APPORTIONMENT OF COST

NOVEMBER 2008

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1.0 Introduction

These guidelines for the apportionment of costs for works on State Roads between the RTA and Councils have been developed by the RTA and the Local Government and Shires Associations.

2.0 Apportionment of Costs - General

2.1 Principles

In apportioning costs for works on State Roads between the RTA and Councils the following agreed approach has been adopted:

- That the Roads Authority Funds meet the costs of an agreed basic level of service to cater for traffic conditions for the life of the project while Council meets the costs of development works in excess of that agreed standard.

The Roads Authority Funds may be provided exclusively from RTA funds or, if a shared funding arrangement is in place, from a pool of RTA and Council funds. That is if, for example, the RTA and Council agree to contribute equally to the project/program, the Road Authority's contribution to costs would be met from the pool of joint funds.

The levels of service and standards of road construction are to be those which are supported by the RTA. The current RTA endorsed standards established by AUSTROADS and the former National Association of Australian State Road Authorities (NAASRA) are suggested as the most fitting.

No distinction is to be made between works in different areas of the State as the apportionment of costs is based on traffic needs.

It is intended that the on-going maintenance costs after project completion will be apportioned in accordance with the Road Maintenance Council Contracts (RMCC), see Annexure B of RTA document M2..

2.2 Application

The cost apportionment process is outlined in Clause 2.7. It is critical to the apportionment process that road and traffic design codes of practice accepted by both the RTA and Council are used to design a roadway which will provide an agreed level of service at the end of its design life. The RTA endorsed *"Guide to Traffic Engineering Practice", NAASRA (1988), Part 2 (Roadway Capacity) and Part 3 (Traffic Studies)* are currently seen as the most suitable source documents for design level of service methodology.

Level of Service D is to be applied to determine the number of traffic lanes which should be provided. This Level of Service is considered to reflect the boundary state between stable and unstable traffic flow conditions and hence the desirable end of a roadway's service life. It is defined differently depending upon the particular location of the road as defined below.

2.3 Definitions

Non-Urban / Rural Areas

Roads in non-urban areas will generally contain many of the following features:

- Localised street lighting at major intersections only.
- Sparse development adjacent to the road with buildings generally set a considerable distance back from the road boundary.
- Land use generally associated with agricultural, forestry or passive recreational activities or industries involving large scale operations.
- Intersections will be widely spaced. (approximately 1 km minimum)
- Road traffic has little or infrequent interaction with adjacent development.
- Regulatory speed generally 80 km/h or more.

Uninterrupted Flow (generally rural-type conditions)

Traffic flow conditions are the result of interactions between vehicles in the traffic stream, and between vehicles and the geometric and environmental characteristics of the road. There are no fixed elements external to the traffic stream, such as traffic control signals which cause interruptions to traffic flow.

Under such conditions Level of Service D is close to the limit of stable flow and is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.

Urban Areas

Roads in urban areas will generally contain most of the following features:-

- Street lighting.
- Extensive residential, commercial or industrial development or associated land uses abuts the road.
- Significant interaction between adjacent development and passing traffic.
- Considerable pedestrian movements.
- Closely spaced intersections.
- Numerous public utility services will be present.
- Regulatory speed generally 80 km/h or less.

Urban areas include all cities and suburbs plus towns in otherwise rural areas.

Interrupted Flow (generally urban-type conditions)

Fixed elements such as traffic control signals, stop signs or other types of control cause traffic to stop periodically, irrespective of the total amount of traffic.

Under these conditions Level of Service D borders on a range in which small increases in flow can significantly increase intersection delay and reduce travel speed. Travel speeds are about 40% of the free flow speed.

2.4 Apportionment Data

The typical mid-block capacity of urban roads with interrupted flow are shown in Table 7.3 of "Guide to Traffic Engineering Practice" - Part 2 - Roadway Capacity. These values represent Level of Service E and hence are reduced for Level of Service D as tabulated below.

Table 2.1

Typical Service Flow Rates For Level of Service D with Interrupted Flow

Type of road carriageway	One-way mid-block passenger car units per hour
2 lane undivided (with occasional parking)	540
2 lane undivided (with no parking)	810
4 lane undivided (with occasional parking)	1350
4 lane undivided (with clearways or no standing)	1620
4 lane divided (with clearways or no standing)	1710
6 lane undivided (with occasional parking)	2160
6 lane divided (with clearways or no standing)	2610

The method of identifying those specific years within the life of the project in which each roadway lane is essential to meet Design Hourly Volume (DHV) demand is illustrated graphically at Figure 2.1.

Use of the highest volume indicator described in Section 2.5.4, 'Guide to Traffic Engineering Practice' - Part 3 - Traffic Studies as the basis for specifying current and future design traffic volumes is recommended.

To achieve the desired level of service at an acceptable cost an appropriate Design Hourly Volume (DHV) must be selected. The recommended DHV's are listed in Table 2.2 for the various traffic environments.

Table 2.2

Highest Design Hourly Volume

And Alternative Percentage of AADT

Traffic environment	Highest DHV	DHV as a % of AADT
National Route	100th	---
Urban Arterial Road	30th	10%
Rural Arterial Road	50th	15%
Collector or Distributor Road	100th	12%
Recreational Road	150th	18%
Developmental Road	100th	12%

In the absence of detailed traffic count data sufficient to establish the appropriate DHV, use of the publication "Traffic Volumes and Supplementary Data" - Roads and Traffic Authority may be applied in conjunction with use of the percentage values shown in Table 2.2. Directional traffic split information would also be required together with the estimated number of heavy vehicles.

