TOLL FACILITIES : A ROAD CONSTRUCTION OPTION

Joe H. Kenny,
Manager - Traffic and Safety,
Royal Automobile Club of Queensland (RACQ),
Brisbane.

ABSTRACT: *The construction of Toll Facilities is one alternative method of Roads Financing, which has been used only to a limited extent in Australia.*

This paper outlines a strategy for charging tolls on roads, bridges, tunnels, etc., and lists conditions which, if applied, make such tolls acceptable to motorists and motoring organisations, and which should be acceptable to Governments.

The proposed conditions are:

1. *The facility must be financially viable.*
2. *The toll facility should be of freeway standard to reduce both travel time and road trauma, with the saving in road users' time and running costs greater than the toll paid.*
3. *The tolls to be removed as soon as capital costs are recovered.*
4. *The facilities to be financed and operated by the public sector, but not from current road funds; and*
5. *Any existing "Free" road in close proximity to the toll facility to be retained and adequately maintained.*

Implementation of this strategy would generate such benefits as better roads at reduced construction costs, reduced loan repayments and greatly reduced road trauma.

TOLL FACILITIES: A ROAD CONSTRUCTION OPTION

INTRODUCTION

Existing methods of road financing in Australia have serious limitations, exacerbated by the basic constraint that Australia is a large continent with a comparatively small population.

Allocation of funds for new road construction competes with the demands of numerous other sectors, including health, education, social welfare, defence, telecommunication and postal services, irrigation and water supply, port facilities, etc.

Changes in governments at all three levels over the past 40 years have not produced any significant changes in the eventual allocation of funds for roads, and there is no indication that there will be significant improvement in the future.

This paper suggests a strategy for the building of toll facilities subject to certain constraints. The motoring public strongly feels that it is already paying more than its share in direct and indirect taxation, and will react negatively and probably forcefully, unless it can perceive obvious and tangible short and long-term benefits.

TOLL ROAD PARAMETERS

The parameters of the suggested strategy are as follows:

1. THE FACILITY MUST BE FINANCIALLY VIABLE

Under the financial and operating arrangements detailed in Section 4, each project must be financially viable and seek recovery of capital costs; desirably in less than 15 years (within 10-12 years preferred).

In passing, it should be noted that the financial calculations for each project require detailed estimates fo acquisition and resumption costs, interest rates and repayment details, toll collection and operating costs, etc., to enable calculations applicable to each specific project to be made.

Therefore, only broad financial generalisations can be made in this paper, leaving financial calculations of particular projects to be made when more precise data are available.

Attitudinal surveys were conducted by the RACQ (Kenny, unpublished paper, 1972) by interviewing users of sections of the Bruce Highway from Brisbane to Nambour. These confirmed general acceptance of the proposal based on a "user pays" principle, conditional on a period of operation of the road as a toll facility being limited to a defined period of between 10 and 15 years.

This was confirmed in a subsequent survey in December 1974 and January 1975 at Bribie Island among three subject survey categories:

a. Residents of Bribie Island,
b. Day trippers (weekends), and
c. Commercial users.

The Bribie Island Bridge had been operated as a toll facility since 1963 and a charge of 60 cents per private vehicle had been levied from 1963 to early 1975, when the toll was removed.

Previously, access to the island had been by vehicle barge at a cost of $1 per crossing, and the higher level of service of the bridge (24 hours versus daylight hours only), the improved level of service (no waiting for the barge), and improved safety were acceptable to all those surveyed.

Regular users (resident and commercial), indicated that an additional factor in their acceptance of the toll was the assurance by the government that it would be removed when the capital cost of the toll bridge had been recovered.

2. **THE TOLL FACILITY SHOULD BE OF FREEWAY STANDARD TO REDUCE BOTH TRAVEL TIME AND ROAD TRAUMA, WITH THE SAVING IN ROAD USERS' TIME AND RUNNING COSTS GREATER THAN THE TOLL PAID**

The attitudinal surveys (1972) conducted on the Bruce Highway at service stations, roadside fruit and vegetable stalls and convenience food outlets confirmed that motorists, even though resenting the payment of additional fees when they considered that, as a class, they were already overtaxed, accepted the concept of the payment of a toll of approximately 60% of the calculated SAVINGS enjoyed by using the newer, higher grade facility.

