Appendix B1

Design:

Berry Bypass original southern route design submission received Dec 2011

Date: 22 February 2012
To: Roads and Maritime Services
From: Bruce Ramsay
Re: Submission of 12 December 2011

My submission represented preliminary work and investigations into a southern Berry route.

To clarify the costings provided: I estimated the potential saving in Direct Costs to be up to $23million. However, if contractor costs and full contingency amounts are included, the potential savings could be up to $50million.

The costings are preliminary, without the design and structural investigations that are required as a next step. I felt the initial costings were potentially commercially sensitive. However in the interest of transparency, note they are now attached.

Bruce Ramsay.

NSW Government - Transport.
Roads & Marine Services.
Berry Office.
Berry NSW.
12th December 2011.

Attention: The Project Director. (Mr. S. Zhivanovich).

Dear Steve,

Re - RMS Public Meeting, 6th December 2011.
Foxground and Berry bypass alignment.
Community Response.

Please refer to the attached document for inclusion in the above Community Response.

This submission has been presented due to the large amount of Community dissatisfaction with the preferred Northern Option. This was evident from the number of questions & objections at the above public meeting.
As such I was approached after the meeting by a number of the residents to review a possible Southern Option, in the light of the objections forthcoming from the preferred Northern Option.
This Southern Option alleviates virtually all of the concerns to the Northern Option that were voiced at the public meeting.

It also meets with the needs of the RMS by removing all of the Northern alignment complexities that impinge on the community which have resulted in the large urban design considerations & expenditures, that are needed to alleviate these problems, especially issues of safety, access, noise and visual impairment.

You will note from the enclosed Southern Option alignment, that it extends between Ch15000 through to the intersection with the existing Princes Highway at Croziers Rd.,.
This represents an increase of length covered by the bypass over the

Northern alignment (Schofields Ln., - Croziers Rd.,) of 1,270m.

In order to make a meaningful direct cost comparison between the two options, the Northern Option alignment, commencing at Ch15000, has been extended a further 1,270m to the same termination point as the Southern Option at Croziers Rd.,

One of the "spin-off" benefits that this 1,270m long extension provides, is it now eliminates all the road access problems relating to Huntingdale Park Estate, Victoria St., Hitchcocks Ln., Schofields Ln., Andersons Ln., Mullers Ln., & Croziers Rd., as well as the Kangaroo Valley Rd., interchange. It also removes the noise problem at the BUPA Aged Care Facility.
Previously the bypass was within 70m of this facility.

NOTE:-This alternative Southern Option has been presented in the full knowledge, of the current RMS mandate to consider the Preferred Northern Option only at this stage & the pending Transport Minister announcement on the 20th December 2011.

However this case presented for the Southern Option is **too** overwhelming in it's simplicity and economic advantage not to be seriously considered at this point in time. It represents a **WIN/WIN** situation for all parties concerned.

I trust that the Minister will make his judgement on the way forward in the full light of this proposal.

Yours sincerely,

Bruce Ramsay.
402 Tourist Rd.,
Beaumont.
NSW. 2577.
Ph:- 4464 3909
Email:- cbr@shoalhaven.net.au

THE BERRY BYPASS

Southern Option (B.R.5) versus Northern Option.

SYNOPSIS

Note:- The Southern Option at this point in time is not the RMS Preferred Option, but it is far superior to the Northern Option in all major aspects - environmental, social, technical & financial - in that it meets the desired needs of almost all parties - a **Win/Win** for all.
(Refer attached Horizontal Alignment for Southern Option details.)

The major components of the comparison are as follows:-

1) NOISE & SOUND.

The horizontal alignment is a minimum 880m to the south of the existing Princes Highway (Queen St.,) through the Berry township, with a nearest point to the southern boundary of the township (at the Masonic Village) of 470m.
In comparison the Preferred Northern Option is 270m to the north of Queen St., with a nearest point at North St., of approx 45m - variable.
As such the residents of the Berry township, whether they reside on either the southern or northern side of Queen St., have a far superior buffer zone with the Southern Option (B.R.5). This buffer zone is a minimum of 425m metres greater than the northern buffer zone. As such there will not be a requirement for any sound attenuation noise walls or low noise asphalt surfacing of the road.

2) VISUAL IMPACT.

The horizontal alignment of the Southern Option is generally unseen from the Berry township, therefore visual impact is negligible. The escarpment & rural scene is not adversely impacted as it is with the Northern Option.

3) COMMUNITY DISLOCATION.

The Northern Option has been severly criticised for the dislocation it will create to the community of Berry.
It is not a Bypass in true intent and could best be described as a "**Throughway**".
It seriously divides the existing & future residential areas of the township, effectively creating two townships of West Berry and East Berry.The future planned residential development of Berry will occur to the west of the Huntingdale Park Estate. There is current future planning for in excess of 500 new residences, mainly in West Berry.
When it was originally decided to create a Bypass of Berry circa. 1952 (60 years ago), land was set aside in the undeveloped areas bounding the town to provide the necessary corridor. However over the past 60 years development of the township has been approved along and through this corridor, to such an extent, that the corridor has been absorbed into the precincts of the residential areas, hence the above description of a "Throughway".
The final decision makers for the Bypass Corridor **must** take this into account when considering acceptance of responsibility for this Northern Option.

As an example of how such decisions may go wrong - consider the current problems that exist at Nowra - with the absorption into the town of the 1970 Nowra Bypass.
Over the last 40 years development has been approved in close proximity on both sides of

the Bypass (Stockland Mall e.t.c.) plus the South Nowra Industrial/Commercial Zones & the Worrigee residential estates. This has resulted in major traffic congestion (especially during holiday peak periods), due to the need to provide, an overbridge, traffic lights, round-abouts, climbing lanes and passing lanes for traffic movements across the Bypass.
As such the Nowra Bypass has not delivered true value to the community - the accepted lifespan for civil engineering facilities is 100 years +, in the Nowra case it was made redundant within 20 years !

We don't want the same thing happening in Berry.

In making decisions relating to cost & value, the true cost must be taken into account - financial, social, environmental & longevity in order to deliver maximum value (& return) for the monies expended.
The accepted definition of value engineering is:-
VALUE = COST + BENEFIT.
This formula can be adjusted to provide a desciption for both Benefit & Cost:-
(Benefit = Value - Cost) and (Cost = Value - Benefit.)
In the Nowra Bypass case the value has been eroded by more than 80% ! (100 years - 20 years = 80 years.).

4) HISTORIC PRECINCT.
The Southern Option horizontal alignment adjoining the historic precinct on the eastern approach to Berry at Pulman St., has a horizontal buffer zone of 260m, which greatly exceeds the distances at the existing intersection of the Princes Highway/Pulman St.,
As such the visual and noise impacts will not impact in any serious way on these areas.

5) THE BUPA AGED CARE FACILITY.
The Northern Option may result in major noise impact for the newly constructed BUPA Aged Care Facility as it will pass within 70m.
However the Southern Option has a minimum clearance exceeding 670m to the south of the BUPA facility.

6) THE DAVID BERRY HOSPITAL.
The Southern Option will not have a major noise or visual impact on the David Berry Hospital as it will pass 360m away to the west. The hospital is also heavily screened with thick bushland along the exposed face.

7) FLOOD RISK.
For the Southern Option the Southern Flood Plain which carries both Broughton Mill Creek & Broughton Creek is crossed by a low level viaduct with a length of approx 1,595m. The eastern abutment is located towards the rear of the Mananga Residence boundary line, with the viaduct spanning Tannery Rd., the railway, Broughton Mill Creek and terminating at a western abutment beyond Wharf Rd.,
The remainder of the horizontal alignment will be on an embankment at R.L.4.5m (same height as the rail embankment) running parallel to the rail line and be offset by about 440m to the south of the rail. Due to the existing undulating ground line the proposed embankment may vary in height between 1.0m & 5.0m., similar to the existing rail embankment.
Three further structures (including a second rail overbridge) will be included along this

embankment to facilitate culvert/farm crossings for existing creeks, farm access and overbridges, (Mullers Lane).
In comparison, the Northern Option requires far greater flood protection and cost to mitigate the 1% AEP flood risk to the township.

8) ACID SULPHATE SOILS.
Acid Sulphate Soils have been identified along the southern alignment, as one of the major technical problems which is currently influencing the preference for the Northern Option. Aggressive Acid Sulphate Soils are a consideration in respect of buried concrete structures which come into contact with these soils, however the use of Sulphate Resistant Cements in concrete mix designs are commonly specified by designers to overcome any technical considerations that may be encountered.
Further long term protection of exposed concrete structures may be specified utilising applied sealants to concrete surfaces within affected wet/dry zones. As such the presence of Acid Sulphate Soils is not a valid technical reason to discount the Southern Option.

9) COST COMPARISONS. (True Value).
The Southern Option is estimated to **cost far less** than the Northern Option.

In order to provide a meaningful comparison between the two options, relevant engineering costs have been deduced from information obtained through discussions with the RMS. These are "bulked up costs", which include for the RMS overhead margins, design, site management & risk.

The basis of these costings is as follows:-
Overall RMS preliminary budget for the three stage project, (Gerringong to Bomaderry) is currently set at $1 Billion for approximately 30 kilometres of 4 lane expressway, with provision for future widening to 6 lanes.

In order to construct a more detailed budget, certain individual cost elements need to be considered and $ rates deduced. These elements can be deducted from the $1 Billion budget in order to provide more precise estimating rates for the general roadworks, which form the bulk of the project.

Calculations are as follows:-
Note:- Estimates pertaining to the Northern Option are highlighted in **BLUE.**
Estimates pertaining to the Southern Option are highlighted in **RED.**

a) General bridging - the RMS advise that their guide budget for 30m span bridges (Super T) is $2,500/m^2 of plan deck area.

An estimate of likely bridge deck areas for the total project are as follows:-
Northern Option = 15,100m^2
Southern Option = 40,000m^2
Remaining structures (stages 1 & 3) = 6,500m^2

a.1) Cost of bridging for the Northern Option (3 stages) = $ 54m
a.2) Cost of bridging for the Southern Option (3 stages) = $ 116m

b) Land acquisitions - Provisional Item - $15m
c) Deep cutting (Toolijooa Cut) - Provisional Item - $50m
d) Noise walls /earth embankments - Provisional Item - $10m
e) Footbridges, farm/cattle access culverts - Provisional Item - $5m
f) Access roads - farm & road intersections - Provisional Item - $5m
g) Creek diversion & flood mitigation - Provisional Item - $5m
h) Landscaping. - Provisional Item - $2m
i) Urban design facilitation - Provisional Item - $5m

Deduct a.1) & b) to i) from $1Billion, residual amount = $ 849m
Net general roadwork remaining (deduct structures) = 29,035 lineal metres.

j) Therefore by deduction the General Roadworks rate = $29,240 per metre.

Apply the above $ rates to the Northern & Southern Options, to obtain the estimate of both the Northern & Southern Bypass Options.

A) Berry Bypass - Northern Option:-

RMS budget current estimate	$205m
Add Schofields Ln. to Croziers Rd. (1,270m x $29,240 /m)	37m
TOTAL	$242m

Note:- For a direct cost comparison with the Southern Option the length of Expressway between Schofields Ln., to Croziers Rd., has been added to the Northern Option.