Traffic growth over the design life may be linear or compound depending upon the rate of traffic generating development affecting the road. In general, rural areas will experience linear growth whereas urban areas will experience compound growth.

In order to determine the appropriate growth rate to be used, a review of past AADT figures and known/likely significant traffic generating developments affecting the roadway during the design life should be undertaken.

In view of the uncertainty associated with determining both the DHV and appropriate growth rate a design life of twenty (20) years should be adopted for all projects. This design life solely relates to the level of service criteria and not to pavement design life which may be considerably more on important roads.

A sample calculation to determine the apportionment of cost for roadworks between the Road Authority and Council is in Section 2.8.

The method of apportioning each element of cost is listed in Clause 3.0 (Apportionment of Cost - Specific Items).

2.5 Development Contributions

The cost of additional works on a State Road required to cater for a significant private or Council development shall be apportioned fully to Council only where it is the Consent Authority.

It shall normally be Council's responsibility as the Consent Authority to obtain a contribution for any such works from the developer pursuant to the provision of the Environmental Planning and Assessment Act, 1979, or through other agreements.

2.6 Advantages

The guidelines focus directly upon the project objective of providing an agreed level of service to motorists during periods of peak demand over the agreed project design life. It also places responsibility with the Road Authority for bearing the cost of providing roadworks to a standard which meets accepted codes of practice.

The guidelines include provision for Council to enhance any project beyond the minimum level of service at its own cost or at a developer's cost should it consider this desirable.

Should the level of service calculation reveal that an additional traffic lane is required within the design life (20 years) but it is not required for many years Council would retain the option of not proceeding with construction of this facility as part of the project. Early in the project development phase Council should indicate to the RTA its priority/financial commitment to the project and whether it is prepared to support its share of cost for any additional lanes or footways.

If Council does not wish to pursue construction of any additional works due to financial constraints, then the Road Authority may also defer construction of the additional facilities or alternatively construct them at its full cost.

2.7 The Cost Apportionment Process

The Road Management Authority (RMA)
i.e. the RTA or Council, depending upon the classification
of the road, identifies critical traffic volumes
for the project design life (20 years)
and the desired traffic lane requirements.

°

V

Council identifies any project enhancement
(eg parking lanes, it believes should be
implemented as part of the project)
or whether to limit construction to
essential lane requirements only.

°

V

The RMA identifies the specific years
within the life of the project in which
each roadway lane is essential
to meet Design Hourly Volume (DHV) demand
using RTA and Council endorsed guides.

°

V

The cost of constructing each roadway lane is
apportioned with Road Authority Funds meeting the cost of providing each lane as and when it is required to meet DHV demand (eg, if a lane is required to meet say the DHV after 15 years of a 20 year project design life the Road Authority Funds will bear 25% of the cost of the immediate construction of the lane).

Council will meet the residue of project costs,
including the cost of any project enhancement
beyond that necessary to meet traffic demands.

°

V

The RMA prepares project geometrical design plans
and an estimate of cost.

°

V

The RMA completes a draft apportionment of costs
and submits it to the other party for its concurrence.

NOTE:

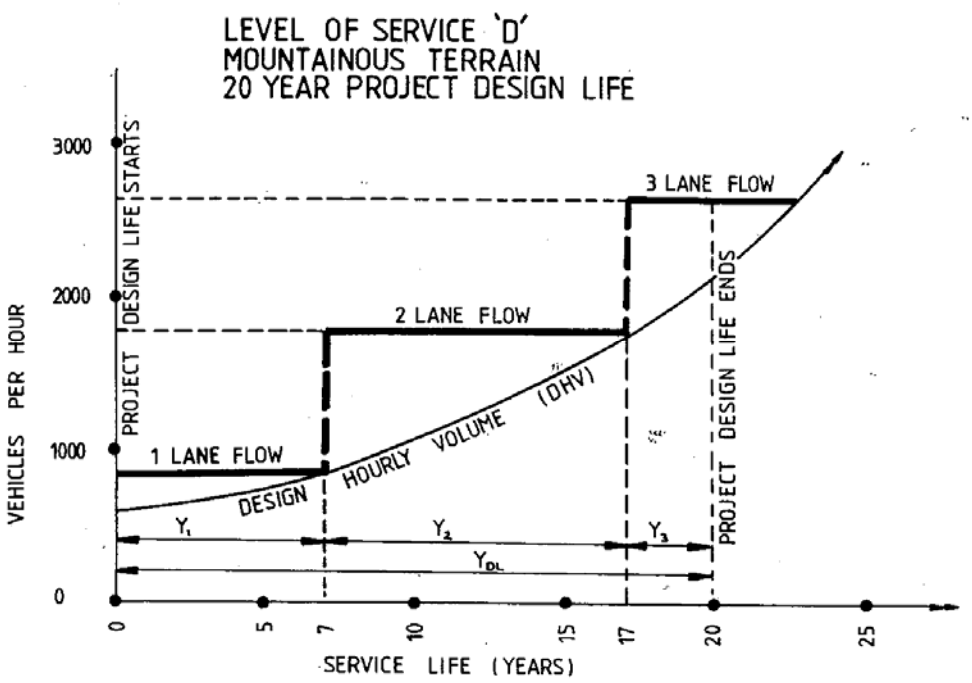
Agreement between the RTA and Council is to be reached progressively on the outcomes of the above stages in the cost apportionment process.

