# INNER SYDNEY TRUCK ROUTE STUDY

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*ABSTRACT:* *The adverse environmental impacts of motor vehicles and particularly heavy trucks have increasingly become a matter of public concern. In Sydney some local councils have reacted by restricting heavy vehicles or through traffic from using local streets.*

*Yet trucks perform an important commercial duty and an efficiently functioning road system is important to the entire community. This trade-off between environmental and road user needs is most pronounced in the inner Sydney area. Prohibiting trucks from using all but classified roads in this area is a possible extension of present programs. The expected results and implications of such an action are discussed.*

*Information is drawn from work of the Urban Transport Study Group but its interpretation is the author's own and does not necessarily represent the views of the Study Group.*

Background Paper for
Session 3

## INTRODUCTION

The adverse environmental impact of motor vehicles on the community has been the subject of continuing public concern in the past. One of the more recent initiatives of local government in Sydney taken to deal with environmental problems of traffic has been to restrict heavy vehicles or through traffic from local residential streets.

Yet without new alternative rights-of-way car and truck traffic is faced with additional travel penalties at a time when urban freight movement especially, is being recognised for its important contribution to a city's industrial and commercial well-being.

The extensive prohibition of trucks from local roads leaves a limited system of roads that can be called 'truck routes'. Present practice in Sydney acts to force heavy vehicles to use 'truck routes' unless requiring direct access to destinations not on the system. It does not ban trucks completely.

It is with this background that the Urban Transport Study Group was requested by URTAC[1] to undertake a study examining the potential for truck routes in the Sydney region especially the older inner city suburbs where the existing road system poses both traffic and environmental problems.

The procedure adopted for the study was to analyse the effects of varying levels of road system restriction on heavy vehicles for the five inner city municipalities of South Sydney, Botany, Marrickville, Leichhardt and Ashfield. The effects of imposing such restriction on through traffic were also analysed for comparison purposes.

This paper will review the major findings of the study after briefly noting the relevant Sydney experience and summarising what is meant by the environmental impact of trucks.

## SYDNEY EXPERIENCE WITH TRUCK ROUTES

For some time local councils have prohibited heavy vehicles from using particular streets but the instances were few in number and were localised in effect. Recently councils have considered extending the use of truck controls significantly.

Ashfield Council introduced regulations in June 1977 applying to all local roads leading from declared Main and Secondary roads in the municipality. Vehicles using those local roads were limited to a maximum loaded weight of 3 tonnes unless needing them to access a local destination.

The administrative procedure to accomplish this was relatively simple. Ordinance 30D of Section 277(A) of the Local Government Act empowers councils to declare that a road is a light traffic thoroughfare merely by passing a council resolution and by erecting conspicuous signs displaying the maximum permitted weight and an alternative route.

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1 Urban Transport Advisory Committee of N.S.W. Results of the study are given in Truck and Through Traffic Routeing : Inner Sydney Study Area, August 1978 (limited distribution to URTAC departments).

Although the intention was not to develop a 'truck route system' the present main and secondary roads became 'de facto' truck routes for heavy commercial vehicles travelling through Ashfield and also for those travelling into or out of any local precinct bounded by these classified roads.

Reaction by truck drivers and operators to the Ashfield Scheme was strong. A ban on deliveries to premises in Ashfield was imposed by the Transport Workers Union and later lifted subject to the load limit being raised on some selected roads and an extension of one secondary road being examined. Although Ashfield covers only a little over 8 square kilometres the effects of a blanket truck route network were immediately felt.

Major road closures in Mosman and North Sydney instituted under Section 269 of the Local Government Act also limited the choice of route for trucks and were in response to the environmental intrusion of traffic. However trucks were not held to be the major contributor to the environmental problem.

Motorists soundly objected to the added congestion leading the government to amend the act to make road closures dependent on the agreement of the state Traffic Authority or, failing that, the Minister. It is instructive to note that many local residents objected because of the recurring inconvenience of accessing their own homes and local activities.

## THE PROBLEM WITH TRUCKS

It is not difficult to appreciate why car and truck drivers oppose through movement restrictions. The environmental justification for restrictions warrants more discussion. Residents, pedestrians, and others exposed to traffic find it dangerous and annoying. On a pro rata basis truck traffic is found to be even more disturbing and disruptive than ordinary traffic for the following reasons.

Road damage: The grounds for declaring light traffic throughfares set down in the legislation is to halt pavement damage. It was the prime reason the Mayor of Ashfield gave for that council's action.