B) Berry Bypass - Southern Option:-

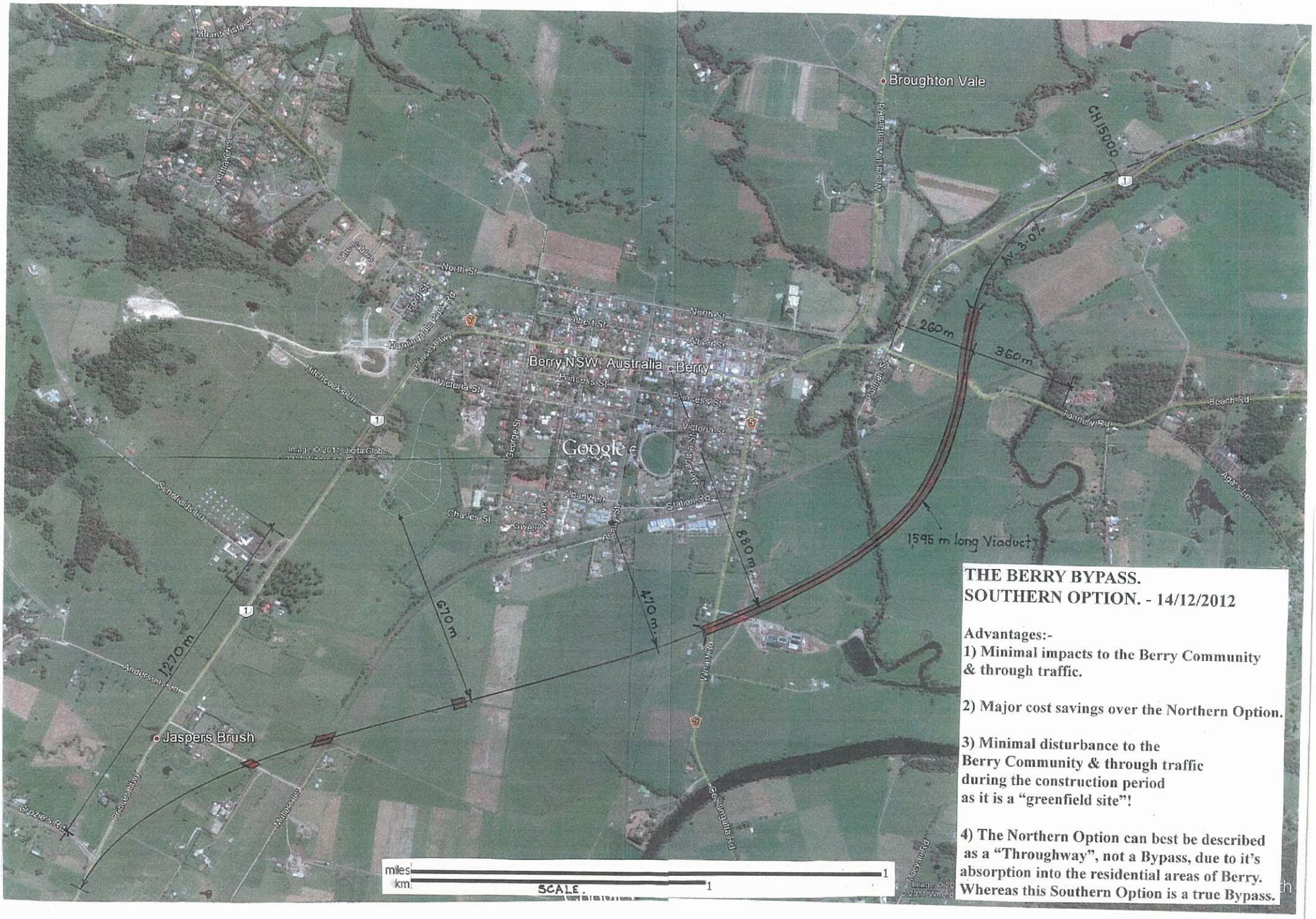
Viaduct (36,685m2 x $2,500/m$^{2)}$	$ 92m
Secondary bridging (3,335m^2 x $2,500/m$^{2)}$	8m
Contingency for bridging	16m
Roadworks (3,100m x $29,240 per lineal metre)	90m
Contingency for roadworks	13m
TOTAL	$ 219m

SOUTHERN OPTION - ESTIMATED SAVING:- $ 23m (incl. contingenies)

10) SUMMARY.

The above estimate for the Southern Option alternative, indicates **major** financial saving over the Northern Option, however the real saving is far, far, greater when consideration is given to the lifetime cost/benefit (100 years +) as outlined in paragraphs **1) to 8)** above.

Should the reader have any queries, comments or requires clarification on any points, please do not hesitate in contacting the author (Bruce Ramsay) at his email - cbr@shoalhaven.net.au



THE BERRY BYPASS.
SOUTHERN OPTION. - 14/12/2012

Advantages:-

1) Minimal impacts to the Berry Community & through traffic.

2) Major cost savings over the Northern Option.

3) Minimal disturbance to the Berry Community & through traffic during the construction period as it is a "greenfield site"!

4) The Northern Option can best be described as a "Throughway", not a Bypass, due to it's absorption into the residential areas of Berry. Whereas this Southern Option is a true Bypass.

Appendix B2

Design:

Princes Highway Gerringong to Bomaderry concept design criteria

PRINCES HIGHWAY GERRINGONG TO BOMADERRY

CONCEPT DESIGN CRITERIA

Purpose

The purpose of this list of design criteria is to clarify design criteria listed in the Scope of Work and Technical Criteria for the development of the Concept Design for the 32km section of the Princes Highway between Gerringong (Mount Pleasant) and Bomaderry (Cambewarra Road – Main Road 261) 42.6 km to 74.6 km south of Wollongong.

Interpretation of these Criteria

(a) The criteria in this document are minimum criteria, including technical, operational and performance requirements for the Princes Highway Upgrade. The approval of the RTA's Representative is required for the adoption of alternative criteria or standards. Where alternative criteria or standards are adopted they must be clearly identified in an appendix to the relevant Design Report.

(b) If more than one criterion applies in respect of any part of the Highway then direction must be sought from the RTA's Representative.

(c) The Highway must meet the standards of RTA and AUSTROADS publications and relevant Australian Standards. If suitable Australian Standards do not exist for the design of any element of the Highway, the Designer may use international standards that reflect world's best practice, subject to the written approval of RTA's Representative.

1. Order of Precedence

(i) Any specific provisions in this document

(ii) Project Scope of Works and Technical Criteria;

(iii) RTA Technical Directives

(iv) RTA publications;

(v) AUSTROADS;

(vi) Australian Standards;

(vii) Standards Australia handbooks; and

(viii) Other reference documents and standards.

2. **Traffic** (for geometric element design)

Design Year – Highway and Local Roads
Proposed completion year plus 20 years
Traffic flow based on the 100th highest hour to reflect the recreational peak flows

Level of Service
LOS C or better

Road users (highway, local roads, property access)
Highway – 25m B-double, 12.5m single unit (emergency U-turn bay),19m semi-trailer (access U-turn Bay) refer Figure 9 & 10
Local Road - 19m semi trailer unless designated a B-double access
Property Access – 19m semi trailer farm residence and paddock access by negotiation with the land owner

Truck Speed - 100km/h
Truck acceleration and deceleration rates – refer to Figure 12.1 and 12.1

Clear Zone and Safety Barrier Analysis
Adopt 50% - 50% slow lane / fast lane split for analysis at year of completion plus 20 years

Transfer from Sand Track – assume 90%

3. **Control Line**

Standard RTA labelling convention in accordance with CADD Manual Issue Version 3.2 June 2005

Control line to be string located in centre of carriageways with superelevation rotated about the control axis to facilitate future lane additions.

Horizontal alignment of each carriageway may be independent of each other with control on the median side edgeline.

4. **Highway Alignment – New Dual Carriageway**

Criteria	Requirement	Reference	Comment
Design Speed Horizontal alignment	110km/h	SWTC 1.6	
Design Speed Vertical alignment	100km/h	SWTC 1.6	
Crest K min value	66	RDG Table 2.3.6 (2.5s)	
Sag K main value	33.4	RDG Table 2.3.8 (Headlight considerations)	
Reaction Time (RT)	2.5 sec	RDG Table 2.1.1	
Plan Transition	<1000m Radius	RDG Table 2.2.2 & 2.2.3 (C)	

Superelevation Transition	<1000m Radius	RDG Table 2.2.2 & 2.2.3 (C)	Must not overlap causing "butterfly" shaped pavements
Sightline Eye Height Car Truck	 1.15m 2.4m	RDG Table 2.3.6	
Horizontal Stopping Sight Distance	210	RDG Table 2.1.1	
Vertical Stopping Sight distance	175	RDG Table 2.3.6 (2.5s)	
Approach Sight Distance & Safe Intersection Sight Distance	1.15m to 0m 1.15m to 1.15m	RDG Figure 2.3.3	At all intersections, emergency crossovers, truck rest areas, farm accesses & paddock accesses
Horizontal radius	Min 600m for on-highway upgrade	RDG Table 2.2.1	
	Min 750m for off-line construction	As directed by RTA	A reduction to 600m will be considered but approval is required for each specific site
Arc Length	20% reduction acceptable	RDG Table 2.2.2	Anything less than the RDG must be reported
Compound Curves	If unavoidable must be in same design speed range	Pacific Highway 4.2	Must be reported
Reverse Curve Spacing for curves without horizontal transitions	>Design speed in metres	RDG Section 2.2.23	
Grade	Des Max 6.0%	RDG Table 2.3.1 (Rolling terrain)	
	Abs Max 8.0%	As directed by RTA	
	Min in cutting 0.5%	As directed by RTA	Vertical curve excluded

5. Highway Alignment - Ramps

Criteria	Requirement	Reference	Comment
General arrangement (on-load and off-load)	Figure 6	RTA Entry and Exit Ramps Rev 1.1 Figure 6 and Grade Separated Interchanges (A Design Guide) NAASRA 1984	Must have full deceleration occur in the auxiliary lane ie no deceleration in the through lane
Level of service - For design year 20 years after completion	LOS C or better	Austroads Traffic Engineering Practice – Part 2	Design flow based on 100th highest hour
Design Speed Off-load Ramp	110km/h at start of diverge and gore area As per Fig 6	Figure 6	60km/h at local road intersection

On-load Ramp			Trucks at minimum 85km/h at point "T"
Provision for cyclists	Comply with RTA guidelines	RTA NSW Bicycle Guidelines and Austroads Traffic Engineering Practice – Part 14	Include provision at all interchanges RTA Guidelines, see Fig 7.22
Sightline To start of auxiliary lane To gore nose	 350m desirable 350m absolute min	 Figure 6	
Reaction Time	2.5 seconds	As directed by RTA	
Horizontal Alignment (ramp proper)	To suit speed regime	RDG Section 2	
Vertical Alignment (ramp proper)	To suit speed regime	Table Figure 6	
Terminal	To suit 19m semi trailer unless designated a B-Double access	RDG Section 4 and RTA Roundabouts Geometric Design Method	Provide furniture to suit B-double turning movements. Linemarking to suit 19m semi-trailer turning movements