Figure 2.1

Example of Design Hourly Volume (DHV)

Lane Requirements during Project Design Life

2.8 Example of Apportionment of Cost



Lane 1:

Essential for Level of Service "D" from the outset and for full life of project.

Roads Authority Funds apportionment = full lane cost

Lane 2:

Essential in the periods Y_2 and Y_3 (or 13 years) of the project design life of Y_{DL} (or 20) years.

Roads Authority Funds apportionment = $\{ (Y_2 + Y_3) / Y_{DL} \} \times$ (lane cost)

= (13 / 20) × (lane cost)

Council apportionment = $(Y_1 / Y_{DL}) \times$ (lane cost)

= (7 / 20) × (lane cost)

Lane 3:

Essential in the period Y_3 (or 3 years) of 20 year project design life.

Roads Authority Funds apportionment = $(Y_3 / Y_{DL}) \times$ (lane cost)

= $({}^{3} / 20) \times$ (lane cost)

Council apportionment = $\{ (Y_{DL} - Y3) / YDL \} \times$ (lane cost)

= $({}^{17} /20) \times$ (lane cost)

3.0 Apportionment of Cost - Specific Items

3.1 Medians and Traffic Facilities

Where medians, islands, right and "U" turn storage bays, pedestrian refuges, pedestrian and traffic signals and traffic facilities form part of the approved project the Roads Authority will bear the full cost of these measures as they are critical to the effective operation of the traffic lanes.

3.2 Roadway Lanes

The desirable number of roadway lanes to be provided is determined by the need to meet the Design Hourly Volume (DHV) demand. The number of lanes actually constructed may be varied from that calculated above as stated in Section 2.6

The cost of constructing each roadway lane is apportioned on the basis of its requirements to meet DHV demand as a proportion to the design life of the project.

Council's cost is proportional to the period up until the lane is required to meet DHV demand whilst the Road Authority's cost is proportional to the period that the lane is required to meet DHV demand.

Lane widths should follow the distribution shown in the RTA's "Road Design Guide" or "Delineation Guidelines".

The design carriageway widths for each section of road will be determined on the basis of site constraints and the merits of each case in accordance with RTA design guides or adopted engineering principles.

3.3 Road Shoulders / Kerb and Gutter

Standard width road shoulders shall be provided in rural areas and kerb and gutter in urban areas as a matter of policy unless otherwise requested by Council.

Urban roads shall be defined by neighbouring land use being either residential, industrial, commercial or an associated use such as schools, sporting facilities, car parks and public utility installations. However, kerb and guttering shall not be placed adjacent to vacant land in an otherwise urban area as part of a State Road project unless, due to the merits of the situation, approval to its construction is obtained from the RTA.

The Roads Authority Funds will bear half the cost of kerb and gutter construction in urban areas. Council will bear half the cost of kerb and gutter or may elect to recover up to this amount from adjacent property owners pursuant to Section 217 of the Roads Act, 1993.

In an urban area where kerb and gutter is not warranted and is not requested by Council the same rural cross section as in the adjacent rural area should normally be adopted. In this case the Roads Authority Funds will bear the full cost of the replacement shoulder. In addition where it is cost effective to widen, strengthen or seal the shoulder to reduce edge maintenance costs, the Roads Authority Funds will meet the cost to a maximum shoulder width of three (3) metres.

The Road Authority will bear the full cost of road shoulders in rural areas or the full cost of kerb and gutter where provided as an alternative. The absolute minimum shoulder width is one (1) metre with the desirable minimum width being two (2) metres.

3.4 Auxiliary Lanes / Bus Bays

Auxiliary lanes on State Roads essential to maintain traffic flow at the design level of service will be constructed in both rural and urban areas at full cost to the Roads Authority Funds.

3.5 Parking Lanes

Council will bear the full cost of subsequent upgrading of a road shoulder to the standard of a parking lane in rural areas should it seek construction of this facility. This includes the cost of any kerb and gutter placed subsequent to the State Road construction project.

Council will bear the full cost of the earthworks, road pavement and surfacing required to provide a parking lane in urban areas, with the kerb and gutter cost apportioned as in 3.3 above.

3.6 Cycleways

The Roads Authority Funds will bear the full cost of all traffic lane widening necessary to accommodate a cycleway approved by both Council and the RTA as an element of an adopted cycleway strategy plan.

The Roads Authority Funds will bear half cost of an agreed separate cycleway or shared cycleway / footpath constructed along or adjacent to a classified road.

3.7 Footways / Footpath Paving

Unless previously agreed profiling of a maximum 3.7 metre wide earth footway along both sides of a road carriageway to cater for pedestrian traffic and servicing is mandatory in urban reconstruction. The Roads Authority Funds will bear the full cost of this work including the cost of any necessary land acquisitions, retaining walls, access and property adjustments associated with such profiling. However, where these associated works have been or become necessary due to enhancement works requested by Council (eg provision of a parking lane), Council will bear the proportional additional cost resulting from the development works.

Council will bear the full cost of constructing footpath paving.