Road damage is linked to three summary factors: The total number of vehicles passing over the road, the quality of the road base construction and the destructive power of the vehicle. As a rule-of-thumb the latter is proportional to the 4th power of individual axle loads which is understandably higher for heavy vehicles. Stronger pavement is more resistant to heavier loads and it should be more economical to confine as much of the heavier loads to the strongest pavements available.

Noise: Residents and pedestrians were found to worry most about traffic noise in a review done for the Central Industrial Area Study (UTS, 1977). Measurements undertaken then confirmed that trucks were largely responsible for maintaining 'peak' $L_{10}$ noise levels[1] at morning rush hour levels right throughout the day. The average noise levels decreased through the off-peak hours however.

1 Peak noise is commonly taken as that exceeded for 10% of the time.

Burgess (1977) calibrated an equation for estimating traffic noise under conditions typical of many Sydney locations that emphasised the significant contribution truck traffic makes to noise levels. Where trucks make up 20% of the traffic stream the $L_{10}$ would be 6dBA higher than if there were no trucks and the same number of vehicles - a discernible difference.

Accidents: Trucks are held by the public to be more dangerous than lighter vehicles. This is because their accidents are generally more severe and involve proportionately more fatalities. Yet statistics for articulated trucks involved in accidents of all types (fatal, casualty and property damage) in NSW in 1976 show that the rate of 2.6 per million kilometres travelled was nearly 30% below that for cars and station wagons.

Exhaust Emissions: Localised air pollution is another by-product of heavy trucks. Although diesel emissions contain less dangerous carbon monoxide they are more noticeable than petrol exhausts and the general public has been found to believe observable fumes are more harmful to their health (GLC, 1976).

Other Complaints: People have complained that trucks do more to deter people from crossing roads than general traffic and hence sever communities; their size is out of character with some neighbourhoods and is therefore threatening or annoying; and spillage from trucks litters local streets. Vibration and infrasonic sound may also cause structural damage to nearby houses and premises. The interpretation of the seriousness of these effects is necessarily subjective.

Measurement of Environmental Damage: One way that has been suggested to cost the environmental damage is through the depreciation of property market values (Jarvie, 1977) although it would be an almost impossible task in practice if an accurate estimate as a basis of compensation, for example, were wanted.

The environmental effects trucks and traffic in general have on people, and the manner in which people accept them vary considerably. the Swindon Freight Study (Purcell et al, 1977) developed a nuisance index in an attempt to have an overall measure which is easy to calculate and whose meaning is simple to appreciate. The index could be used to compare schemes and depended on the number of pedestrians or households affected, the changes in the flows of goods vehicles of different gross weights and the present flow of traffic.

Results from an opinion poll gave supporting evidence that extra heavy vehicles increased the major nuisances roughly in proportion to the inverse of total traffic flow. Thus to achieve the lowest aggregate nuisance in an area, the best policies would be to focus as much traffic on as few roads as possible, particularly the heavier vehicles, and choose those roads that have the fewest residents and pedestrians.

## ENVIRONMENTAL DAMAGE AND TRUCK ROUTEING

The Swindon Nuisance index behaves well in reflecting the two principles that the GLC reports as the underlying logic to truck routeing:

> '(i) Some routes are wider or otherwise less environmentally sensitive and there is justification for particularly encouraging essential lorries to use them.
>
> (ii) The impact of a small number of lorries if added to an existing lorry flow is much less than if they use a route which would otherwise not have lorries on it.'

The first principle suggests some routes have a greater 'environmental capacity' which in the Swindon Index is inversely related to pedestrians and households along the route. Lacking that information for Sydney the UTS study used as a surrogate, land use. Roads fronted by industrial uses have a higher environmental capacity than those fronted by residential properties is a sample interpretation.

The second principle assumes that the benefits to a large number of persons outweigh the marginal disbenefits imposed on a smaller number. There is an over-riding criticism that it may not be justifiable to improve conditions for those people in a fair position at the expense of those already in a bad position.

Here lies a critical point. The trade-off in truck routeing between road user losses and environmental gains is not the only one. There is a supplementary trade-off between environmental gains and losses.

In the GLC lorry routeing exercise, Hasell (1978) states that a proposed 425 mile network would have had little or no effect on the total costs of goods movement in London. But before introduction the public's views were sought. The strongest reaction was against the inclusion of some 40% of the least suitable parts of the network by those living alongside the roads in question. There was little support from those that stood to benefit.