For some motorists to accept this concept, it was necessary to draw the respondent's attention to an estimate of total savings per trip, which included

savings in time, decreased fuel consumption, wear and tear on tyres, brakes, transmission systems, etc. Even among those respondents convinced that motorists as a group were already overtaxed, a charge of about 60% of the SAVINGS enjoyed by using the new, higher grade facility was indicated as acceptable.

3. **THE TOLLS TO BE REMOVED AS SOON AS CAPITAL COSTS ARE RECOVERED**

This was another constraint revealed in the attitudinal surveys, required for acceptance by the motorists interviewed.

Almost unanimously, those interviewed indicated non-acceptance of the toll road concept, in which the toll facility became another point of tax collection on motorists (both private, recreational and commercial) or when viewed as another governmental method of "revenue raising".

In calculating the time for recovery of the capital costs, this strategy accepts the recovery of capital repayments, interest charges and operating costs (e.g., toll collection costs, etc.) but not maintenance costs of the facility, which are seen to be the responsibility of the relevant commonwealth, state or local authorities operating the facility.

4. **THE FACILITIES TO BE FINANCED AND OPERATED BY THE PUBLIC SECTOR, BUT NOT FROM CURRENT ROAD FUNDS**

This parameter is critical because of the existing taxation laws in Australia.

Two main alternatives are currently available:

a. Financing through the private sector and,
b. Financing through the public sector.

Financing and operating a toll facility through the private sector currently attracts 49% company tax on pre-tax profits and payroll tax, if the salaries for all employees exceed $312,000.

Under current Australian taxation procedures, therefore, a combination of company tax and payroll tax reduces annual nett profit by at least 50%.

At best this means that an operating company must either charge twice the toll or take at least twice as long to recover its capital cost - neglecting justifiable return on investment, interest charges, etc.

This is one of the areas in which broad financial generalisations have to be made because details specific to a particular project are unknown, e.g., the expected rate of return on the risk capital, interest on borrowed funds, etc.

But by making reasonable assumptions on the necessity of repayments of interest or shareholders' dividends, the recovery of capital costs, for a toll facility owned and operated by the private sector, can take three or four times as long when compared to the same facilities' being owned and operated by the public sector (i.e., 30 or 40 years instead of 10 years), if the same toll charges are levied.

This is simply because the ownership and operation of such facilities by the public sector (local, state or federal government) does not require the payment of those taxes (company tax) applicable to the private sector.

Under current Australian taxation laws, therefore, operation of a toll facility creates another instrument and location of tax collection from road users if the facility is owned by the private sector. This requires either an increase in the tolls charged for each use of the facility, or a significant extension of the time span for the recovery of funds invested, or a combination of both.

All of these act as disincentives to potential users of such facilities.

5. ANY EXISTING "FREE" ROAD IN CLOSE PROXIMITY TO THE TOLL FACILITY TO BE RETAINED AND ADEQUATELY MAINTAINED

Where the new, higher grade toll facility is in proximity to an existing facility providing service to other interests, (local residents and businesses, farming communities, access to tourist attractions, etc.), it is essential that the existing facility be adequately maintained for as long as that existing facility continues to satisfy the needs of new and pre-existing interests.

Established precedent for this condition exists in the retention and maintenance of existing roads following the construction of Tollways north and south of Sydney in New South Wales.

ADDITIONAL BENEFITS

The construction of toll roads, within the above parameters, generates additional benefits in that higher grade facilities (better roads) can be provided much earlier than by the current systems of road funding, with their attendant disadvantages.

Because a significantly greater length of upgraded road can be constructed in one operation, economies of scale in the provision of materials, etc., can be realised, and reduction of other construction costs (e.g., less frequent relocation of construction plant and equipment) can be realised, compared with the present method of piecemeal construction as limited funding becomes available.

Loan repayments over shorter periods are also capable of effecting significant savings.

Additionally, provision of a high grade access facility and by-passes around towns can make tourist and recreational areas more accessible and can thus accelerate development of such areas - if this is considered to be desirable (examples: Bribie Island and Sunshine Coast Areas, Queensland).

