WorleyParsons

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WESTNET RAIL

Review of Unit Prices for Clause 9 Ceiling Price Review

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SYNOPSIS

A review of unit prices of infrastructure components and services has been carried out to assist WestNet's Floor and Ceiling calculations prescribed under the provisions of Railway Access Code in Western Australia..

This report has been produced for the sole purpose of providing WestNet Rail and its associated entities information about unit costs for infrastructure components.

PROJECT 501/09515/0 - REVIEW OF UNIT PRICES FOR CLAUSE 9 CEILING PRICE REVIEW

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Draft	P Kaye	M Baggott	N/A	31 May 2006	N/A	
1	Draft 2	P Kaye	M Baggott	N/A	7 June 2006		N/A
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1. INTRODUCTION

WestNet Rail commissioned WorleyParsons to undertake a general review of unit prices that underpin the Floor and Ceiling calculations as prescribed under the provisions of the Railway Access Code in Western Australia.

Track infrastructure costs are required for the typical routes within WestNet Rail network comprising the four primary routes considered in the *Pricing of Rail Infrastructure November 2002* (the *GHD Report*) and *Determination of Floor and Ceiling Costs to apply to WestNet Rail* produced by The Western Australian Independent Rail Access Regulator in September 2003 (the *Initial Determination*).

- Forrestfield to Kalgoorlie
- Kalgoorlie to Leonora
- Kalgoorlie to Esperance
- Kwinana to Bunbury Inner Harbour

Additionally, WestNet's cost model includes unit costs for other routes which typically have lighter load carrying capacity and hence different construction components; these lines are identified as:

- Brunswick to Premier
- Grain line 16 tal
- Grain line 19 tal

2. SCOPE OF WORKS

The following elements were included in the brief to WorleyParsons commission:-

- Summarise, from previous determinations, the specifications for track, signalling and communications infrastructure
- Identify the cost elements and appropriate unit rate categorisations
- Identify targeted suppliers/contractors and provide brief to allow understanding of the requirements
- Receive the suppliers and contractors quotes/tenders, make any adjustments for misunderstandings or incompleteness in their quotes through consultation with them
- Compile the best offers to provide a “market tested” best result
- Report

Specifications for track, signalling and communications infrastructure remains unchanged from the initial determination approved by the Economic Regulation Authority (ERA) in September 2003.

Assumptions to be adopted during the unit rate review were provided by WestNet as follows:

- Adopt MEERA (Modern Equivalent Replacement Asset), i.e. replacement value of current design standards of existing infrastructure.
- Adopt current best practices for construction
- Adopt a “Greenfield” approach for all infrastructure construction. Work is undertaken free of all rail traffic
- Adopt the most economic construction package to deliver the lowest economical costs and pricing discounts recognising economies of scale
- Allowance for wastage
- Transport of materials to site
- Engineering and construction overheads are to be separately defined

3. PRICING METHODOLOGY

3.1 Principles adopted

WestNet provided copies of previous cost reviews carried out by GHD in November 2002 and recorded in document *Pricing of Rail Infrastructure November 2002* (the *GHD Report*). This document provided some detail of specifications used and identified some of the assumptions that were made.

Additionally the *Determination of Floor and Ceiling Costs to apply to WestNet Rail* produced by the Western Australian Independent Rail Access Regulator in September 2003 (the *Initial Determination*), was reviewed to note the final unit rates adopted and used in the *Initial Determination*.

Spreadsheets of pricing schedules provided by WestNet Rail identified other unit costs used for lighter load capacity lines not included in the *GHD report* or the *Initial Determination.*

3.2 Methodology

For consistency WestNet requested that minimal changes were made to any specification or parameters agreed in the *Initial Determination*; therefore, WorleyParsons have utilised the specifications and methodologies identified in the *GHD Report* or the *Initial Determination*. Where differences have been noted between the two documents, then the information contained in the *Initial Determination* took precedence. For the items identified on WestNet pricing schedules that do not appear in either the *GHD Report* or *The Initial Determination,* the descriptions from WestNet pricing schedules have been used.

Where items are readily available and specifications well defined, component suppliers were identified and contacted. Suppliers were briefed on the requirements for the costing exercise and made aware of the potential (theoretical) quantities required; so that current market rates could be obtained and that they reflected the economies of scale for the amounts required. These details are further discussed under individual unit cost section.

Where items or services are not specifically defined, have very site specific issues that have to be considered or where the requirements could be interpreted differently to that discussed in the *GHD Report* or the *Initial Determination*, then suitable uplift escalation factors were researched and applied.