6. Highway and Ramp Cross Section

Criteria	Requirement	Reference	Comment
Upgrade lanes (in each direction) Ramps	2 1	SWTC 1.3	With provision for future widening in median
Climbing Lanes	Loss of truck speed to 40km/h and LOS D 20 years after construction	As directed by RTA Refer to Email 20/03/09	Confirmed by RTA Standards & Policy Climbing lane to occupy ultimate 3rd lane (narrow median, Ref Figure 3)
Lane width (including interchange ramps and aux lanes)	3.5m	As directed by RTA	
Nearside (outside) shoulder	2.5m	As directed by RTA	3.0m sealed clearance adjacent to safety barrier to cater for cyclists, maintenance and emergency services vehicles (also applies to auxiliary lanes)
Offside (median) shoulder	Min 1.0m	RDG Section 3.3.3	
Median width - No right turn bay - Right turn bay treatment required	10.2m (edgeline to edgeline) 13.0m (edgeline to edgeline)	As directed by RTA RDG 4.8.18	To suit future upgrade to 3 lanes with wire rope barrier 3.2m between edgelines To facilitate future intersection treatment

			with 6m wide median
Outside verge (adjacent 4 to 1 or flatter batters) Outside verge (adjacent barrier)	Adopt 2m rounding commencing at shoulder Adopt 2m rounding commencing 0.5m outside wire rope safety barrier	RDG Table 6.14 RDG Table 6.14	For driver to maintain control To maintain max 10:1 slope at extremity of wire rope deflection
Median verge (adjacent 4 to 1 or flatter batters)	Min 0.5m	As directed by RTA	Only applies on independent alignments
Cutting berm (adjacent SO gutter)	Min 0.5m Des 2.0m	To suit recommendations of the geotechnical report	Note that it may exceed these dimensions to accommodate sight lines, rock fall zones and catch fence treatments
Outside clear zone	< 10% slope - 11.0m 10% to 4:1 batters max 14m	RGD Section 3.7	
Clearance to boundary	Min 6.0m	As directed by RTA	Need to allow for sedimentation structures and access for maintenance between catch or diversion drains and boundary. Consider widening on a case by case basis where a geotechnical risk exists.
Gutters	Located outside of shoulders	Figure 2 & 5	WRSB located 0.2m from edge of gutter G4 SB 0m offset from SO gutter
Flood immunity	1:100 years for new structures. A minimum of 1:20 years if an existing structure can be utilised subject to structural capacity adequate for new design life	SWTC 1.2 (assumed both lanes in both directions)	Provide a clearance of 0.5m above the 1:100 year flood level to the lowest edge of shoulder. Prove that the adoption of a structure with a 1:20 year flood capacity does not exacerbate flooding.
Batters Fill < 1.5m high Fill > 1.5m high Cut 2:1 or flatter Cut steeper than 2:1	 4:1 2:1 7m maximum between benches 10m maximum between benches	 Refer to the project Geotechnical Reports	 Not to exceed clear zone 4m wide bench at max 10m Provide 50m long end rounding

Bridges			
Outside shoulder	Min 3.0m	As directed by RTA	Shoulder width on bridges to match approach shoulder width
Median shoulder	Min 1.0m	As directed by RTA	
Vertical clearance Over highway Over regional and local road Over railway (future DC electric)	 5.3m 4.6m 5.8m	RDG Section 3	 Allow for duplication on western side
Span length for super T girders (1800mm deep)	Des Max 35m Abs Max 37m	As directed by RTA	Preferred over existing road and railway

7. Alignment – Temporary Tie-ins

Design speed (horizontal and vertical alignment)

Longer term situations such as tie-ins between construction stages
- 80km/h min.
- 100km/h - when speed environment may be perceived as high speed e.g. south of Berry

Short term - 40km/h

Reaction time

- 2.5 seconds, longer term
- 1.5 seconds, short term

Clear zone

- RDG clear zones apply

Cross section

- 1.0m min. shoulders (subject to sightlines)
- 2 x 3.5m min. traffic lanes

8. Alignment – Local Roads

Design Standard
- Road Design Guide

Design speed (horizontal and vertical alignment)
- 60km/h.

Vertical alignment
- Grade – desirable maximum 6%
- maximum 8% or as required to match existing

Reaction time
- 1.5 seconds

Clear zone
- RDG clear zones apply

Cross section
- 2.0m min. sealed shoulders (subject to RDG requirement for 3.0m when adjacent to barrier lines)

Council requirements
- to be negotiated

9. Intersection, crossovers, farm accesses, etc

Facility Strategy
- Intersections – replace intersections with junctions where possible by linking local roads
- Median cross-overs – 5km average spacing, refer Figure 8 (for contra flow provisions, in addition to U-turn facilities)
- U-turn facility – 2.5km average spacing, preferably in adjoining local roads, refer Figures 9 & 10 for on highway U-turn facilities,
- Buses and service vehicles encouraged to use U-turn facilities on local roads as stops, especially for school children .
- Farm access – left in, left out (protected right turn only if no available U-turn facility)
- Heavy Vehicle Rest Areas – one for each direction of travel, preferably located in close proximity to sewerage facilities
-Heavy Vehicle Inspection Bays – one in each direction
- Stockpile sites – 3 required (3,500m2 – min 40m long), 1 each between Gerringong and Kiama LGA boundary, Kiama LGA boundary and Berry and Berry and Bomaderry
- Detail required at concept stage must address road safety, environmental management and the capacity of the facility to provide the service required.

Local Road Intersection
- left in, left out along with protected right turn bays and turn facilities on local roads,
- left turn deceleration lane where warranted by traffic volumes).
-Left turn configuration to "BAL" treatment
- Bus stop off highway where possible
- Protect right turn deceleration lane - 3.5m wide with 0.5m shoulder, refer Figure 7
- Cyclists to use highway shoulder
- Provide safe intersection sight distance – use sight benching if necessary
- Concept design to show location and layout with sufficient investigation to ensure turn paths, sight distance so that adequate land reservation can be provided.

Emergency crossovers
- Design speed – 40km/h
- Designed in accordance with Figure 8
- Min sight distance 210m required
- Movements - allow 25m B-double to cross
- Concept design to show location and indicative layout

Emergency U-turn bays
- Provided for emergency services
- Designed in accordance with Figure 9, where no other U-turn facility is available
- Safe intersection sight distance required for through vehicles and 5 seconds minimum gap sight distance for turning and entering vehicles, refer RDG Section 4.9.4

- U-turn for 12.5m single unit truck to cross with verge widening to accommodate the turned path, so that adequate land reservation can be provided
- Concept design to show location and indicative layout

Access U-turn bays
- Provided for adjacent landholders, refer Figure 10, where no other U-turn facility is available
- U-turn for farm access 19m semi-trailer (ensure sufficient land reserved)
- Safe intersection sight distance required for through vehicles and 5 seconds minimum gap sight distance for turning and entering vehicles, refer RDG Section 4.9.4
- Concept design to show location and layout with sufficient investigation to ensure turn paths, sight distance and adequate land reservation can be provided

10. **Drainage**

Highway Strategy
- To carry out hydrologic/hydraulic investigations and assessments in accordance with the Scope of Works and Technical criteria, Section 4.38.
- Flood immunity for a design flood event requires the lowest edge of shoulder to be 0.5m above the respective high flood level, refer to Figure 1.
- Replace all existing drainage structures and cattle underpasses where function is required for the upgraded highway
- Identify cost savings in retaining any structures that are in good condition and have a suitable service life.
- The following minimum average recurrence intervals must be applied to elements of the design (select only those applicable for concept design)
  - (i) Culverts where surcharge is allowable 50 years
  - (ii) Structures where surcharge is undesirable 100 years
  - (iii) Channels and open drains 5 years
  - (iv) Gutter flow spread limited to width of shoulder 10 years
  - (v) Piped system (including pits) 10 years
  - (vi) Major storm event check for no property damage 100 years
  - (vii) Major storm event check for no structure damage 2000 years
- Climate change allowance – increase storm intensity by 6% for each storm event
- Cross drainage should be separated from pavement drainage systems
- Provide sufficient land acquisition near water crossings for installation of accidental spill and sedimentation basins of appropriate size, Refer "Managing Urban Stormwater – Soils and Construction" Volume 1 (the Blue Book)

Local Road Strategy
- Provide a flood immunity target of 1:20 year flood event
- Retain existing structures where possible

Surface Flow
- Drainage structures are required where works intercept runoff from floodplains, watercourses, depressions or drainage lines
- Concept design must specify structure size, location and indicative inlet and outlet treatment (eg 2 cell 1800mm x 900mm box culvert 35m long, 30 degree skew at 43.700km, standard headwalls, rock mattress inlet protection 6m wide x 10m long, with outlet dissipater type D, etc)
- Invert levels, profiles and headwall detail not required for concept design but sufficient investigation is required to ensure specified cover requirements can be achieved as this could impact on the vertical alignment or road boundaries
- Bridge drainage must be connected to the road drainage system.

Pavement Drainage
- Adopt a minimum pipe size of 450mm dia for all drainage
- Indicative drainage networks should be shown where they will be required and fit with the transverse drainage system, eg in a large cutting determine a discharge at the outlet point and distribute flow over a typical pit and pipe network system.

Subsurface Drainage
- No details required at concept stage

11. Structures

Bridges
- Width – refer to Section 6
- Provide a general arrangement drawing that shows the plan view, profile and cross section in accordance with SWTC Section 4.15 (ix)

Culverts
- refer to Drainage Section 10

Retaining Walls
- Concept design should include sufficient analysis to enable location, length, max height and face area to be specified with a wall type recommended that will suit the foundation and load conditions

12. Tunnels

Facility Strategy

- Separate bores for each carriageway
- Include provision for cyclists at this stage
- Provide for future expansion to 3 lanes preferably at 100kph, with an alternate cyclist facility
-Provide for dangerous goods passing through the tunnel

Design Standard

- Refer to Pacific Highway design guidelines

13. Barriers

Barriers
- Steel wire rope preferred subject to horizontal and vertical curve limitations
- Show where G4 will be required such as tight radius curves at access points

Terminals
- identify the type of terminal to suit the situation.

14. Environmental measures

Noise impacts
- Traffic noise mitigation measures must be incorporated into the concept design, ie lowering vertical

alignment, noise mounds, noise wall location, dimensions, bridge joint design, pavement surfacing etc.

