition, www.completestreets.org, viewed 24 Feb 2011.
9. ITE (2010), *Designing Walkable Urban Thoroughfares: A Context-Sensitive Approach, An ITE Recommended Practice,* Institute of Transportation Engineers (www.ite.org) and Congress for New Urbanism (www.cnu.org), www.ite.org/css, viewed 24 Feb 2011.
10. Schiller, Bruun & Kenworthy, p 292.
11. *Traffic Calming Library,* Institute of Transportation Engineers, http://www.ite.org/traffic/, viewed 24 Feb 2011.
12. 'Traffic Calming', Great Britain Department of Transport, The Stationary Office, 2007, http://www.dft.gov.uk/pgr/roads/tpm/ltnotes/pdfltn0107trafficcalm.pdf, viewed 24 Feb 2011.
13. However, it is important to select manuals that are not biased in favour of private vehicle traffic. This is discussed in Walter Hook, 'Preserving and Expanding the Role of Non-Motorised Transport', 2003, *Sustainable Transport: A Sourcebook for Policy-makers in Developing Countries,* GIZ, www.sutp.org, viewed 23 Feb 2011.
14. VTPI, *Online TDM Encyclopedia,* Victoria Transport Policy Institute, 2010, www.vtpi.org/tdm, viewed 24 Feb 2011.
15. 'Rebound Effects' *Online TDM Encyclopedia,* Victoria Transport Policy Institute http://www.vtpi.org/tdm/tdm64.htm, viewed 24 Feb 2011.