Unless otherwise stated the unit costs stated in this report are March 2006 costs. The unit costs proposed have been confirmed through interaction with suppliers, contractors, industry contacts and internal expertise within WorleyParsons. This interaction has provided the ability to compare values

with various sources and other projects to give a high level of certainty that the values provided are realistic and accurately reflect the current market rates.

3.3 Unit Costs

3.3.1 Rail

Supply

The specification for rail was taken from the *Initial Determination* approved Modern Equivalent Asset (MEA) table p18.

MEA Specification	Line			
	Forrestfield to Kalgoorlie (EGR)	Kalgoorlie to Leonora	Kalgoorlie to Esperance	Kwinana to Bunbury Inner Harbour (SWM)
Rail	60 kg/m	50 kg/m	50 kg/m	50 kg/m

Supply length of 27.5m and delivery to Midland for flashbutt welding into 110m lengths is the same as that identified in the *Initial Determination.*

Unit rates for rail were obtained from OneSteel for AS50 (50kg/m) and AS60 (60kg/m) Plain Carbon Rail have been used. The costs are for 27.5m lengths delivered to the flash butt welding facility at Midland. OneSteel provided the costs for the 2002 review; this therefore gives confidence that this is an accurate reflection of the cost differences between 2002 and 2006.

In addition to the rail MEA specifications identified in the *Initial Determination*, costs were obtained for the lighter (41 kg/m) weight rail identified in WestNet's existing pricing schedules.

Rail costs		
Description	**Unit**	**Cost**
41 kg/m	tonne	$1600
50 kg/m - AS50 Plain Carbon Steel	tonne	$1500
60 kg/m - AS60 Plain Carbon Steel	tonne	$1440

Rail welding

Rail is supplied from the manufacturer in 27.5m lengths and the railway construction process uses 110m lengths. The construction length rails are produced using flashbutt welding technique, typically

at a facility at Midland. Each 110m length requires 3 flashbutt welds. The operator of the flashbutt welding facility at Midland has provided unit rates for this process. Site welds to join the 110m lengths are typically made using the Thermit welding process and these rates have been included in the tracklaying costs. The actual logistics of constructing the network from greenfields were considered to be adequately addressed by this methodology.

Flashbutt welding		
Description	**Unit**	**Cost**
Flashbutt Weld	Each	$200.00

3.3.2 Sleepers

Unit costs for sleepers have been obtained for a number of types of sleeper that may be used on the WestNet infrastructure. It should be noted that the use of timber sleepers is becoming limited in WA due to availability of supply and cost when compared with concrete equivalent; costs for all options have been obtained so that comparisons can be made.

MEA Specification from *Initial Determination*	**Line**			
	Forrestfield to Kalgoorlie (EGR)	Kalgoorlie to Leonora	Kalgoorlie to Esperance	Kwinana to Bunbury Inner Harbour (SWM)
Gauge	Standard + Dual	Standard	Standard	Narrow
Sleepers	Concrete	Timber + 1 in 4 Steel	Timber + 1 in 2 steel	Concrete

In addition to the sleeper MEA specifications identified in the *Initial Determination*, costs were obtained for other sleepers identified in WestNet's existing pricing schedules, which include narrow and dual gauge steel and timber.

Concrete and steel sleepers

Sleeper costs were obtained from suppliers according to the construction material. Order quantities discussed with suppliers were for minimum 100km of track, in the order of 160,000 to 170,000 sleepers.

Sleeper Costs				
Description	**Unit**	**Supplier**	**Cost**	**Notes**
Concrete NG	each		$85.00	Ex works Perth Metro Includes rail fasteners
Concrete SG	each		$95.00	Ex works Perth Metro Includes rail fasteners
Concrete DG	each		$140.00	Ex works Perth Metro Includes rail fasteners
Steel NG M7.5 non-insulated system	each	OneSteel	$65.35	Delivered to Midland includes rail fasteners
Steel NG M8.5 insulated system	each	OneSteel	$83.25	Delivered to Midland includes rail fasteners
Steel SG M7.5 non-insulated system	each	OneSteel	$75.35	Delivered to Midland includes rail fasteners
Steel SG M8.5 insulated system	each	OneSteel	$93.25	Delivered to Midland includes rail fasteners
Steel DG M7.5 non-insulated system	each	OneSteel	$288.50	Delivered to Midland includes rail fasteners
Steel DG M8.5 insulated system	each	OneSteel	$313.45	Delivered to Midland includes rail fasteners

The considerable difference in cost between single gauge and dual gauge sleepers was discussed with the supplier, who confirmed that the dual gauge version requires a significant amount of different manufacturing techniques to complete the fabrication; particularly due to the welding of rail support plates.