Hasell goes on to state 'because so many of the routes objected to were essential if a complete network was to be designated, a comprehensive network of lorry routes was not at present a feasible proposition'.

The lesson to be drawn is that it's insufficient to only ensure that a truck routeing scheme guarantees acceptable road performance and a net environmental improvement, but it also must not antagonise those who would experience a worsened traffic environment.

## TRUCK ROUTES IN INNER SYDNEY

The five inner Sydney local government areas of Botany, South Sydney, Marrickville, Leichhardt and Ashfield stretch from Botany Bay to Port Jackson dividing the city and eastern suburbs from the western and southern suburbs. They form an important industrial and freight generating area, accounting for over 20% of the region's manufacturing employment, and also they are an important living area, housing more than one quarter of a million people.

Ashfield and Leichhardt are distinguished from the other LGA's by a greater proportion of through traffic (Table 1). It helps to explain why in Ashfield through traffic was identified as a major environmental villain and why truck routes have been judged a success.

TABLE 1

Morning Peak Trip Distribution
In the Study Area : 1976

| L.G.A. | Trips Using Roads in Local Government Area | | | |
|---|---|---|---|---|
| | Trucks | | Total Vehicles | |
| | No. | % Through | No. | % Through |
| South Sydney | 4,350 | 26% | 55,800 | 30% |
| Botany | 2,250 | 24% | 38,950 | 31% |
| Marrickville | 3,450 | 28% | 57,650 | 40% |
| Leichhardt | 3,500 | 51% | 72,250 | 63% |
| Ashfield | 2,400 | 61% | 42,700 | 62% |

About 95% of all vehicle travel takes place on 196 kilometres of major traffic routes in the Study area. There are a further 630 kilometres of local roads used predominantly for access to local properties. The latter class of roads pose few problems in prohibiting through truck movements but that action offers little in return. Trucks using them are mostly on local deliveries and would not be eliminated.

Trucks on Main and Secondary Roads

The more important issue is whether the 60 kilometres of major traffic routes solely under council control are vital for through traffic. The DMR contributes in whole or part to the upkeep of the other 136 kilometres of roadway and it would be unlikely to want or allow trucks to be selectively restricted from state-funded roads.

Interviews arranged by UTS and the Department of Motor Transport with haulage firms and truck drivers revealed that longer distance truck trips are already mostly confined to main roads and that operators themselves are more concerned about facing the same conditions as their competitors and less concerned about levels of congestion.

When tested with main and secondary roads functioning as the only routes for through truck movements, trucks were found to travel 2½% further and take 6½% more time in completing their trips than in the base case. Compare this with the estimate that an average trip in the morning peak is 5% longer and takes 51% more time than would be the case if just 1/3rd the total number of trips were competing for the same road space. The effect of general congestion swamps the effect of truck routeing.

Model results are supported by the way route selection was described in the interviews. Truck drivers essentially chose routes so as to minimise travel times, and altered routes quickly in response to changes in traffic light timing, turn restrictions, roadworks, accidents and other perceived sources of congestion. Up-to-date information on the 'best' routes was exchanged informally between drivers (UTS, 1978). This explains the lengthening of trips where Hasell (1977) found that 'the imposition of routeing would not increase overall travel distances'. He found however that London truck drivers often took circuitous routes out of habit not justified by present-day travel conditions.

One main reason why congestion does not mount under a main and secondary road truck route system is that non-truck traffic is still free to use local roads. Light traffic adjusts to added congestion on truck routes by diverting to less congested local roads. No new bottlenecks would be created, traffic flow in relation to capacity would remain almost unaltered and on traditional traffic engineering grounds truck routeing would be acceptable.

Still, opposition based on the fact that the worsening of conditions is sudden and can be tied directly to an authority's action which can be reversed, may be enough to force abandonment of the scheme. The uneven coverage of main roads, under which Marrickville experiences the most apparent shortage, would focus resistance and become a greater barrier to success of the scheme as a whole.

Defence of main road truck routes rests on the assessment of environmental improvement. The costs to truck operations amount to about $3,200 a day when valued at 2.34¢ for each added kilometre and 0.68¢ for each added hour. The costs of establishment and enforcement are also estimable. But the benefits of fewer trucks on the 90 kilometres of major local roads, less the added hardship of those exposed to the higher truck volumes on main roads, defy an indisputable evaluation.