15. Other facilities

General
- In accordance with Scope of Works and Technical Criteria – Refer Section 4.15

Sign posting
- Show directional & Tourist signs

Streetlighting
- V3 Design Standard in accordance with As1158.1.1

16. Presentation

General
- In accordance with CADD Manual Version 3.2 June 2005 Refer to Victoria Creek Deviation example
- In accordance with the Scope of Works and Technical Criteria – Refer Section 4.15
- On A3 sheets

Sheet Index
- List sheets in concept design

Typical Cross Sections
- Show sufficient sections to describe the major elements

Plan and Longitudinal Section
- Horizontal 1:2000, vertical 1:400 (min) – preferably 10:1 distortion with breaks if necessary

Detail Plan
- Scale 1:1000
- 2 sections per sheet are satisfactory if not too cluttered
- Include conceptual drainage scheme
- Show safety barrier locations
- Include services (add separate drawing if details are too cluttered)
- Show line marking
- Show diagrammatic signposting scheme
- Show light pole locations

Cross sections
- Spacing 10m on curves and lane tapers, 20m elsewhere

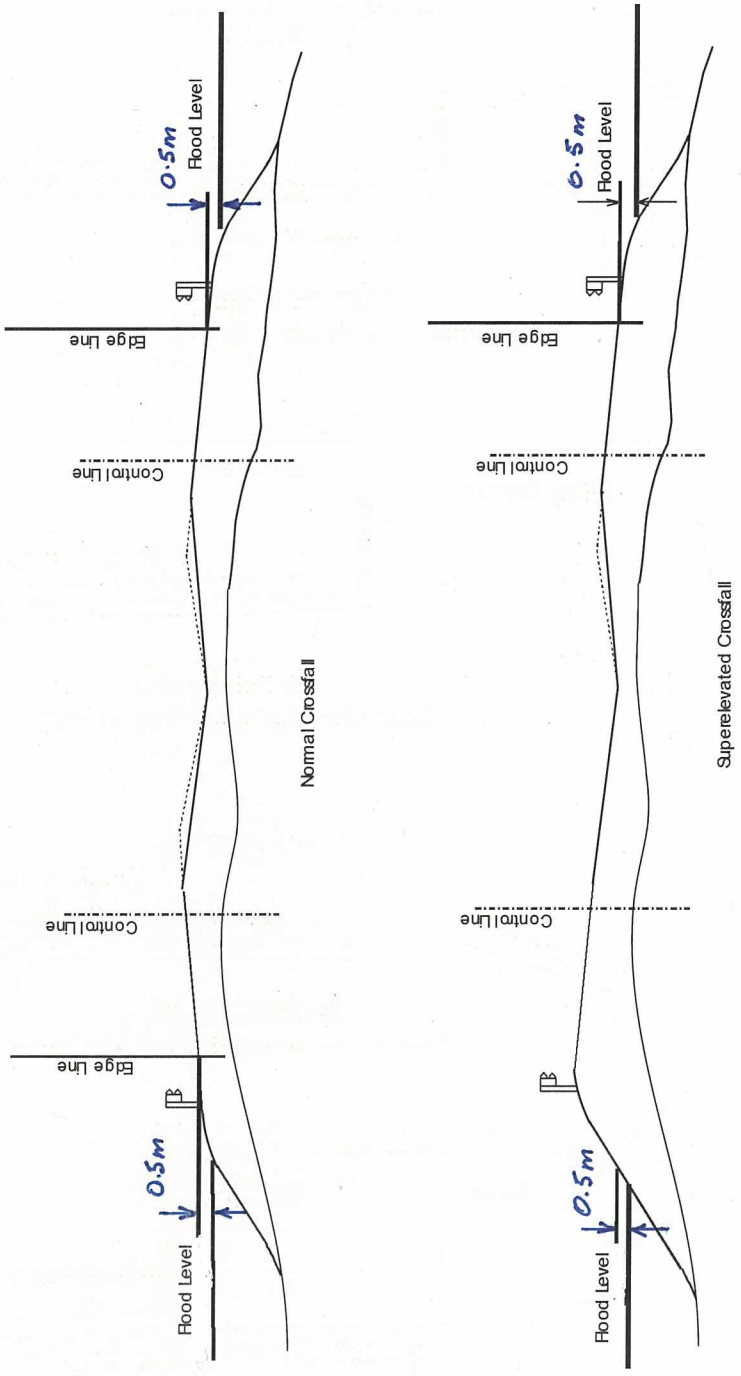


Figure 1 - Flood Immunity

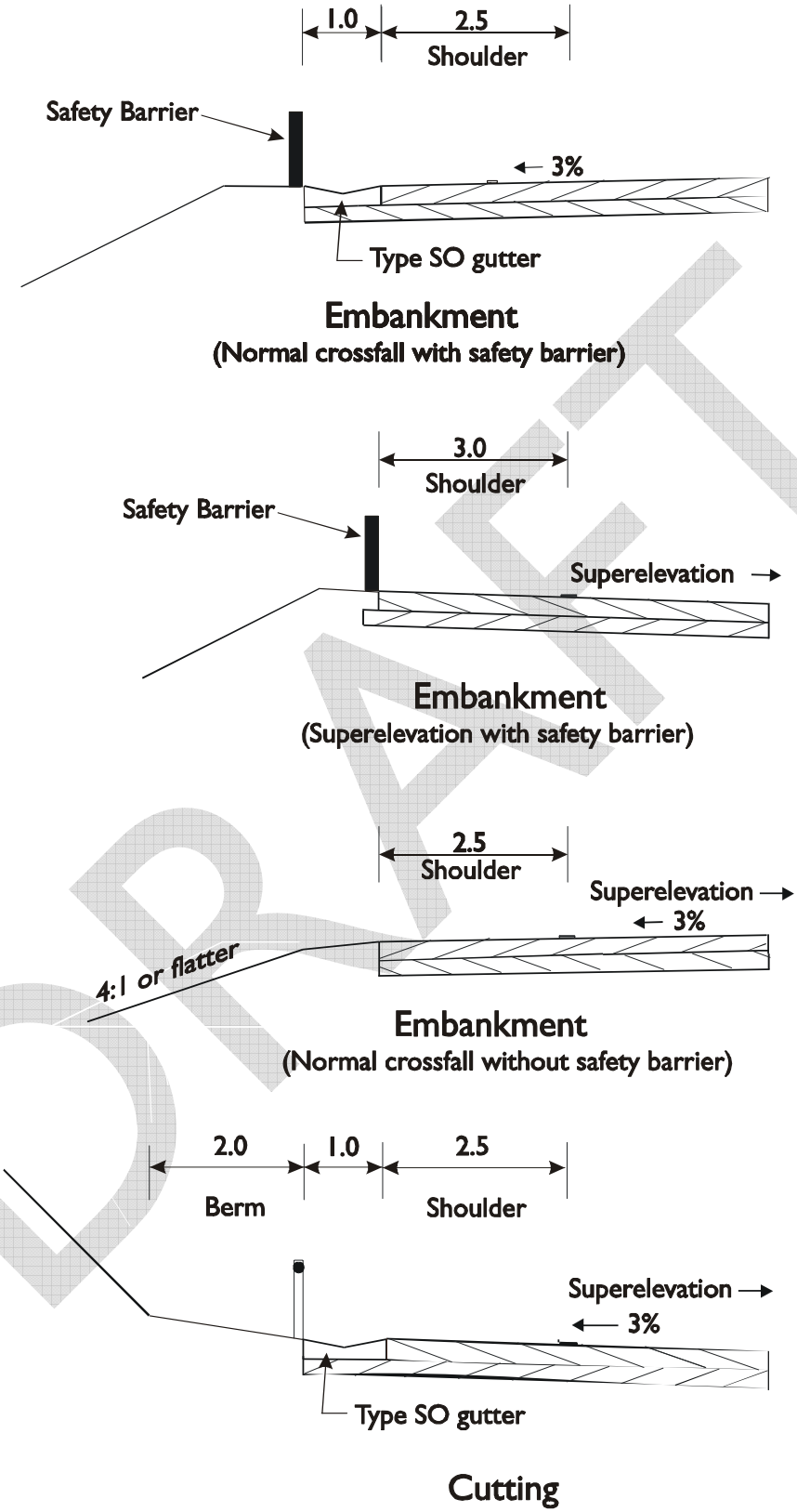


Figure 2 - Shoulder Widths and Configurations

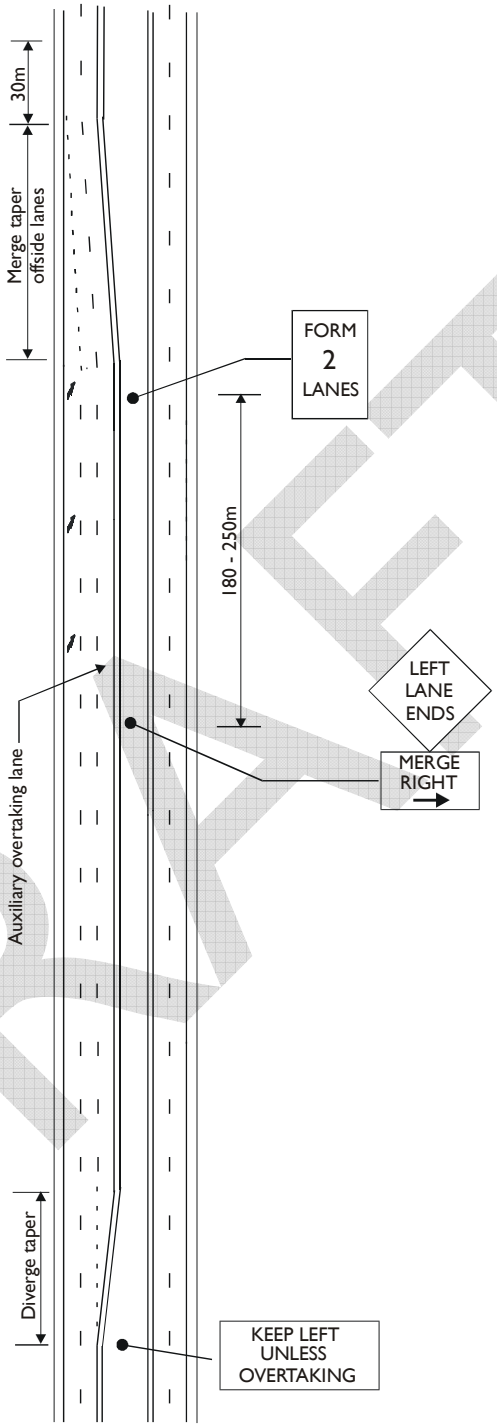


Figure 3 - Auxiliary Overtaking Lane

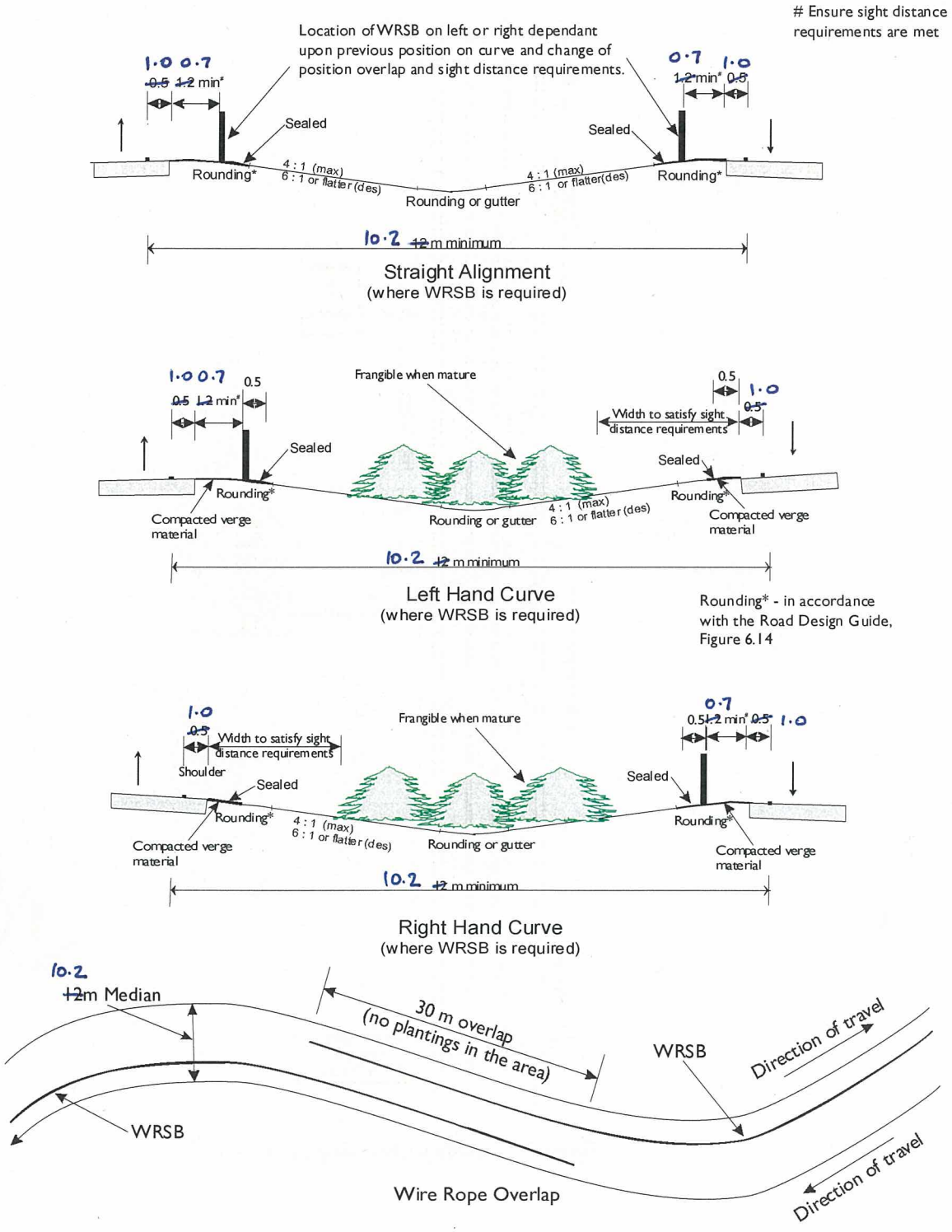
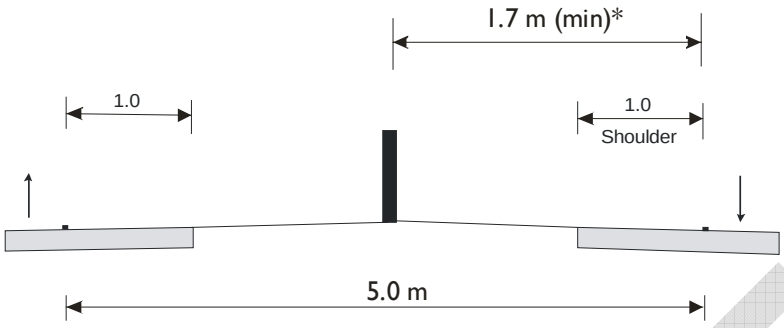
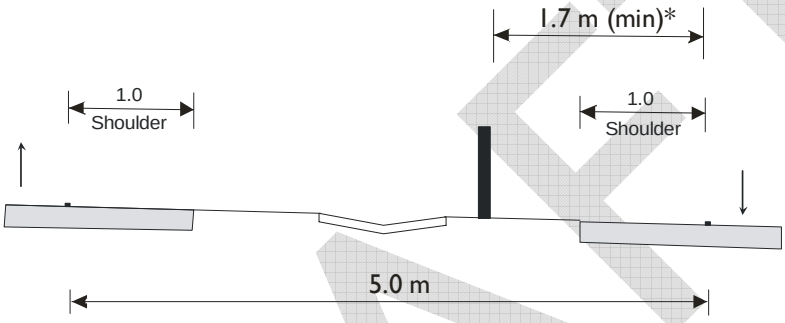


Figure 4 - Wide Median Treatment

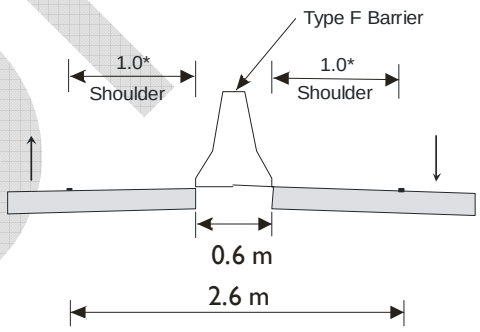


Narrow Median



Narrow Median
(with drainage)

* Ensure sight distance requirements are met



Narrow Median
(alternative)

Figure 5 - Narrow Median Treatment

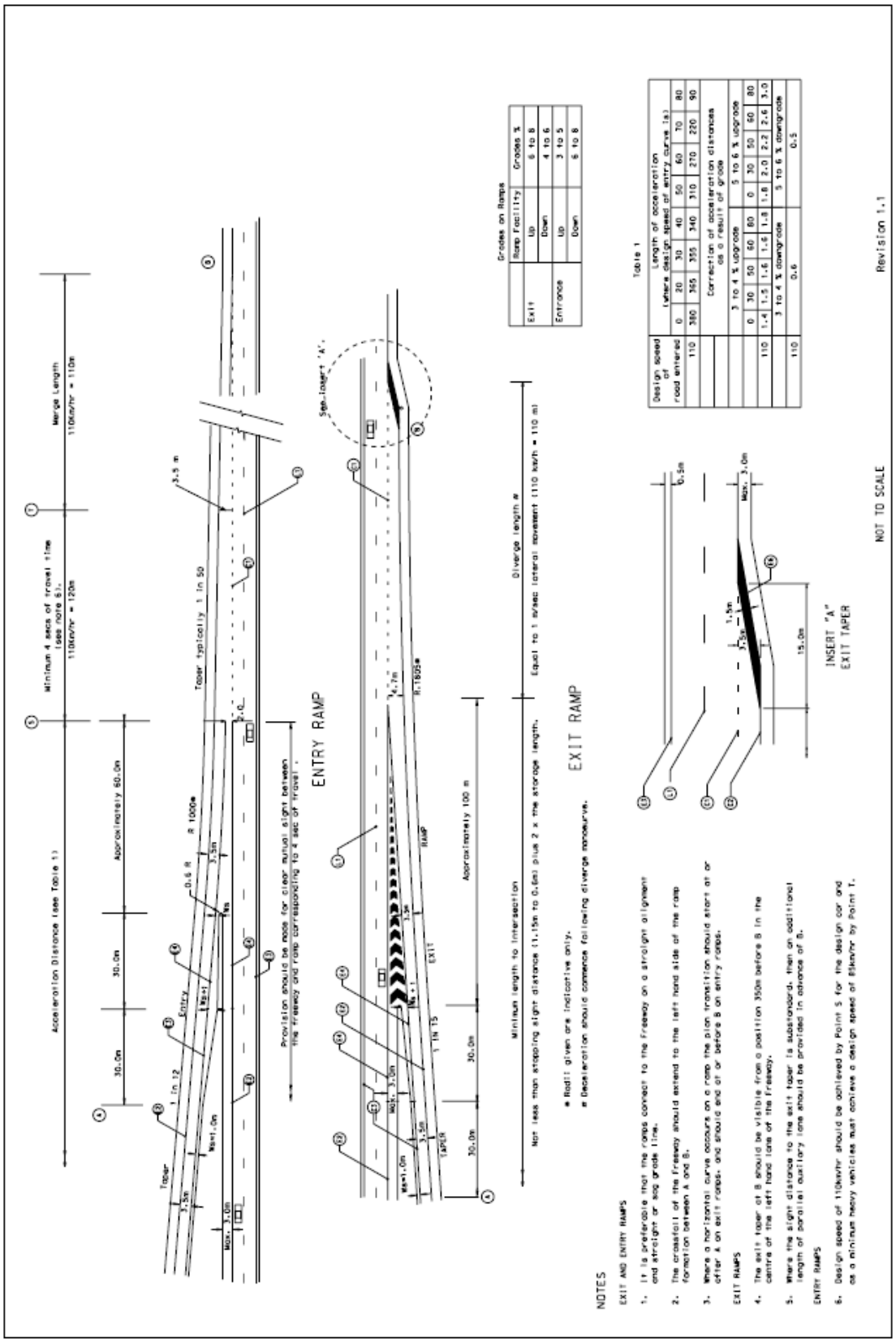
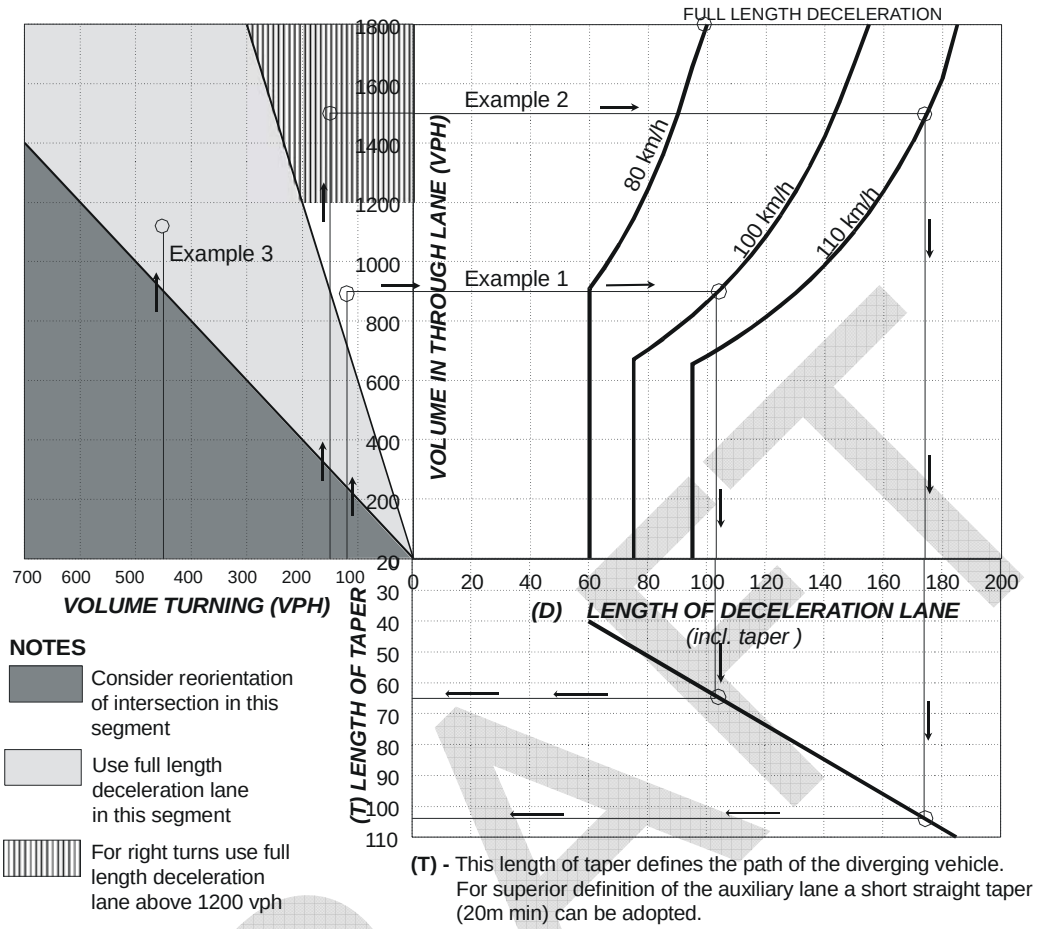
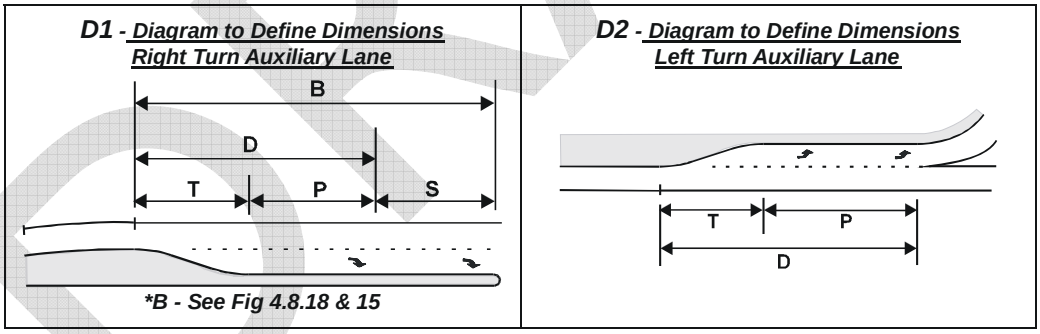