3.8 Stormwater Drainage

Stormwater drainage systems should generally be designed in accordance with the recommended procedures in "Australian Rainfall and Runoff - A Guide to Flood Estimation", Institution of Engineers Australia, 1987. On projects with significant drainage consequences or cost it may be desirable to review the total catchment management strategy to assess whether facilities such as farm dams, levees, diversion structures or detention basins should be constructed or upgraded to offset the cost of downstream drainage works. In such situations the Roads Authority Funds will contribute to the cost of constructing such alternative facilities in a proportion to be agreed based upon the merits of each case.

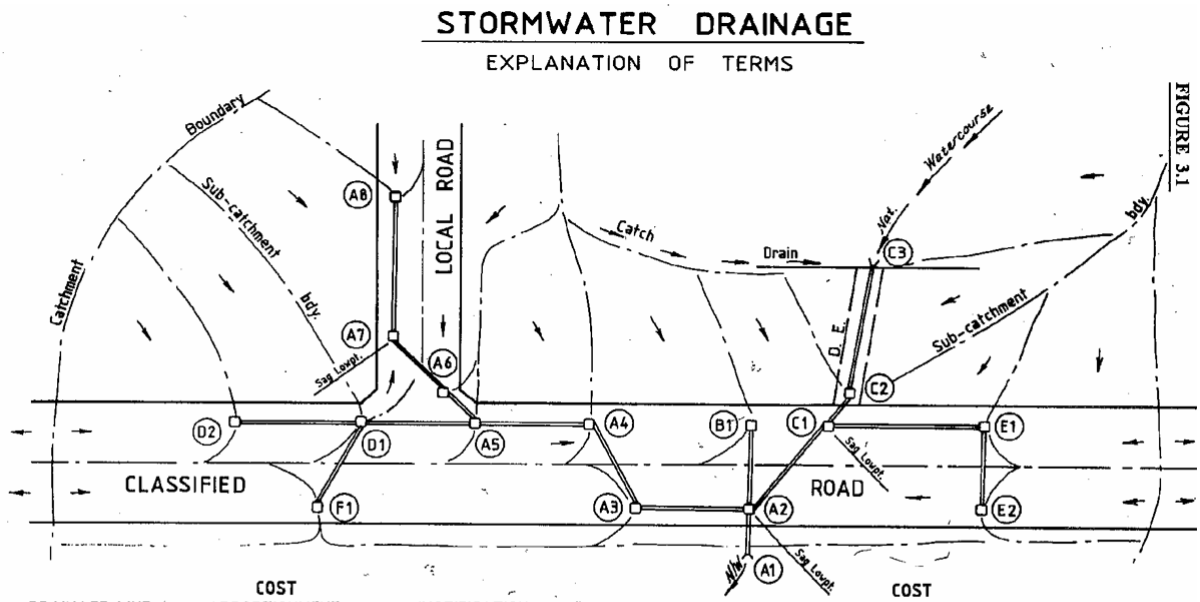
The Road Authority will bear the full cost of providing transverse drainage works within the road reserve. The Roads Authority Funds will also bear the full cost of any longitudinal drainage works required to cater solely for the stormwater runoff from catchment areas draining directly onto or within the project site. Such systems shall be designed to cater for the stormwater runoff determined on the basis that the catchments are fully developed to the potential of the areas' zoning(s).

Council and the Roads Authority Funds will share the cost of longitudinal drainage works required to incorporate an indirect or 'district' drainage system. The proportion of cost to be borne by Council shall be the ratio of the design Equivalent Impervious Area (EIA) of the district drainage catchment to the design EIA of the total catchment for the section of longitudinal drainage under consideration.

The Roads Authority Funds will bear the cost of any drainage works required outside the road reserve to enable satisfactory discharge into Council's outfall stormwater system or to a natural watercourse. Where the outfall system is discharged into a natural watercourse of inadequate capacity or stability, the obtaining of drainage easements is necessary pursuant to Section 3.10 to facilitate improvement works.

Figure 3.1 provides diagrammatic representation of the typical elements of a drainage system and the appropriate cost apportionment.

Provision of necessary inlet, outlet, pollution control and scour protection measures are an integral part of the transverse drainage works and are full cost to the Roads Authority Funds.



DRAINAGE LINE	COST APPORTIONMENT	JUSTIFICATION
A1 - A2	RAF	Transverse drainage
A2 - A3	RAF/COUNCIL	Shared longitudinal
A3 - A4	RAF	Transverse drainage
A4 - A5	RAF/COUNCIL	Shared longitudinal
A5 - A8	COUNCIL	District drainage
A2 - B1	RAF	Transverse drainage
A2 - C2	RAF	Transverse drainage
C2 - C3	COUNCIL	District drainage
A5 - D2	RAF	Direct drainage
C1 - E1	RAF	Direct drainage
E1 - E2	RAF	Transverse drainage
D1 - F1	RAF	Transverse drainage

DRAINAGE STRUCTURE	COST APPORTIONMENT	JUSTIFICATION
H'wall A1 incl. Scour Protection and Pollution Control measures	RAF	Transverse drainage
Pits A2, A3 & A4	RAF	Transverse drainage
Pit A5	RAF/COUNCIL	Shared longitudinal
Pits A6, A7 & A8	COUNCIL	District drainage
Pit B1	RAF	Transverse drainage
Pits C1 & C2	RAF	Transverse drainage
H'wall C3 & Scour Protection	COUNCIL	District drainage
Pit D1	RAF	Transverse drainage
Pit D2	RAF	Direct drainage
Pits E1 & E2	RAF	Transverse drainage
Pit F1	RAF	Transverse drainage

3.9 Utility Services Relocations/Adjustments

The cost of any utility service relocations or adjustments will be shared between Council and the Road Authority in the same proportion as the total direct cost of all roadworks and drainage works (excluding all miscellaneous works). Roadworks shall include associated earthworks, sub-base and base, wearing surface and kerb and gutter (if any) and drainage works shall include bridges and district drainage works only on projects where these works influence the cost of the necessary relocations or adjustments.