Timber Sleepers

Concrete and steel sleeper systems are supplied with fastening components and track fixing jewellery; as part of this assembly is incorporated in the sleeper manufacturing process. For timber sleepers, costs for fastening system have been obtained separately and applied to the timber sleepers to produce an all inclusive cost.

Timber Sleepers				
Description	**Unit**	**Supplier**	**Cost**	**Notes**
Assemblies				
Timber NG	each	Recent WestNet purchase for timber + fasteners from Pandrol	$103.00	16 TAL assumes x2 baseplates, x4 lockspikes and x4 rail clips
Timber SG	each	Recent WestNet purchase for timber + fasteners from Pandrol	$117.80	19 TAL assumes x2 baseplates, x4 lockspikes and x4 rail clips
Timber DG	each	Recent WestNet purchase for timber + fasteners from Pandrol	$147.20	Assumes use of SG timber 19 TAL assumes x3 baseplates, x6 lockspikes and x6 rail clips
Components				
Timber NG	each	Recent WestNet purchase for timber	$44.20	16 TAL
Timber SG	each	Recent WestNet purchase for timber	$59.00	19 TAL
Baseplate	each	Pandrol	$22.00	Usually x2 per sleeper
Lockspike	each	Pandrol	$1.25	Usually x4 per sleeper
Rail clip	each	Pandrol	$2.50	Usually x4 per sleeper

3.3.3 Ballast

The MEA specification for ballast depth is as shown in the table and the depths were used to estimate ballast quantities.

Ballast MEA Specification	**Line**			
	Forrestfield to Kalgoorlie (EGR)	Kalgoorlie to Leonora	Kalgoorlie to Esperance	Kwinana to Bunbury Inner Harbour (SWM)
Ballast depth (mm)	300	200	250	250

Ballast suppliers were contacted to obtain market rates for supply of ballast, assuming that the minimum order would be 300,000t. All suppliers queried the delivery arrangements, as this could have a significant impact on the cost of their product. As specific delivery locations for construction sites could vary considerably, costs were obtained for supply rates at the quarry. A number of quarry locations were contacted to obtain strategic location points across the network; assuming that ballast would be transported up 250km (assumed average 150km) from the supply point to the construction worksite.

Ballast			
Quarry location	**Unit**	**Ex Quarry cost**	**Assumed Construction sites supplied**
Perth metro	per tonne	$25.00	SWM and EGR (part)
Bunbury	per tonne	$25.00	SWM
Kalgoorlie	per tonne	$16.50	EGR (part), Leonora
Kalgoorlie	per tonne	$20.00	EGR (part), Leonora
Esperance	per tonne	$25.50	Esperance

For the purposes of haulage; **$0.08 per tonne per km** is considered a reasonable and acceptable value to adopt, given that the assumed average transport distance would be 150km from the nearest supply quarry, this equates to an average **$12/t** haulage cost.

3.3.4 Turnouts

The specification for turnouts has been taken from the *GHD report,* as the *Initial Determination* does not specifically identify a MEA for these components. Assuming the *GHD report* configuration for turnouts also provides consistency for comparing unit costs changes between 2002 and 2006.

Turnout Specification (GHD report Section 8)	**Line**			
	Forrestfield to Kalgoorlie (EGR)	Kalgoorlie to Leonora	Kalgoorlie to Esperance	Kwinana to Bunbury Inner Harbour (SWM)
Narrow gauge 1:12 60 kg rail tangential switch blades on concrete sleeper	✘	✘	✘	✓
Standard gauge 1:12 60 kg rail tangential switch blades on concrete sleeper	✓	✓	✓	✘
Dual Gauge 1:16 60 kg rail tangential switch blades on concrete sleeper	✓	✘	✘	✘

Using the same suppliers as referenced in the *GHD Report,* costs for manufacture and delivery of turnouts to Perth were obtained. Installation costs were also supplied from the same source as the *GHD Report*.

Turnout type	**Unit**	**Supply cost delivered to Perth**	**Installation cost**
Narrow gauge 1:12 60 kg rail tangential switch blades on concrete sleeper	Each	$135,000.00	$72,000.00
Standard gauge 1:12 60 kg rail tangential switch blades on concrete sleeper	Each	$133,000.00	$72,000.00
Dual Gauge 1:16 60 kg rail tangential switch blades on concrete sleeper	Each	$357,000.00	$97,000.00

In addition to the turnout MEA specifications identified in the *GHD Report*, costs were obtained for other turnout combinations identified in WestNet's existing pricing schedules.