Figure 6 - Acceleration / Deceleration Lengths on Ramp



(T) - This length of taper defines the path of the diverging vehicle. For superior definition of the auxiliary lane a short straight taper (20m min) can be adopted.



Correction to D for Grade

Grade	Ratio of length on grade to length on level	
	Upgrade	Downgrade
0 - 2%	1.0	1.0
3 - 4%	0.9	1.2
5 - 6%	0.8	1.35

Left Turn Auxiliary Lanes
Reduction to D when exit speed ≥20 km/h

20 km/h	10 m reduction
30 km/h	15 m reduction
40 km/h	25 m reduction
50 km/h	40 m reduction
60 km/h	55 m reduction
70 km/h	75 m reduction
80 km/h	100 m reduction
90 km/h	125 m reduction

Figure 7 - Minimum Length of Deceleration Auxiliary Turning Lanes

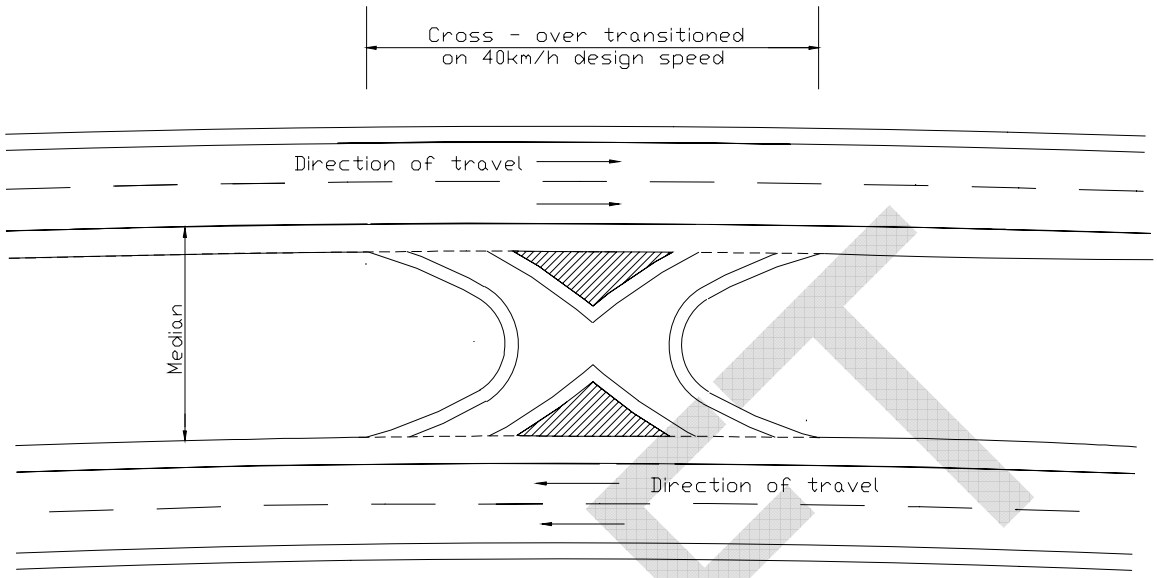


Figure 8 - Emergency Crossover Facility

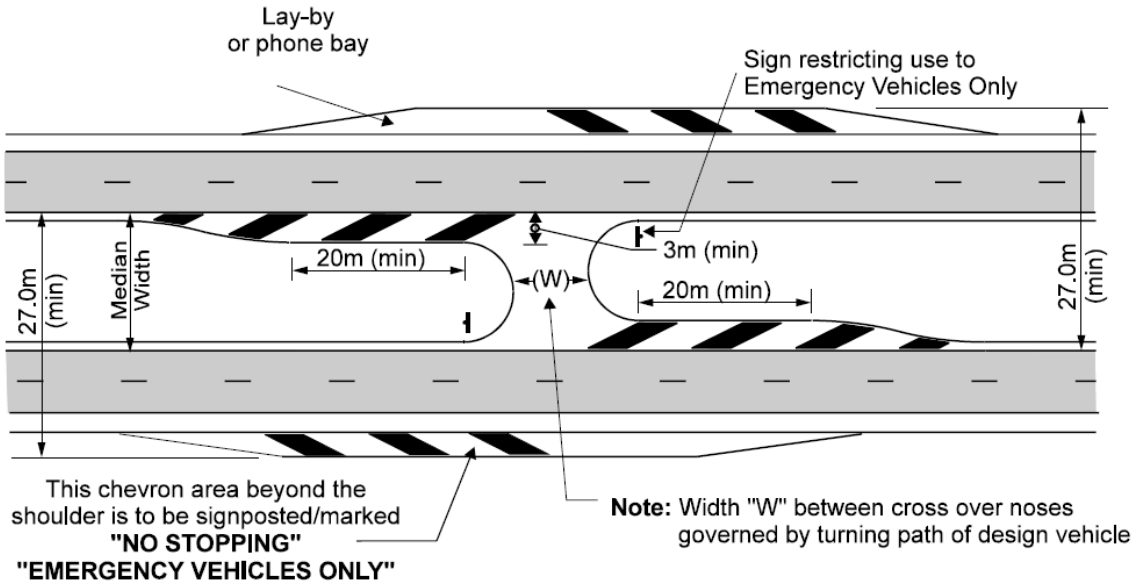


Figure 9 - Emergency U-Turn Bay

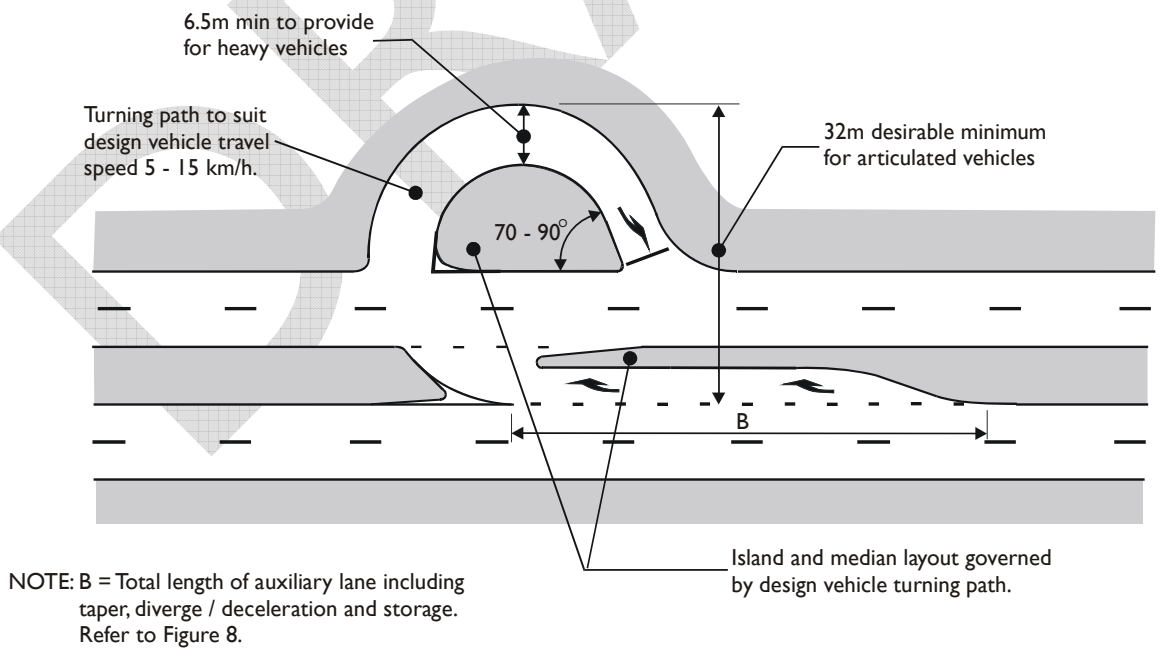


Figure 10 - Access U-Turn Bay

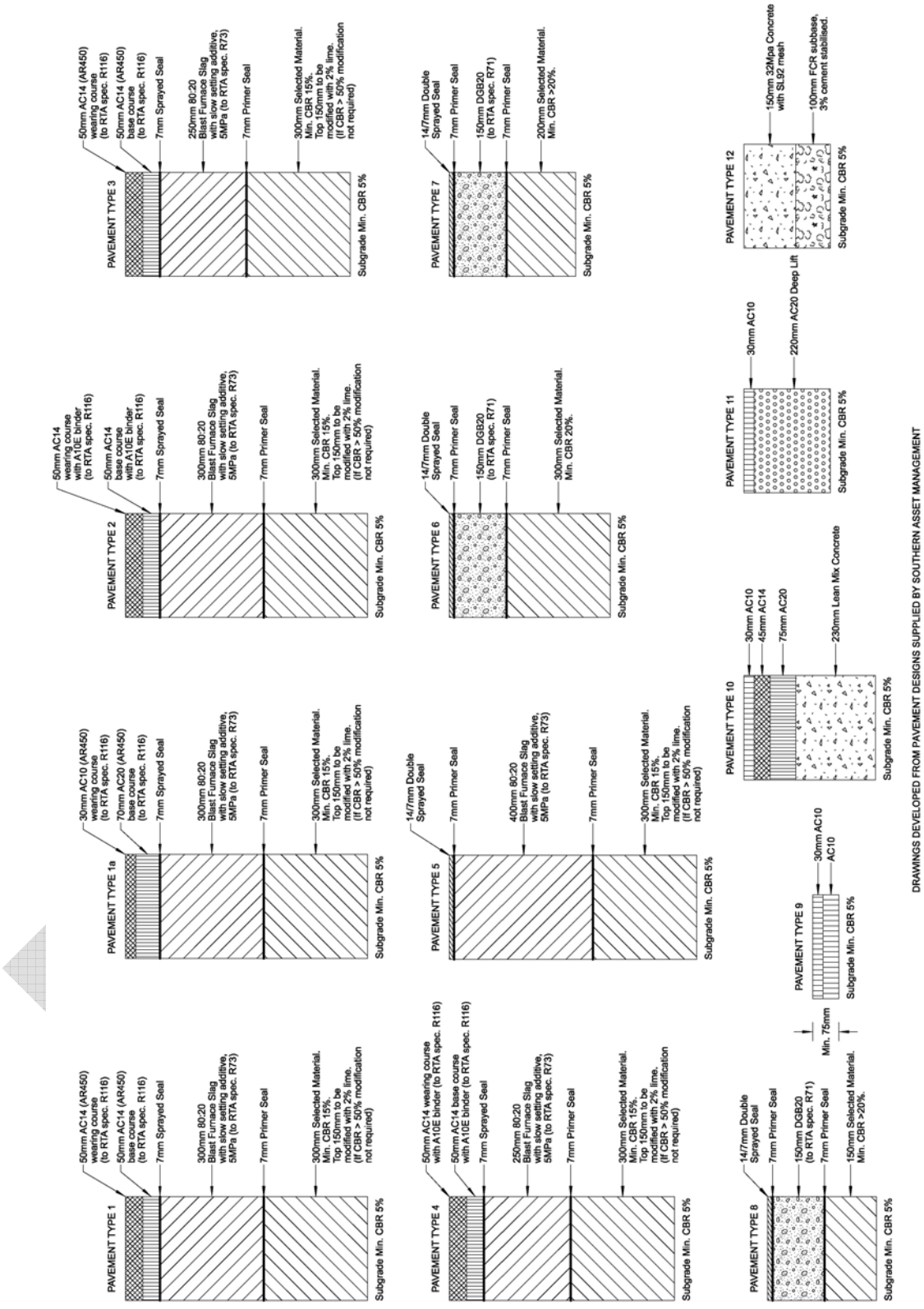


Figure 11- Typical Heavy Duty Pavements

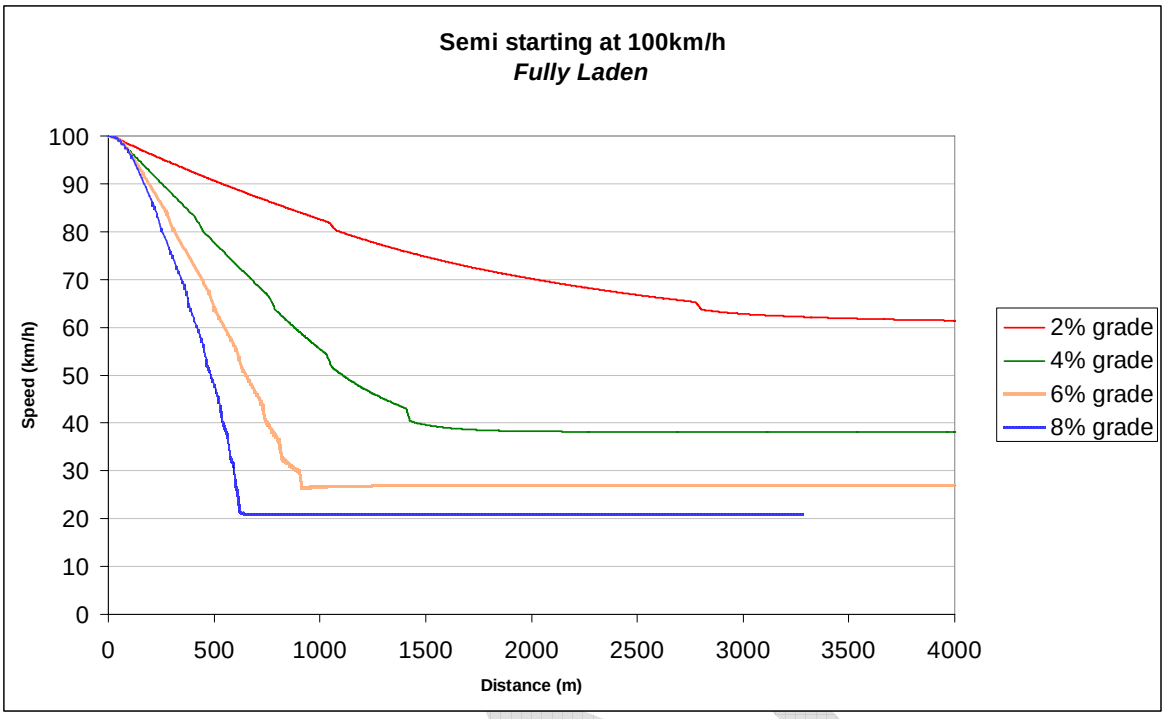


Figure 12.1 - Semi-Trailer Deceleration Rates

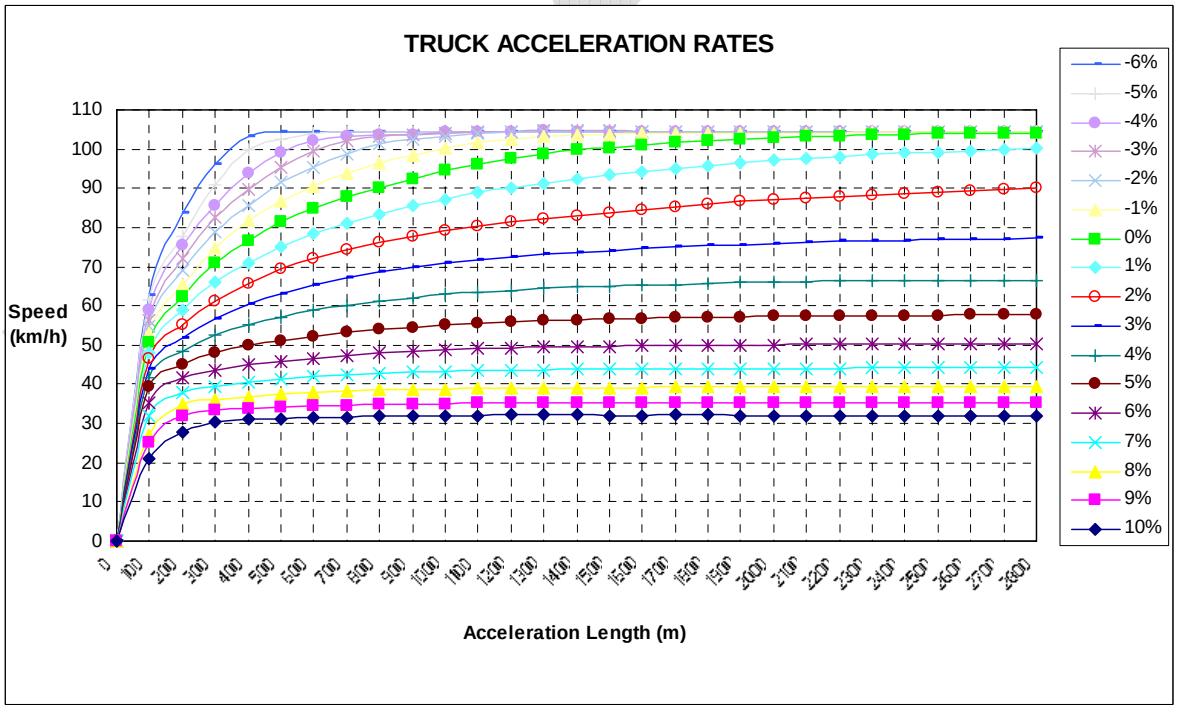


Figure 12.2 - Truck Acceleration Rates

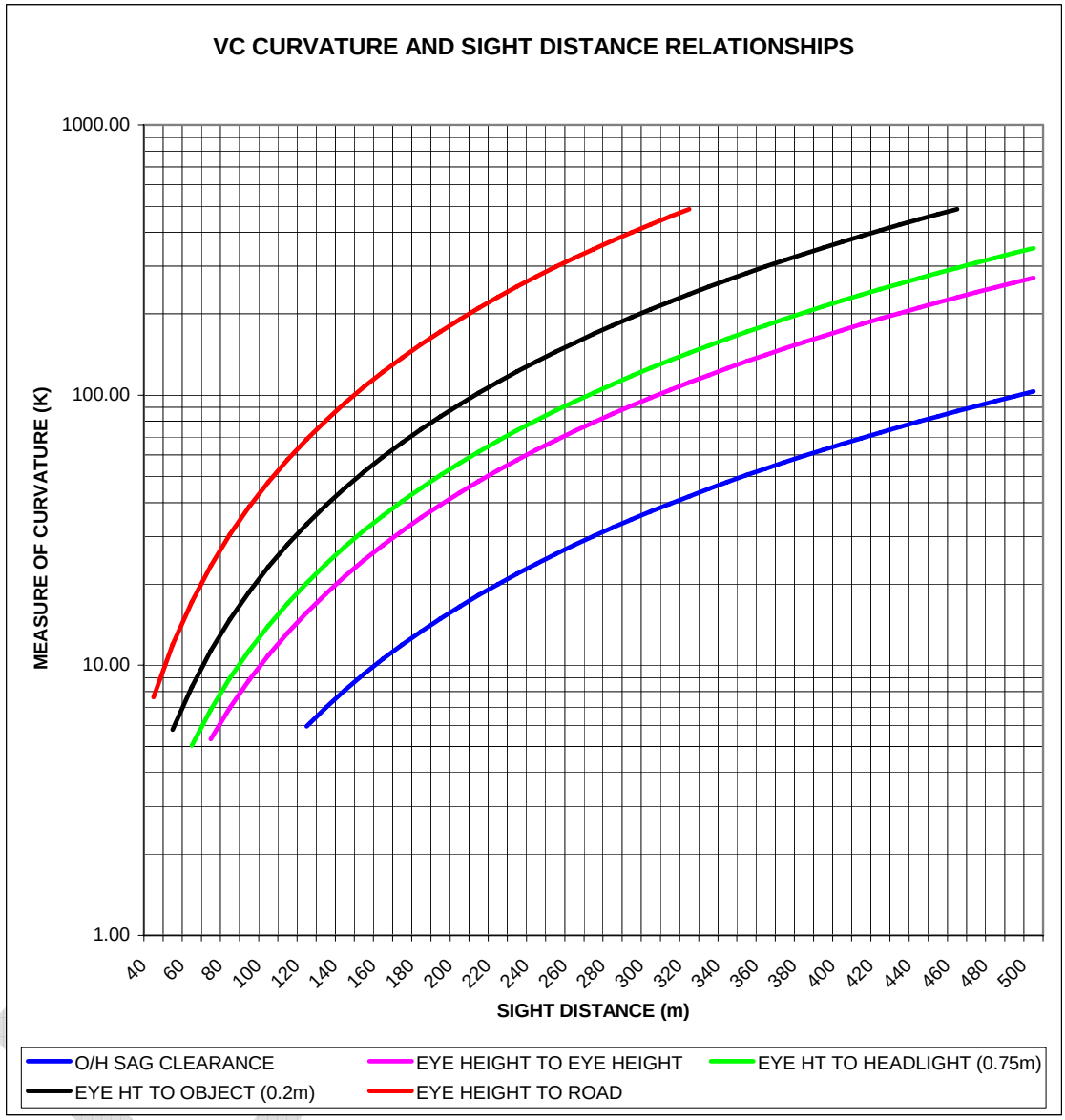


Figure 13 - Vertical Curve – Sight Distance Relationships

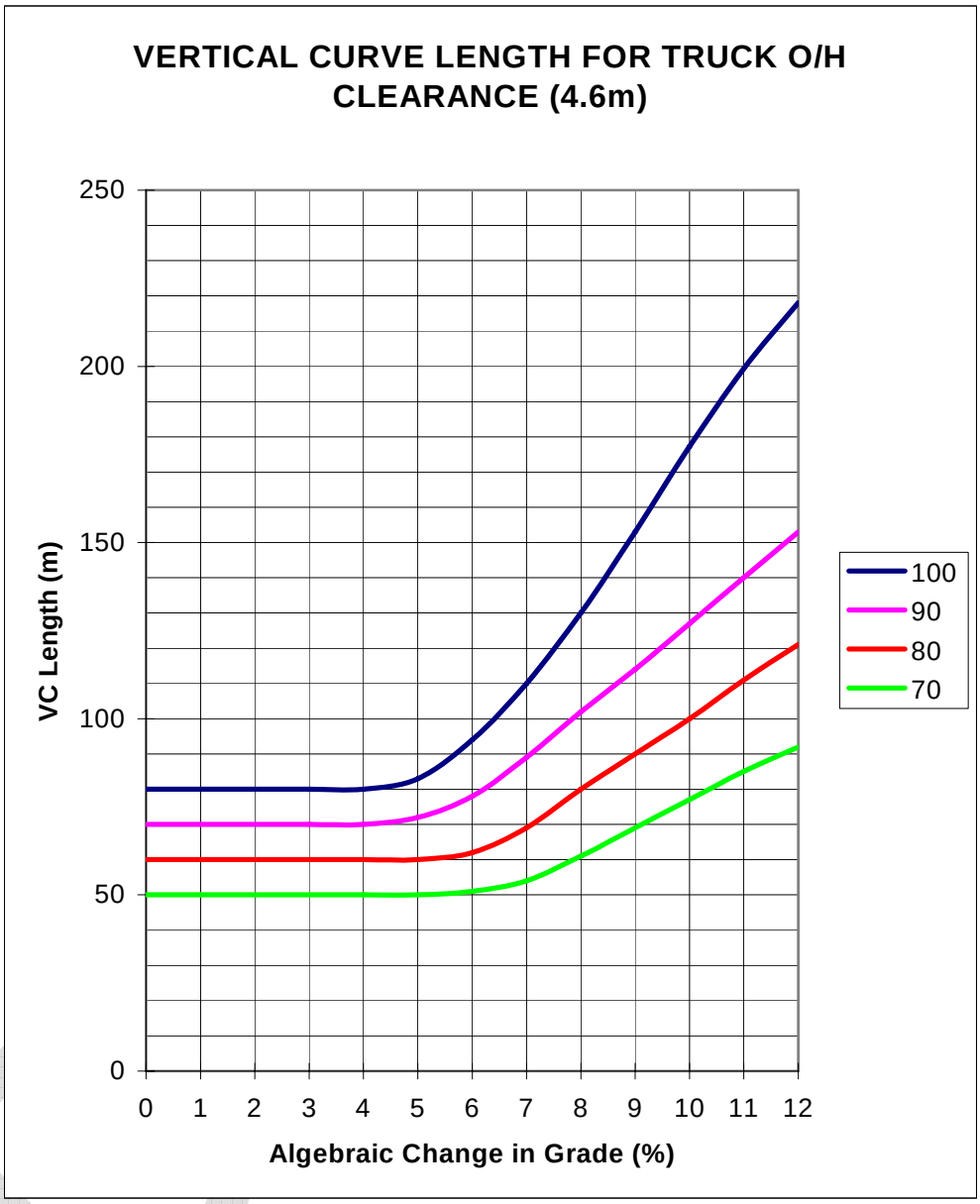


Figure 14 - Vertical Clearances

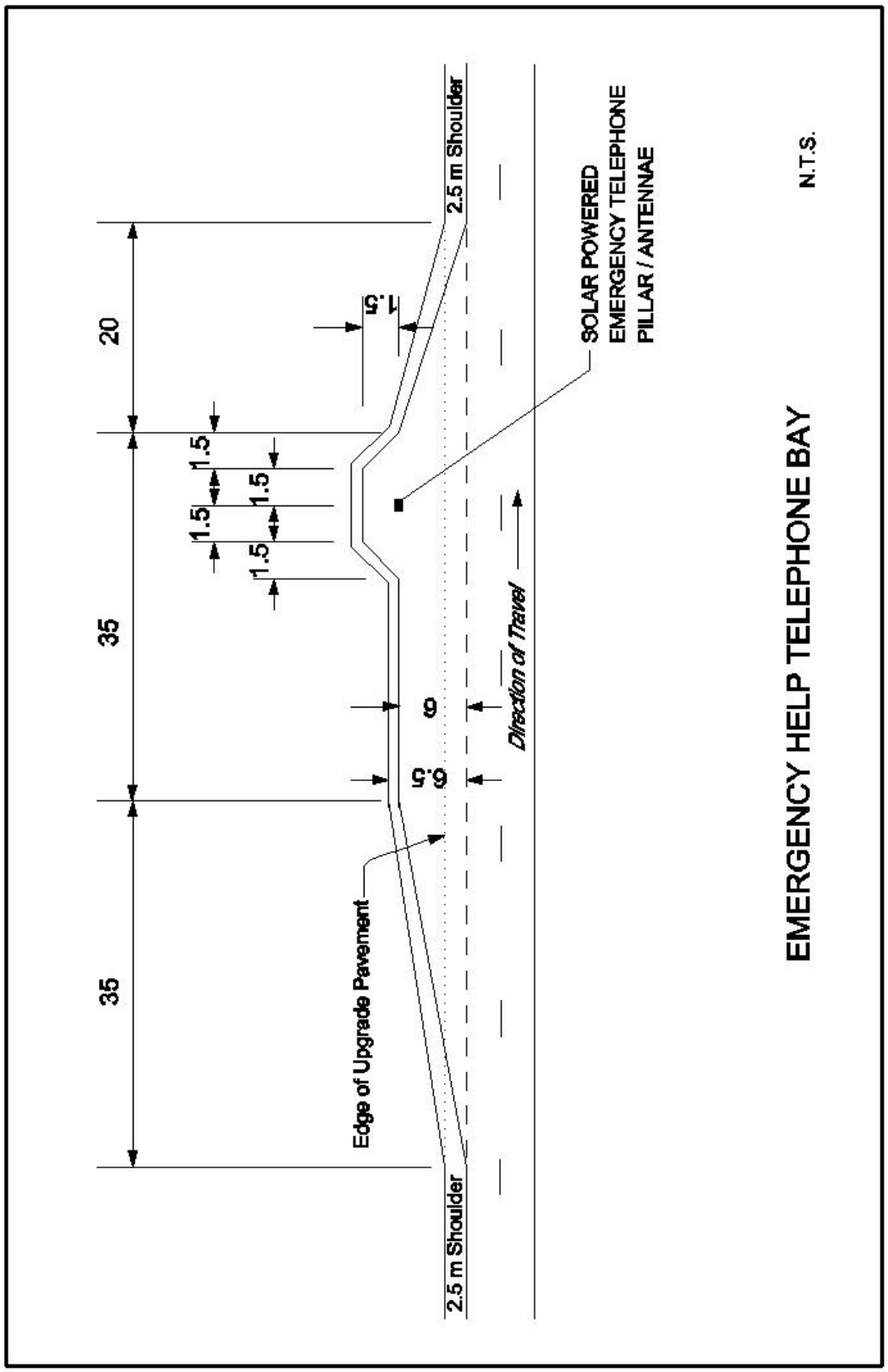


Figure 15 - Emergency Help Telephone Bay / Truck Lay-By

Appendix B3

Design:

Princes Highway Gerringong to Bomaderry concept design criteria addendum: Foxground and Berry Bypass specific design criteria

PRINCES HIGHWAY GERRINGONG TO BOMADERRY

CONCEPT DESIGN CRITERIA

ADDENDUM: FOXGROUND AND BERRY BYPASS SPECIFIC DESIGN CRITERIA

Purpose

This addendum supplements the Princes Highway Gerringong to Bomaderry Concept Design Criteria for the development of the Concept Design for the 32km section of the Princes Highway between Gerringong and Bomaderry.

The purpose of the Concept Design Criteria is to provide a list of design criteria is to clarify design criteria listed in the Scope of Work and Technical Criteria for the development of the Concept Design for the 32km section of the Princes Highway between Gerringong (Mount Pleasant) and Bomaderry (Cambewarra Road – Main Road 261) 42.6 km to 74.6 km south of Wollongong.

This addendum provides additional clarification of design criteria listed in the Scope of Work and Technical Criteria for the design development in the Foxground and Berry bypass section of the works. This addendum applies to the works between chainages 7600 and 20400 (Foxground Road to Flying Fox Creek).

Interpretation of these Criteria

Interpretation of these Criteria
(a) The criteria in this document are minimum criteria, including technical, operational and performance requirements for the Princes Highway Upgrade. The approval of the RTA's [RMS's] Representative is required for the adoption of alternative criteria or standards. Where alternative criteria or standards are adopted they must be clearly identified in an appendix to the relevant Design Report.