Overall it was found there would be no change in the study area's average exposure to trucks (300 in the 2 hours morning peak), general traffic (3200 vehicles over 2 morning peak hours) and noise (an $L_{10}$ of 72dBA at 10 metres from the centreline of traffic flow). The same trips[1] are made without significant extra diversion and although speeds are lower, speed has been found to have little bearing on noise, the major environmental complaint.

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1 Under real-life conditions trips might be suppressed by congestion but it is reasonable to believe that commercial trips and peak private trips are inelastic to small changes in time and cost at least in the short run. Any suppression would cause an overestimate of congestion costs, and an underestimate of environmental benefits but would be countered by a loss of consumer utility for the traveller.

Change would occur in the pattern of exposure to trucks and noise. Four percent more of the major traffic routes carry fewer than 200 trucks in the morning peak but 2% more experience over a thousand. The percentage of roads with an $L_{10}$ over 76dBA at 10 metres climbs from 21 to 27.

The distribution of benefits relates closely to the characteristics of the main and major local road system. Proportionately more major local roads cross Marrickville and they front relatively more residential properties. Therefore it is understandable that Marrickville derives more environmental improvement from truck routes than Leichhardt and residential roads fare better than roads along commercial and institutional land uses. Table 2 contains the breakdown of route distance within the municipalities of the study area and by route distance along the 4 major types of land use.

TABLE 2

Length of Major Traffic
Routes in the Study Area (km)

| | Classified Roads | Major Local Roads | TOTAL |
|---|---|---|---|
| Study Area | 134 | 60 | 194 |
| South Sydney | 33 | 11 | 44 |
| Botany | 32 | 5 | 37 |
| Marrickville | 25 | 27 | 52 |
| Leichhardt | 24 | 11 | 35 |
| Ashfield | 20 | 8 | 28 |
| Residential | 54 | 45 | 99 |
| Parks, Hospitals, etc. | 18 | 1 | 19 |
| Commercial | 21 | 3 | 24 |
| Industrial | 41 | 11 | 52 |

On one hand prohibiting trucks from using major local roads has the effect of relieving mostly residential roads of truck intrusion, the most sensitive of land uses, but on the other hand a greater number of residential roads remain in the truck route system. Also 11 kilometres of industrial roads are automatically controlled although less vulnerable to trucks and potentially valuable as alternative routes to more sensitive main roads.

An Augmented Network and Road Closures

The GLC (1976) draws the conclusion that 'greater segregation of traffic flows seems likely to be almost as relevant to general traffic as to lorries'. Action that is within the power of councils but subject to Traffic Authority agreement could be taken to close local roads to all through traffic and achieve this segregation.

Within the study area the worsening of congestion would be marked. On one critical screenline crossing the area from north to south, 11 of an original 25 roads would be lost to through movements, raising the volume to capacity ratio from 0.86 to 1.15. Throughout the area trips would take 41% more time on average although lengthening by only 1%. Road conditions would clearly be intolerable for both truck and car driver alike.

Noise intrusion is a good indicator of what would happen to the traffic environment. Fully 28% of the major traffic routes would show a drop in peak noise levels to below 65dBA but also 5% would have levels raised above 76dBA. The percentage of Marrickville's main traffic routes experiencing noise below 65dBA would climb from 6% to 51% and 48% of residential main traffic routes would fall in the low noise category where in the base case only 3% do.

Full road closure generates the same sort of effects as closing the same roads to only trucks, but they are more extreme. More roads have better environments, more roads have worse environments and road users face much poorer travel conditions.

It is not within the power of councils to declare light traffic thoroughfares on main or secondary roads however they could co-operate to exclude important major local roads from a prohibition scheme. More, rather than fewer, kilometres of road would be available for through traffic suggesting that travellers would comparatively benefit and non-users would experience less change in exposure to traffic.

The main road network augmented by 30 kilometres of important major local roads was tested as a truck route system and a through traffic system.

When restricting trucks to it their trips were 3% longer but extra time taken was reduced to less than 2%. Traffic in general felt no effect. When all through traffic was channelled through the larger network both trucks and light traffic took about 15% more time for the same trips and covered 3% more distance. From the capacity viewpoint the truck route system would pose no problem. However capacity would be strained in the circumstance that all through traffic had to make do with the augmented or intermediate network.

Again using noise to describe the environmental change, average peak noise did not alter and the road lengths with levels below 65dBA only increased when restricting all through traffic to the intermediate network, rising from 6 to 18% of its length.

The environmental change is less apparent at an area-wide or strategic scale for a longer major traffic route network. Improvements could be expected for small localised groups but they would very much depend on the detailed design of the system.