REDUCTION OF ROAD TRAUMA

While provision of an improved-standard toll facility yields immediate benefits to its users, another significant saving realised as a result of the earlier construction of a freeway is the reduction of road trauma.

Searles (1985) reported:

> "In the U.S.A., the interstate highways (mainly freeways) have an accident injury rate one-quarter of that of non-interstate highways".

This indicates a reduction of 75%.

Waslin (1984) in a paper presented at the National Road Safety Symposium in October 1984, quoted a D.M.R. (NSW) report:

> "When a two-lane highway is replaced by a freeway, accident savings in the order of 80-85% can be expected' (Kenderes, 1982). More specifically, results show that the provision of the Yanderra to Aylmerton Section of the South Western Freeway (now Hume Highway) resulted in a reduction in the all-accident rate of 89%, in the injury rate of 88%, and in the fatality rate of 78%. These are statistically significant reduction rates".

The achieved reduction of road trauma following the opening of a freeway-standard facility is largely dependent on the degree of inadequacy of the superseded road.

Photograph 1 shows the minimal horizontal separation between vehicles travelling in opposite directions on what was a major highway (with AADTs of 10,000) until only very recently. Photograph 2 shows the new facility where opposing traffic is separated by more than 10 m. The potential for reducing head-on collisions is obvious.

Similarly, the increase in radius of both vertical and horizontal curves and reduction in conflict potentials from traffic entering, exiting or visiting rest stops or shops along the highway reduces the number of single vehicle and angled collisions.

The reduction in road trauma costs is not usually seen by governments as a direct saving. Nevertheless, the savings to the community as a whole are real and could/should be included in the cost-benefit calculations of the new facility. If included, the pay-back period would be substantially reduced.

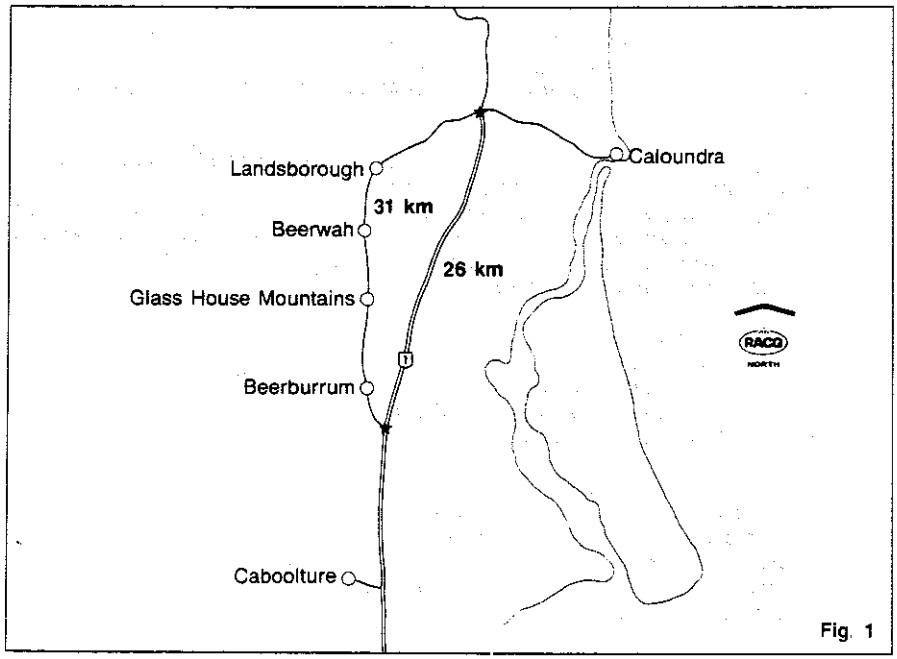
TOLL FACILITIES: A ROAD CONSTRUCTION OPTION

CASE STUDY

A recently completed section of freeway-standard road in Queensland illustrates the advantages of the strategy proposed in this paper.

This 26 km, four-lane divided length of the Bruce Highway was constructed as an alternative to 31km of two-lane undivided highway which passed through the townships of Beerburrum, Glass House, Beerwah and Landsborough (fig. 1).

FIGURE 1. SECTION OF BRUCE HIGHWAY



Although the superseded section of the old highway was both inadequate and dangerous, the opening of the new section was not possible until December 1985 due to the deficiency in current road funding arrangements.