Utility services shall include telephone, electricity, gas, water and sewer mains or facilities. No variation to this basis of apportionment shall apply if Council is the controlling Authority of the utility service affected.

3.10 Property Adjustments and Land Acquisition

The Roads Authority Funds will bear the full cost of property adjustments and access adjustment costs, survey, valuation and legal fees, and any compensation payable for the refixing of road levels, property damage or loss of amenity associated with a project.

Property adjustment costs shall be limited to the work necessary to reinstate a property (where possible) to the condition or amenity which existed prior to the road project. This includes the cost of any noise reduction facilities or associated measures. The property owner must bear the estimated additional cost of any improvement work sought in conjunction with the reinstatement.

The Roads Authority Funds will also bear the full cost of land acquisitions associated with an approved road widening or drainage scheme. Should Council seek to acquire land beyond the limit of the approved scheme to facilitate its enhancement works then Council must bear any additional cost of such acquisitions.

The cost of acquiring any easements necessary to contain the approved works shall also be borne fully by the Roads Authority Funds except for easements acquired by Council outside the approved scheme to facilitate development works.

3.11 Side Streets

The Roads Authority Funds will bear the full cost of reinstating all side streets to the level of service existing prior to the reconstruction of the road.

Where a surfaced State Road intersects with an unsurfaced side road a sprayed bituminous surface 7.0 metres wide shall be provided in the side street for a distance of 10.0 metres to prevent grit being carried onto the State Road. The cost of this work shall be shared equally between Council and the Roads Authority Funds.

Council will bear the cost of all other works undertaken to increase the level of service of the side street.

3.12 Intersections

The cost of constructing traffic lanes through an intersection (including the circulating carriageway of a roundabout) will be apportioned at the same ratio as the cost of traffic lanes (excluding parking lanes) on the major State Road leg adjacent to the intersection.

3.13 Existing Facilities

Where existing kerb and guttering, cycleways, footpaving or utility service bridges are affected by works on a State Road the Roads Authority Funds will meet the full cost of replacing or reinstating such facilities.

3.14 Bridges

Bridges on State Roads over a watercourse or floodway shall be considered as transverse drainage with full cost to the Roads Authority Funds, including the full cost of one footway or a shared footway / cycleway. Where a second footway or shared footway / cycleway is provided on a bridge the cost of this facility is to be shared equally between the Roads Authority Funds and Council.

Provision of grade separated overpasses or underpasses involving a State Road for any purpose other than a pedestrian or utility service facility will be at full cost to the Roads Authority Funds as these facilities are considered essential for the efficient operation of the State Road.

The cost of grade separated pedestrian facilities will be shared equally between Council and the Roads Authority Funds. Utility service bridges shall be constructed and maintained at the full cost of the utility authority.

In situations where a bridge approach is depressed to act as a causeway during significant storm events, the cost of any batter protection work necessary will be at the full cost of the Roads Authority Funds. In such situations the normal apportionment of road carriageway costs will apply.

3.15 Landscaping

The cost of agreed landscaping for batters, footways and medians shall be apportioned fully to the Road Authority, including the initial cost of plant care for proper establishment. The additional estimated cost of enhancement landscaping shall be apportioned to Council.

3.16 Project Assessment

For projects approved by the RTA, the cost of preparation and review of an Environmental Impact Assessment, Development Application or any other fees or charges associated with studies, consents or investigations required to either develop or gain approval for the State Road project shall be borne fully by the Roads Authority Funds.

3.17 Maintenance and/or Rehabilitation Works

Responsibility for the cost of maintenance and/or rehabilitation works will be in accordance with the Road Maintenance Council Contracts (RMCC), see Annexure B of RTA Document M2. The RMCC agreements contain the primary documents that apply to road maintenance across the State, however some other situations may occur in certain areas due to previously arranged local practice.

Traffic lanes will be maintained at full cost to the Roads Authority Funds with parking lanes and adjacent kerb and gutter at full cost to Council. Similarly median and transverse drainage will be maintained at the full cost of the Roads Authority Funds. Longitudinal drainage systems primarily catering for direct catchment areas will be maintained at the full cost of the Roads Authority Funds; however, systems primarily catering for district catchment areas will be maintained at Council's cost.

Footpaths and cycleways will be maintained at Council's cost except on bridges which will be maintained by the Roads Authority Funds. Footways in urban areas will be maintained at Council's cost.

Medians containing paved infill or RTA approved landscaping will be maintained at the cost of the Roads Authority Funds. Enhanced landscaping in medians will be maintained at full cost to Council.

Road shoulders and batters will be maintained at the cost of the Roads Authority Funds.

Once clearway or parking restrictions are imposed upon a parking lane to provide a traffic lane or passing facility for peak hour demands the maintenance responsibility will become full cost to the Roads Authority Funds for the section affected, including adjacent kerb and gutter.

All bridges and causeways on or over State Roads except utility service bridges or those bridges the responsibility of another Authority will be maintained at the full cost of the Roads Authority Funds.