Turnout type	Unit	Supply cost delivered to Perth	Notes
Narrow gauge 1:12 60 kg rail tangential switch blades on timber sleeper	Each	$114,000.00	
Standard gauge 1:12 60 kg rail tangential switch blades on timber sleeper	Each	$101,000.00	
Dual Gauge 1:16 60 kg rail tangential switch blades on timber sleeper	Each	$288,000.00	
Narrow gauge 1:12 50 kg rail tangential switch blades on timber sleeper	Each	$134,418.00	50 kg/m rail substituted as an alternative to 47 kg/m rail
Standard gauge 1:12 50 kg rail tangential switch blades on timber sleeper	Each	$120,872.00	50 kg/m rail substituted as an alternative to 47 kg/m rail
Dual Gauge 1:16 50 kg rail tangential switch blades on timber sleeper	Each	$315,726.00	50 kg/m rail substituted as an alternative to 47 kg/m rail
Narrow gauge 1:12 47 kg rail tangential switch blades on timber sleeper	Each	Turnout supplier advised that this size of rail is not an option as the component materials are no longer available	
Standard gauge 1:12 47 kg rail tangential switch blades on timber sleeper	Each	Turnout supplier advised that this size of rail is not an option as the component materials are no longer available	
Dual Gauge 1:16 47 kg rail tangential switch blades on timber sleeper	Each	Turnout supplier advised that this size of rail is not an option as the component materials are no longer available	

3.3.5 Tracklaying

For this costing exercise the contractor that provided costs that were used in the *GHD report* was contacted again and asked to review and uplift the costs to reflect 2006 prices.

Costs were provided assuming the following extent of track laying works, to arrive at a per metre cost for each of the 4 primary routes under review.

Extent of works:

- Transport rail and unload
- Place bottom ballast from stockpile
- Distribute sleepers from site stockpile
- Place and align sleepers
- Place rail from train and clip up sleepers
- Top Ballasting
- Tamping and regulating
- Welding and De-stressing
- Survey from control points

Track Laying **Cost per single track km**	**Line**			
	Forrestfield to Kalgoorlie (EGR)	Kalgoorlie to Leonora	Kalgoorlie to Esperance	Kwinana to Bunbury Inner Harbour (SWM)
Narrow gauge cost per m	N/A	N/A	N/A	$117.51
Standard gauge cost per m	$123.79	$109.16	$109.16	N/A
Dual gauge cost per m	$144.30	N/A	N/A	N/A

3.3.6 Bridges

Bridges fall into the category identified in section 3.2 methodology, as being items that have individual site specific influences such as ground conditions, piling requirements, hydrology and geotechnical factors that significantly affect construction costs.

The method noted in the *GHD report* and adopted in the *Initial Determination,* created categories of bridge dependant on span and widths according to the number of tracks and gauge. The categorisation of bridges identified in the *GHD report* has been retained and an appropriate escalation factor investigated and applied to obtain 2006 cost rates.

A cost escalation factor was obtained from indexes published by the Australian Bureau of Statistics (ABS). The particular index that was utilised is contained in the ABS Producer Price Index; specifically *Index 6427 table 15 & 16 Road and Bridge construction (4121) Western Australia*. The percentage increase from December 2002 to March 2006 is **17.4%.**

Bridge Construction				
Bridge category (from *GHD report*)	**Rate per m^2 (GHD 2002 rate x 117.4%)**			
	Span	**SG and DG**		**NG**
		Single track 4m wide	Twin track 8 m wide	Single track 3.6 wide
Simple	Up to 12 m	$2700.20	$2582.80	$2582.80
Medium	12m to 20m	$3287.20	$3169.80	$3052.40
Complex	Exceeds 20m	$3991.60	$3874.20	$3756.80

3.3.7 Culverts

Supply costs

The *GHD Report* identified a large number of culvert sizes for both Reinforced Concrete Boxes (RCB) and Reinforced Concrete Pipes (RCP). These tables of culvert sizes were adopted in the *Initial Determination.* This 2006 review took these culvert sizes and contacted the supplier that provided costs in 2002 to obtain equivalent 2006 values. The supplier was provided with a table of sizes that required costing and they have supplied 2006 prices for the items that they manufacture; for the gaps in the sizes that are now not available from the supplier, a cost escalation factor was obtained from indexes published by the Australian Bureau of Statistics (ABS). The particular index that was utilised

is contained in the ABS Producer Price Index; specifically *Index 6427 table 10 & 11 Concrete Pipe and Culverts*. The percentage increase from December 2002 to March 2006 is **9.5%.**

Installation costs

The *GHD Report* established factors to apply to material cost for arriving at installation cost for RCB and RCP. These factor rates are 0.8 x material costs for RCB and 1.1 x material costs for RCP. It is considered appropriate and reasonable to continue to use this method for calculating installation costs for 2006.