The National Association of Australian State Road Authorities (NAASRA) Guide to Traffic Engineering Practice (Section 2) specifies road traffic volumes and levels of service for various types of road, and provides the formula:

SERVICE VOLUME = (V/C) W.T.

Where (V/C) is the service volume/capacity ratio:
W is the lane width, and
T is the truck adjustment factor.

Making very conservative assumptions for the variables in this formula, e.g., assuming:

a. Stable flow for rural highways,
b. 80% of road with overtaking sight distance greater than 450m.,
c. operating speed greater than 80 km/h (for 95km/h V/C = 0.35),
d. lane width 3.4 m (highest level 3.7 m)
e. distance from traffic lane edge to nearest obstruction 1.2 m (guide posts)
f. Percentage of trucks 10%, and
g. rolling terrain,

the formula gives:

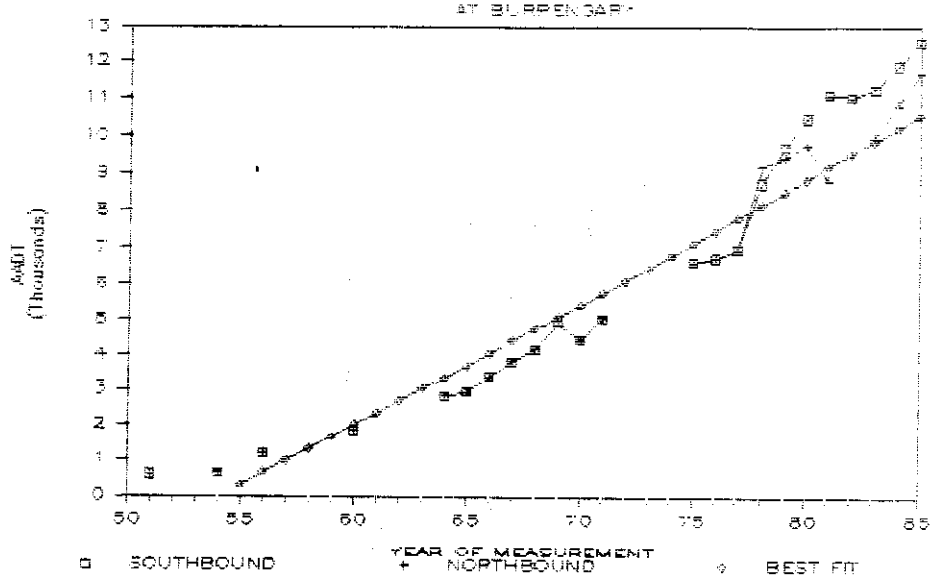
SERVICE VOLUME = 2000 x 0.35 x 0.83 x 0.71
= 413 v.p.h.

5000 v.p.d. over 12 hours
(in one direction)

Figure 2 shows the AADT on the Bruce Highway at the location nearest to the relevant section of road at which traffic counts are available. It indicates that the service volume figure, for one direction on this type of highway, was first exceeded in 1969. Following a drop in 1970, it was again exceeded in 1971, after which it continued to increase annually to 12,500 in 1985.

Construction of the freeway-standard road in 1971 as a toll facility, and operated by the public sector in accordance with the parameters listed in this paper, would have resulted in the recovery of all capital costs and interest charges in about ten (10) years. This section of the highway would thus have reverted to toll free use by the early 1980s.

FIGURE 2 AADT ON BRUCE HIGHWAY AT BURPENGARY



Also, the redemption of costs on this section of highway would have provided two alternatives for the construction of the next major section of Highway 1 north to Nambour (including a by-pass around Nambour):