3.18 Roadside Furniture and Facilities

Roadside furniture such as guard fencing, safety barriers, signposting, kilometre posts, emergency or breakdown telephones, reflective markers and guide posts are to be at the full cost of the Roads Authority Funds.

Facilities such as safety ramps, fireplaces (including associated eating, fresh water and toilet facilities), heavy vehicle rest areas and vehicle checking areas are at the full cost of the Roads Authority Funds.

Linemarking and associated reflective markings are also at the full cost of the Roads Authority Funds.

Facilities such as tourist information boards and enhanced fireplace facilities such as children's playground equipment shall be at Council's cost.

3.19 Subsoil Drainage

Subsoil drainage is generally an essential element associated with such works as retaining walls, slope stabilisation and road pavements.

Subsoil drainage works shall be at full cost to the Roads Authority Funds unless they have become necessary solely due to development works requested by Council in which case Council will bear any additional cost.

3.20 Provision for Traffic

The construction, maintenance and removal of temporary works necessary to assist traffic or pedestrian flows during the course of a project shall be shared between Council and the Roads Authority Funds in the same proportion as the total direct cost of all other roadworks and drainage works (including miscellaneous works).

Provisions for traffic shall include flag operators, sidetracks, ramps and traffic control devices including temporary traffic signals.

Where it is necessary or desirable to direct traffic via an alternative route, the cost of upgrading or adjusting the alternative route shall be considered a provision for traffic, including the cost of its normal maintenance during the term of the detour.

3.21 Job Site Charges

Job site charges shall include such elements as on-site amenities, tool sheds, equipment compounds and associated water supply, electricity and telephone costs. The initial site works to establish these facilities and the cost to remove them and rehabilitate the site should also be included under this item.

The cost of these works shall be shared between Council and the Roads Authority Funds in the same proportion as the total direct cost of all other roadworks and drainage works (including miscellaneous works and provision for traffic).

4.0 Sample Calculation of Level of Service

Example

A two lane, two way road with uninterrupted flow on level terrain. A typical location is Station No 05043 on MR 349 - Brisbane Water Drive at Woy Woy Bay Bridge (just north of Woy Woy township). The road design speed is 80 km/h (assumed). Design Level of Service "D", project design life 20 years.

Data

From "Traffic Volumes and Supplementary Data - Newcastle and Districts DMR (1986)":

1986 AADT	= 14,831
Growth Rate	- 2.5% per annum compound (adopted)
Commercial Vehicles	- 10% adopted (8% trucks, 2% buses)
Directional distribution	- Assume 60/40 split during the peak hour.
Design Hourly Volume (DHV)	- Where no detailed traffic count data is available: Adopt DHV = 10% of AADT (Table 2.2) (DHV data as defined in *"Guide to Traffic Engineering Practice - Part 3 Traffic Studies, NAASRA [1988]"*)

1986 DHV = 1,483 (both directions)

Present (for 1990) DHV = 1,637 (both directions) - calculated

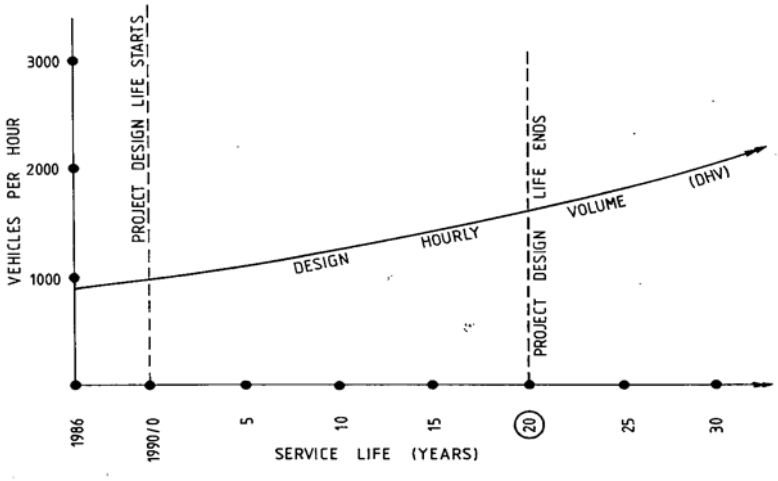
Calculation of Projected Design Hourly Volume (DHV)

One direction DHV = 1,637 x 0.6 = 982. This value is increased at a rate of 2.5% per annum and plotted on Figure A1.

Figure A1

Projected Design Hourly Volume (DHV)

FIGURE A1
PROJECTED DESIGN HOURLY VOLUME (DHV)



Lane Capacity Calculation - two lane road

For Level of Service "D" on a two lane, two way road.

SFD = 2,800 v/c × f_d × f_w × f_{HV}

where: v/c = 1 = 1.0 (T3.1 - level terrain).

NOTE Table 3.1 applies to roads with design speeds >=100 km/h. Adjusting for 80km/h design speed as in this case refer to footnote "b" on Table 3.1 - Average speed is 72.5km/h, therefore read v/c ratio from Level of Service "E" for 60% length <450m sight distance.

f_d = 0.94 (T3.2)

f_w = 0.82 (T3.3 - 3.3m lanes plus 1.0m shoulders)

f_{HV} = 0.90 (T3.4 - 8% trucks and 2% buses)

SF_D = 2,800 × 1.0 × 0.94 × 0.82 × 0.9

= 1,942 vehicles per hour in both directions

In peak direction,

SF_D = 1,942 × 0.6 = 1,165 vehicles per hour.