End Treatments

The *GHD Report* developed a model for determining end treatment quantities based on a function of culvert size and it calculates a volume of concrete required in m^3; this calculation is considered appropriate and reasonable and still applies and can be updated for 2006 costs by adjusting the value used for supply of in-situ reinforced concrete; *GHD Report* arrived at a value of $1000/m^3$

For consistency it is considered appropriate to adopt an escalation factor to arrive at 2006 costs. The particular index that was utilised is contained in the ABS Producer Price Index; *Index 6427 table 15 & 16 Non Building Construction (412) Western Australia*, The percentage increase from December 2002 to March 2006 is **17.4%.**

The cost that should be adopted for culvert end treatments in 2006 is **$1174/m^3**

Culverts

ID	Type	Size	MatCost 2002 $/m	Uplift using ABS 9.5%	Material cost 2006 $/m	% change from 2002	Install $/m Matl. Cost X 1.1 RCP X 0.8 RCB	Weight From GHD Report Kg/m
1	RCB	300X150	$107.26	$117.45	n/a	9.50%	$93.96	363.65
2	RCB	375X225	$133.00	$145.64	n/a	9.50%	$116.51	450.90
3	RCB	450X150	$149.15	$163.32	n/a	9.50%	$130.66	505.66
4	RCB	450X225	$156.75	$171.64	n/a	9.50%	$137.31	531.42
5	RCB	450X300	$170.05	$186.20	n/a	9.50%	$148.96	576.51
6	RCB	450X450	$189.05	$207.01	n/a	9.50%	$165.61	640.93
7	RCB	600X225	$183.35	$200.77	n/a	9.50%	$160.61	621.61
8	RCB	600X300	$196.65	$215.33	n/a	9.50%	$172.27	666.70
9	RCB	600X375	$205.20	$224.69	n/a	9.50%	$179.76	695.68
10	RCB	600X450	$215.65	$236.14	n/a	9.50%	$188.91	731.11
11	RCB	600X600	$233.70	$255.90	n/a	9.50%	$204.72	792.31
12	RCB	750X300	$324.58	$355.42	n/a	9.50%	$284.34	1100.43
13	RCB	750X375	$332.50	$364.09	n/a	9.50%	$291.27	1127.27
14	RCB	750X450	$340.42	$372.76	n/a	9.50%	$298.21	1154.11