a. Construction as an additional toll section, or,

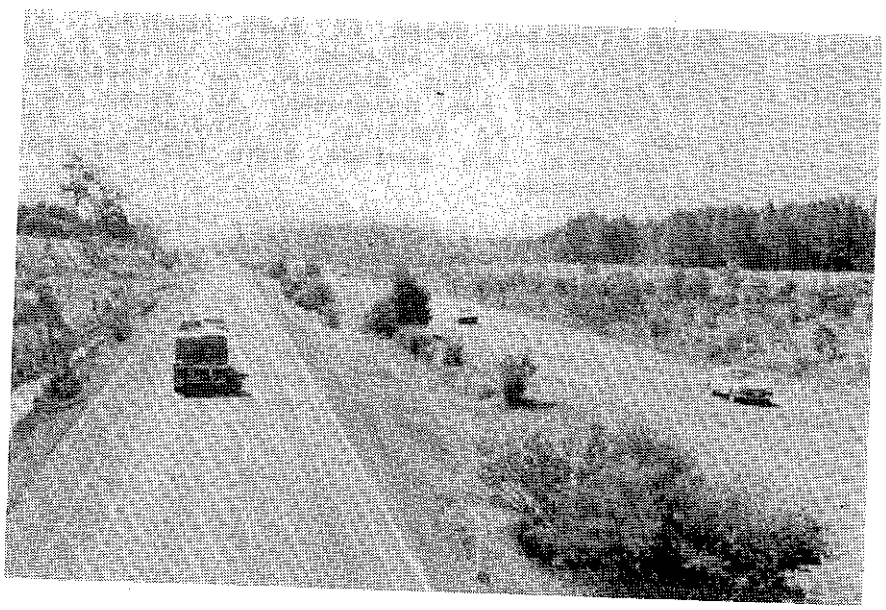
b. Construction as a "free" facility using the funds expended on the section completed in 1985.

Construction of the higher grade road in the early 1970s would have also returned significant savings due to reduced road trauma.

Crash data provided by the Australian Bureau of Statistics for the five years 1981-1985 (inclusive) list 54 deaths (an average of 11 per year) and 343 (an average of 68 per year) seriously injured in the period immediately prior to opening of the new section. The same source lists four deaths and 30 persons seriously injured for the same area in the first year of operation of the new highway.

Photographs number 1 & 2 explain the reason for the reduced road trauma in these changed circumstances.

Photograph 1: Typical traffic using the 6.4m wide, two-lane undivided highway



Photograph 2: The standard of facility with opposing traffic separated by 10m wide reserves which could have been built fifteen years earlier if the strategy suggested in this paper has been implemented.

Accepting the limitations of short term crash data (i.e., one year), estimates of costs provided by the Bureau of Transport Economics (1984) of $350,000 for each fatality and $55,000 for each serious injury, suggest annual average savings of $4.5 million (1986 values) - due solely to the reduction of road trauma directly attributable to provision of the freeway.

Current traffic volumes of 24,000 vehicles per day (both directions) also give an indication of the financial returns likely to be achieved for, say, a $1 charge in each direction.

Daily return	$24,000 per day
Less collection costs	$ 4,000 per day
Nett return	$20,000 per day
Nett return per week =	$140,000
Nett return per year =	$7.28 million

This is an excellent return on a capital outlay of $26 million (1986 values), and would enable the repayment of capital expenditure and interest charges within the time span suggested in this paper.

The estimated saving of $4.5 million per year due to reduced road trauma would have been an added bonus.

CONCLUSION AND RECOMMENDATION

This paper has outlined some of the criteria necessary for determining the viability and acceptability of toll facilities as an alternate means of road funding. An income expenditure analysis showing this option to be viable in 10-15 years has been proposed as a necessary requirement. However, the government is urged, when considering the means of funding, to include in the cost/benefit analysis, the savings from the expected reduction in road trauma.

This could, in some cases, be the deciding factor and in most instances, could mean a great reduction in either the toll itself or the period for which it is applied, or a combination of both.

It is expected that intelligent use of these methods could, in the long term, greatly improve Queensland's highways more quickly than could otherwise occur.

ACKNOWLEDGEMENTS

The assistance of R.A.C.Q. Traffic Engineers Bruce Hartwig and John Wikman in preparing this paper is acknowledged and appreciated, as is the typing of the manuscript by S. Alldridge.

REFERENCES

National Association of Australian State Road Authorities, - Guide to Traffic Engineering Practice, 1976.

SEARLES, B. - Overseas Investigations of Road Safety Countermeasures - N.R.M.A. Sydney, Feb. 1985.

WASLIN, N.A. - Designing Safer Road Systems - National Road Safety Symposium - People and the Road Environment- Department of Transport, Aust. 1984.