(b) If more than one criterion applies in respect of any part of the Highway then direction must be sought from the RTA's Representative.
(c) The Highway must meet the standards of RTA [RMS] and AUSTROADS publications and relevant Australian Standards. If suitable Australian Standards do not exist for the design of any element of the Highway, the designer may use international standards that reflect world's best practice, subject to the written approval of RTA's [RMS's] Representative.

Section 6 - Highway and Ramp Cross Section

Criteria	Requirement	Reference	Comment
Upgrade lanes (in each direction) Ramps	2 1	SWTC 1.3 Figure 6.1 Figure 6.2	With provision for future widening from the outer edge of the formation
Flood immunity	1:100 years for new structures. A minimum	SWTC 1.2 (assumed both lanes in both	Provide a clearance of 0.5m above the 1:100 year flood level to the

	of 1:20 years if an existing structure can be utilised subject to structural capacity adequate for new design life	directions)	lowest edge of shoulder. Prove that the adoption of a structure with a 1:20 year flood capacity does not exacerbate flooding. The Works must be designed so that the Main Carriageways are protected by physical means to prevent flooding. The edge line on the pavement surface of the Main Carriageways must be above the 1:100 year average recurrence interval (ARI) flood level, as detailed by the flood level in Figure 9.10.
Precast arches	Dimensions	Figure SK002	Option of using precast arch bridge

Figure 6.1