WESTNET RAIL

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Culverts								
ID	Type	Size	MatCost 2002 $/m	Uplift using ABS 9.5%	Material cost 2006 $/m	% change from 2002	Install $/m Matl. Cost X 1.1 RCP X 0.8 RCB	Weight From GHD Report Kg/m
15	RCB	750X600	$354.67	$388.36	n/a	9.50%	$310.69	1202.42
16	RCB	900X300	$609.58		$520.80	-14.56%	$416.64	2066.66
17	RCB	900X375	$617.50	$676.16	n/a	9.50%	$540.93	1541.66
18	RCB	900X450	$625.42		$665.00	6.33%	$532.00	1705
19	RCB	900X600	$639.67		$690.00	7.87%	$552.00	1750
20	RCB	900X750	$657.08		$575.00	-12.49%	$460.00	1780
21	RCB	900X900	$672.92		$600.00	-10.84%	$480.00	1995
22	RCB	1200X300	$1,076.67	$1,178.95	n/a	9.50%	$943.16	2540
23	RCB	1200X375	$1,092.50	$1,196.29	n/a	9.50%	$957.03	2590
24	RCB	1200X450	$1,104.38		$766.60	-30.59%	$613.28	2640
25	RCB	1200X600	$1,137.63		$812.50	-28.58%	$650.00	2690
26	RCB	1200X750	$1,159.79		$1,000.00	-13.78%	$800.00	2770
27	RCB	1200X900	$1,204.13		$887.50	-26.30%	$710.00	2888
28	RCB	1200X1050	$1,211.25		$1,150.00	-5.06%	$920.00	3010
29	RCB	1200X1200	$1,219.17		$1,240.00	1.71%	$992.00	3160
30	RCB	1500X900	$1,188.29		$1,220.00	2.67%	$976.00	3430
31	RCB	1500X1200	$1,258.75		$1,370.00	8.84%	$1,096.00	3728
32	RCB	1500X1500	$1,335.54		$1,540.00	15.31%	$1,232.00	4050
33	RCB	1800X900	$1,256.38		$1,510.00	20.19%	$1,208.00	3717
34	RCB	1800X1200	$1,325.25		$1,530.00	15.45%	$1,224.00	4005
35	RCB	1800X1500	$1,374.33		$1,700.00	23.70%	$1,360.00	4322
36	RCB	1800X1800	$1,459.04		$1,860.00	27.48%	$1,488.00	4720
37	RCB	2100X1200	$1,491.50		$1,940.00	30.07%	$1,552.00	4536
38	RCB	2100X1500	$1,565.13		$2,140.00	36.73%	$1,712.00	4853
39	RCB	2100X1800	$1,658.54		$2,330.00	40.48%	$1,864.00	5199
40	RCB	2100X2100	$1,748.79		$2,530.00	44.67%	$2,024.00	5546
41	RCB	2400X1200	$1,618.96		$2,090.00	29.10%	$1,672.00	4959
42	RCB	2400X1500	$1,700.50		$2,280.00	34.08%	$1,824.00	5284
43	RCB	2400X1800	$1,794.71		$2,480.00	38.18%	$1,984.00	5636
44	RCB	2400X2100	$1,875.46		$2,680.00	42.90%	$2,144.00	5956
45	RCB	2400X2400	$1,962.54		$2,890.00	47.26%	$2,312.00	6324
46	RCB	2700X1500	$1,797.88		$2,420.00	34.60%	$1,936.00	5958
47	RCB	2700X1800	$1,872.29		$2,620.00	39.94%	$2,096.00	6269
48	RCB	2700X2100	$1,979.17		$2,820.00	42.48%	$2,256.00	6711
49	RCB	2700X2400	$2,071.00		$3,030.00	46.31%	$2,424.00	7111
50	RCB	2700X2700	$2,174.71		$3,240.00	48.99%	$2,592.00	7527
51	RCB	3000X1800	$2,013.21		$2,780.00	38.09%	$2,224.00	7023
52	RCB	3000X2100	$2,101.08		$2,950.00	40.40%	$2,360.00	7343
53	RCB	3000X2400	$2,197.67		$3,190.00	45.15%	$2,552.00	7711
54	RCB	3000X2700	$2,307.71		$3,410.00	47.77%	$2,728.00	8127
55	RCB	3000X3000	$2,406.67		$3,620.00	50.42%	$2,896.00	8514
56	RCB	3300X1800	$2,736.00		$2,970.00	8.55%	$2,376.00	9003
57	RCB	3300X2100	$2,801.71		$3,170.00	13.15%	$2,536.00	9324
58	RCB	3300X2400	$2,899.88		$3,390.00	16.90%	$2,712.00	9692
59	RCB	3300X2700	$3,009.13		$3,600.00	19.64%	$2,880.00	10137

Culverts								
ID	Type	Size	MatCost 2002 $/m	Uplift using ABS 9.5%	Material cost 2006 $/m	% change from 2002	Install $/m Matl. Cost X 1.1 RCP X 0.8 RCB	Weight From GHD Report Kg/m
60	RCB	3300X3000	$3,108.88		$3,830.00	23.20%	$3,064.00	10495
61	RCB	3300X3300	$3,163.50	$3,464.03	n/a	9.50%	$2,771.23	10797
62	RCB	3600X1800	$3,008.33		$3,230.00	7.37%	$2,584.00	9846
63	RCB	3600X2100	$3,078.79		$3,460.00	12.38%	$2,768.00	10167
64	RCB	3600X2400	$3,087.50		$3,690.00	19.51%	$2,952.00	10535
65	RCB	3600X2700	$3,187.25		$3,930.00	23.30%	$3,144.00	10922
66	RCB	3600X3000	$3,300.85		$4,170.00	26.33%	$3,336.00	11309
68	RCP	300	$38.00		$45.45	19.61%	$50.00	80
69	RCP	375	$54.15		$55.40	2.31%	$60.94	110
70	RCP	450	$74.10		$90.80	22.54%	$99.88	160
71	RCP	525	$92.15		$100.40	8.95%	$110.44	210
72	RCP	600	$114.95		$140.40	22.14%	$154.44	255
73	RCP	675	$151.05	$165.40	n/a	9.50%	$181.94	330
74	RCP	750	$185.25		$204.60	10.45%	$225.06	365
75	RCP	825	$223.25	$244.46	n/a	9.50%	$268.90	430
76	RCP	900	$261.25		$322.70	23.52%	$354.97	500
77	RCP	1050	$332.50		$377.70	13.59%	$415.47	665
78	RCP	1200	$419.90		$491.00	16.93%	$540.10	830
79	RCP	1350	$516.80		$845.00	63.51%	$929.50	1000
80	RCP	1500	$609.90		$1,027.00	68.39%	$1,129.70	1330
81	RCP	1650	$741.00		$1,222.00	64.91%	$1,344.20	1665
82	RCP	1800	$866.40		$1,445.00	66.78%	$1,589.50	1965
83	RCP	1950	$1,032.18		$2,150.00	108.30%	$2,365.00	2365
84	RCP	2100	$1,197.95		$2,670.00	122.88%	$2,937.00	2830