Lane Capacity Calculation - four lane road

For Level of Service "D" on a four lane undivided road, i.e. two lanes in one direction:-

$SF_D = C \times v/c \times N \times f_w \times f_{HV} \times f_e \times f_p$ (one direction)

where:

C = 1900 (Adopt the 80 km/h value)

v/c = 0.76 (T4.1 - 80 km/h value)

N = 2 lanes (in one direction)

f_w = 0.93 (T4.2 - 3.3m lanes plus 1.2m shoulders - undivided)

f_{HV} = 0.94 (T4.3 - 8% trucks, 2% buses)

f_e = 0.87 (T4.4 - Semi-rural/suburban - undivided)

f_p = 0.95 (T4.5 - Saturday morning peak hour flow - some recreational traffic but mostly regular users)

$SF_D = 1{,}900 \times 0.76 \times 2 \times 0.93 \times 0.94 \times 0.87 \times 0.95$

= 2,087 vehicles per hour in one direction

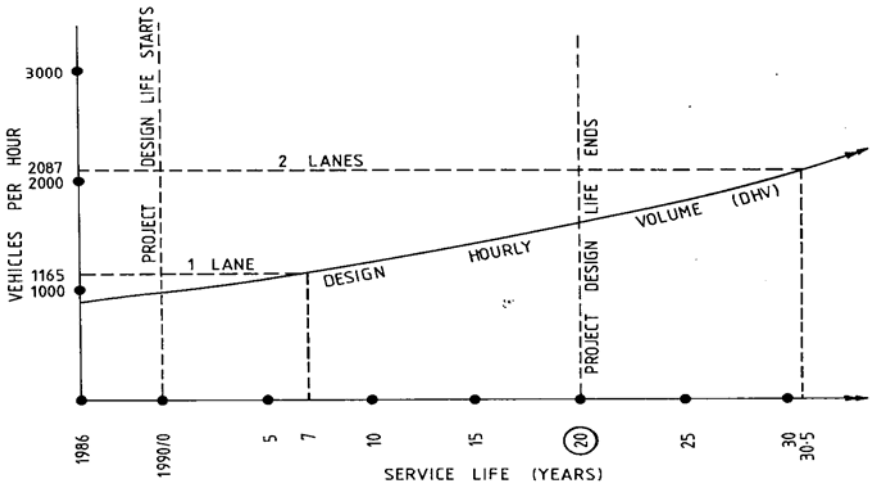
Traffic Lane Requirement Determination

The value of SFD for 1 and 2 lane flow in each direction is plotted on Figure A2 to pin point the specific years within the service life that the level of service will be lowered if an additional lane is not available.

Figure A2

Maximum Traffic Flow Volumes For Level of Service 'D'

FIGURE A2
MAXIMUM TRAFFIC FLOW VOLUMES
FOR LEVEL OF SERVICE "D"



Apportionment of Construction Costs

The present traffic flow of 982 vehicles per hour is less than the one directional service flow rate of SFD = 1,165 vph. In effect the road traffic is yet to reach the maximum peak flow volume for a single lane at Level of Service "D" and a second lane will only be essential in 7 years to avoid lowering the Level of Service.

Similarly a third lane will be required after 30.5 years. However, this is well beyond the project's design life and is not considered further.

Relating saturation volumes directly to the requirement that the Roads Authority Funds bear the cost of providing traffic lanes during the period that they are essential for traffic flow, the following cost apportionment would apply to construction of 2 lanes in each direction (if it were approved during 1990).

Lane 1:

Full cost to Roads Authority Funds as the lane is required during the full life of the project.

Lane 2:

Essential in the period Y_2 (or 13) years of the project design life of Y_{DL} (or 20) years.

Roads Authority Funds apportionment = $(Y_2 / Y_{DL}) \times$ (lane cost)

= $(13 / 20) \times$ (lane cost)

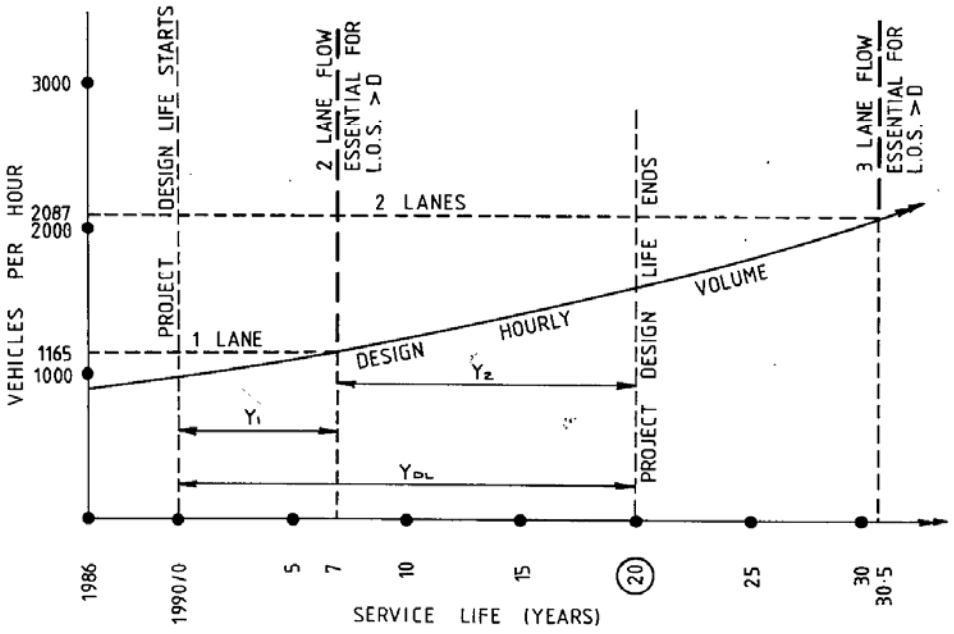
Council apportionment = $(Y_1 / Y_{DL}) \times$ (lane cost)