## Conclusions

Environmental gains from truck routes are more of a redistributional nature than absolute. Of practical importance, local councils in Sydney can now act unilaterally to declare light traffic thoroughfares with potential adverse effects on road users and neighbouring municipalities. It is a similar situation to that which formerly existed whereby councils could independently close local streets. It appears advisable that state government take the same sort of action in response and require council applications for light traffic thoroughfares to be vetted by the Traffic Authority with the right of appeal to the Minister.

Furthermore classified main and secondary roads do not seem to be a ready-made truck route system although the division of powers between state and local government casts them in that role. Such a scheme would unevenly distribute added congestion and would not necessarily do the most to improve environmental conditions.

The technical ways of measuring environmental change and its acceptability in the community are very weak and far from conclusive. Because the anticipated effects of truck routes are subjective, public consultation and involvement seems mandatory. Local councils have been and would still be the best agents for this effort. Hauer (1972) in his survey of Canadian practice found that with the exception of one city 'every other city that now has a truck route system listed "citizen complaints" as a prime motivation for the establishment of a truck route system' and this positive stimulus would do more to assure the success of a scheme than the desire to comprehensively apply a traffic management technique.

The scale of complaint and nuisance is going to vary over any urban area as is the adequacy of its arterial roads. Designing a uniform area-wide truck route system from scratch is bound to run into problems as it did in London. Hasell (1977) reports that 'efforts are now being concentrated on introducing localised routeing as new road construction makes suitable routes available'.

To ensure that consistency in the use of truck prohibitions is achieved guidelines should be developed for councils to follow in drafting proposals and the state government to refer to in assessing them. Criteria might conform to those listed by Hauer (1972):

'(a) Land Use: when a substantial amount of residential property has frontage to the road.

(b) Alternative Route: when a suitable alternative road is available to allow a detour not exceeding a reasonable distance - "reasonable" should be defined.

(c) Medium and Heavy Truck Volume: when the truck volumes indicate that the road is used by less than a specified number of trucks daily.

(d) Unsuitable Pavement: when the pavement is found unsuitable for heavy traffic.'

In Metro Toronto quantified criteria were being developed that allowed a mileage increase of up to 50% in daytime or 100% at night while at no time exceeding 2½ miles as proof that a reasonable detour existed. Also up to 300 trucks in the daytime and 50 in the night-time hours were sufficient to justify prohibition without suspecting any undue disruption of major heavy truck movements.

OTHER APPROACHES TO THE TRUCK PROBLEM

Truck routeing is only one solution to the conflict between trucks and the environment. It is comparatively inexpensive to undertake and has currency in the Sydney situation.

Other policies can be developed to substitute for or supplement the truck route solution. Both the GLC (1976) and Johnson et al (1976) have listed the major ones which in summary are:

(a) improved vehicle design with emphasis on quietening the vehicle,

(b) restricted operating times,

(c) new road construction with proper regard for matching road and environmental capacity,

(d) diversion of freight to other modes,

(e) reduced vehicle mileage by increased consolidation,

(f) better siting of freight generators,

(g) relocation of sensitive land uses,

(k) remedial measures such as double glazing of windows to insulate sensitive land uses,

(i) reduced vehicle size.

The UTS study did not investigate the usefulness of these alternate policies but they do warrant future consideration.

The UTS study also did not evaluate the different categories of trucks which might be controlled by truck route schemes.

Trucks were defined in the study to be 2 and 3 axle rigid trucks, articulated vehicles and special purpose truck types. In June 1977 they comprised 6.6% of the NSW motor vehicle registrations and were responsible for about 9.4% of the vehicle-kilometres of peak hour traffic in the study area. This category corresponds closely with that which would exceed Ashfield's 3 tonne maximum loaded weight limit.

Most overseas examples reveal higher weight limits. The UK used 16 tons gross vehicle weight as its national standard and Canadian cities adopted limits from 3 to 20 tons. It is speculated that higher limits would be more acceptable, ridding local streets of the most intrusive trucks while not disrupting as many truck movements.

Lastly heavy trucks tend to be devoted to a limited range of purposes. Petrol tankers, coal trucks and container trucks are 3 important types that are highly visible in the community and have been singled out for complaint. Edgerton et al (1979) in a companion paper to the ATRF discuss the special issue of container trucks, their movements and impact. Particular solutions adapted to major movements could well be very effective and satisfy most community complaints directed at the environmental intrusion of trucks.

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