3.3.8 Level Crossings

Protection

Level crossing protection treatments have been costed separately from the overall signalling and communications supply and installation costs. Level crossing protection is a significant cost element and can be identified as a unit rate and applied through the costing model using identified population numbers.

For this costing review, 4 typical level crossing protection configurations have been costed. The costs have been obtained from a recent tender submission for ongoing replacement and upgrade of WestNet's level crossing protection systems.

Level Crossing protection	
DC Westrak controlled with 2 flashing light masts with 2 pairs of back to back flashing lights	$106,190.43
DC Westrak controlled with 2 flashing light masts with 2 pairs of back to back flashing lights with pair of boom gates	$149,594.42
Predictor controlled with 2 flashing light masts with 2 pairs of back to back flashing lights	$133,525.35
Predictor controlled with 2 flashing light masts with 2 pairs of back to back flashing lights with pair of boom gates	$192,861.90

Surfacing

Enquiries with WestNet staff noted that the level crossing surfacing recently has only utilised bitumen treatments, and that this is now the preferred treatment for all level crossing surfacing works. A current rate for bitumen was available for recent level crossing works; for the other surface treatment identified in the *GHD report*, an escalation factor has been used to arrive at equivalent 2006 costs. The escalation factor has been derived from ABS published indexes specifically; *Index 6427 table 15 & 16 Road and Bridge construction (4121) Western Australia*, The percentage increase from December 2002 to March 2006 is **17.4%.**

Level Crossing Surfacing			
	unit	**Rate**	**comment**
Bitumen	m^2	$85.00	Recent rates for 2006 works
Concrete	m^2	$88.05	2002 prices uplifted by 17.4%
Gravel	m^2	$70.44	2002 prices uplifted by 17.4%
Metal dust	m^2	$29.35	2002 prices uplifted by 17.4%
Where not available	m^2	$29.35	2002 prices uplifted by 17.4%
Rock ballast	m^2	$23.48	2002 prices uplifted by 17.4%
Timbered	m^2	$41.09	2002 prices uplifted by 17.4%

3.3.9 Earthworks

Significant work was carried out during the 2002 review to agree the MEA for earthworks and has been used for the 2006 assessment of earthworks costs.

It was noted that the *GHD report* discusses different rates for embankment (17m^3$) and formation capping (8.50m^2$) whilst the *Initial Determination* has adopted a single rate (17m^3$) for earthworks including formation capping layer.

For the basis of the 2006 costing review the *GHD report* principles for earthworks costing were adopted to arrive at a rate for formation earthworks and rate for formation capping.

Typical specification supplied to contractor for costing

Height 1.5m (includes capping)

Capping layer 0.23m

Batters 1.5V to 1H

Earthworks					
Example (single track) earthworks volumes from *Initial Determination*	**GHD 2002 rate**	**GHD 2002 per linear metre**	**2006 costing per metre**	**Equivalent 2006 rate**	**Equivalent per m3 2006 rates**
$10m^3/m$ for formation	$\$17.00/m^3$	$170.00	$192.30	$\$19.23/m^3$	**$\$19.23/m^3$**
$6m^2/m$ for capping	$\$8.50/m^2$	$51.00	$57.69	$\$9.62/m^2$	**$\$41.80/m^3$**
Total per linear meter		$221.00	**$250.00**		

It is proposed that the equivalent 2006 value is **$\$19.23/m^3$** for formation earthworks and **$\$41.80/m^3$** for capping layer and that these values are adopted for use in the 2006 calculations.