= $(7 / 20) \times$ (lane cost)

The apportionment ratio measures Y_{DL} , Y_1 and Y_2 are shown on Figure A3.

FIGURE A3

MINIMUM LANE REQUIREMENT TO MAINTAIN LEVEL OF SERVICE "D"



5.0 Guide to Cost Apportionment for Road Construction Items

Guidelines for apportioning various items of costs of a project are summarised in the table below.

Description	Cost apportionment - council/ roads authority funds (raf)	Reference
Traffic		
Provision for Traffic	Same ration as the total direct cost of all other roadworks and drainage works (including miscellaneous works).	CL 3.20
Drainage		
Drainage Culverts	Transverse: 100% RAF Longitudinal: • direct system: 100% RAF • district system: 100% Council • Shared system: the ration of the direct catchment equivalent impervious area (EIA) to the district catchment EIA from design calculations. **Note:** The frequency factors *Fy* or *FFy* used in the Rational Method of design may vary between district and direct drainage systems. Adopt design *CyA* values (EIA) even if frequency factors vary. District: 100% Council Bridges: Generally 100% RAF	CL3.8 CL 3.14
Headwalls, pits and associated inlet/outlet protection works	For transverse system 100% RAF For longitudinal system: • inlet structure: same ratio as the downstream section of culvert • outlet structure: if connecting into a transverse or a district system 100% RAF, otherwise same ratio as the upstream section of the culvert	CL 3.8

Description	Cost apportionment - council/ roads authority funds (raf)	Reference
Bases and cradles (for culverts only)	Same ration as the associated culverts under Item D1 above.	CL 3.8
Subsoil Drainage	Generally 100% RAF	Cl 3.19
Grated Pavement Drains	100% RAF (direct longitudinal drainage)	CL 3.8
Batter Drain	100% RAF (direct longitudinal drainage)	CL 3.8
Kerb and/or Guttering	Replacement: 100% RAF	CL 3.33
Kerb and/or Guttering	New: • Urban areas: generally 50/50 • Rural areas: 100% RAF if placed in lieu of a road shoulder • Additional works requested by Council: 100% Council	CL 3.3
Lining and Facing open drains	Same ration as for an alternative culvert under Item D1.	CL 3.8
Earthworks (All sub-items)	For Roadworks - (based upon the plan areas): • Batter: 100% RAF • Footway (3.7m max): 100% RAF • Roadway lanes (including kerb and guttering): based upon design life and DHV demand • Shoulder: 100% RAF • Median: 100% RAF • Additional works requested by Council: 100% Council.	 CL 3.7 CL 3.2 CL 3.3 CL 3.1

Description	Cost apportionment - council/ roads authority funds (raf)	Reference
Sub-base and base (All sub-items)	For Roadworks: • Roadway lanes: based upon design life and DHV demand • Shoulder: 100% RAF	CL 3.2 CL 3.3
Wearing surface (All sub-items)	For Roadworks: • Roadway lanes: based upon design life and DHV demand • Shoulder: 100% RAF	CL 3.2 CL 3.3
Miscellaneous Fencing and Retaining Walls	Generally 100% RAF unless required solely due to additional works requested by Council, in which case 100% Council. Where extra fencing or retaining walls are required due to additional works requested by Council, Council will bear the proportional additional cost based on the additional plan length (not area) of fencing or wall. Where the additional works result in a reduced plan length of fencing or retaining wall being required, the estimated savings (if any) to the RAF shall be applied to off-set the cost of the additional works.	CL 3.10
Roadside Furniture and Traffic Control Devices	Generally 100% RAF unless required solely due to additional works requested by Council in which case the additional cost shall be 100% to Council.	CL 3.1

Description	Cost apportionment - council/ roads authority funds (raf)	Reference
Lighting	The same ratio as the total direct cost of all roadworks and drainage works (excluding all miscellaneous works) for the project.	CL 3.9
Paving Medians and Footpaths	Medians: 100% RAF Footpaths: • New: 100% Council • Replacement: 100% RAF RTA Approved Cycleways: • New - Separate or shared footway / cycleway: 50:50 • New - Shared cycleway / traffic lane: 100% RAF • Replacement: 100% RAF	CL 3.1 CL 3.13 CL 3.6 CL 3.13
Landscaping, Revegation and Erosion control	Approved works: 100% RAF Additional works requested by Council - additional cost: 100% Council Note: Where additional landscaping requested by Council is used in lieu of paving or other surfacing treatment, estimation of the additional cost shall include a deduction equivalent to the estimated savings (if any) to the RAF associated with the reduced area of alternative approved treatment.	CL 3.15
Property Adjustments and Access Adjustments	100% RAF	CL 3.10