3.3.10 Miscellaneous unit costs

Signs

The *Initial Determination* accepted a nominal figure of $2000 per km for provision and installation of trackside signage. The actual specification for the signs is not clear and would be open to interpretation if actual costs were sought for the 2006 review. For consistency with the *Initial Determination* it is proposed to apply an escalation factor to the 2002 rate to arrive at an equivalent rate for use in 2006. On the basis that the work to install signs is equivalent to non building construction work the escalation factor has been derived from ABS published indexes specifically, *Index 6427 table 15 & 16 Non Building Construction (412) Western Australia*, The percentage increase from December 2002 to March 2006 is **17.4%.**

Signs			
	unit	**rate**	**comment**
Trackside signage	km	$2348.00	2002 rate uplifted by 17.4%

Fencing

The *Initial Determination* accepted a nominal figure of $70,000 per track km for provision and installation of trackside fencing, where required for security or public safety. WestNet advise that the specification for the fencing is 1.8m chainlink with 3 strands barbed wire.

Fencing			
	unit	**rate**	**comment**
Fencing contractor's rate 1.8m chainlink with 3 strands barbed wire	Metre of fence	$25.00	
Rawlinson Australian Construction Handbook 2006	Metre of fence	$36.00	$72,000.00 per track km. Use this for 2006 assessment

The contractor's rate per metre of fencing is substantially less than the *Initial Determination,* it is proposed that the published rate in Rawlinson Construction handbook is a more reliable source for future use, and it is proposed that this figure is adopted for the 2006 assessment.

Shunter's walkway

The *Initial Determination* accepted a nominal figure of $3,150 per km for provision of shunter's walkways. As the detailed specification and dimensions that were used for the 2002 costing are unknown and for consistency with the *Initial Determination* it is proposed to apply an escalation factor the 2002 rate to arrive at an equivalent rate for use in 2006. On the basis that the work to construct shunter's walkway is equivalent to road construction work, the escalation factor has been derived from ABS published indexes specifically *Index 6427 table 15 & 16 Road and Bridge construction (4121) Western Australia*, The percentage increase from December 2002 to March 2006 is **17.4%.**

Shunter's walkway			
	unit	**rate**	**comment**
Shunter's walkway	km	$3,700.00	2002 rate uplifted by 17.4%

Access Roads

The *Initial Determination* accepted a nominal figure of $5,000 per km for provision of access roads. As the detailed specification and dimensions that were used for the 2002 costing are unknown and for consistency with the *Initial Determination* it is proposed to apply an escalation factor the 2002 rate to arrive at an equivalent rate for use in 2006. On the basis that the work to construct rail access road is equivalent to general road construction work, the escalation factor has been derived from ABS published indexes specifically *Index 6427 table 15 & 16 Road and Bridge construction (4121) Western Australia*, The percentage increase from December 2002 to March 2006 is **17.4%.**

Access Roads			
	unit	**rate**	**comment**
Access roads	km	$5,870.00	2002 rate uplifted by 17.4%

3.3.11 Signals and Communications

The signalling and communication system is a complex arrangement comprising many specialised components. The approach in 2002 identified many individual component items of the signalling and communications systems and carried out a bottom up assessment to arrive at the total replacement costs. The total costs were presented for a number of sections for each of the primary routes identified in the *Initial Determination.*

For the 2006 assessment of signalling costs WestNet proposed that existing 2002 costs be reviewed and a suitable escalation factor determined and applied to arrive at 2006 costs. To get an understanding of the extent of the signalling and communications equipment involved, WorleyParsons reviewed the items identified in 2002 and discussed with WestNet Signalling and Communication engineers and confirmed that the components identified in 2002 are generally still relevant to the functionality of the systems in 2006.

Signalling and communications are specialised engineering functions with limited availability of suitable contractors to provided design and installation services. Local knowledge is an important factor and is particularly relevant to understand the functionality required for the WestNet signalling and communications systems.

For the purpose of obtaining an acceptable escalation factor to apply to the 2002 cost and arrive at a 2006 cost, it was necessary to talk to contractors that have recent working knowledge of WestNet's signalling and communications functionality and also have sufficient local expertise to advise on the current market labour rates for the specialist disciplines required for this type of work.

Union Switch & Signal Pty Ltd were identified by WorleyParsons as suitable contractor to provide the information and advice required. They are located in WA and have significant signalling and communications expertise and knowledge of WestNet's functional requirements. They have carried out a number of contracts during the review period 2002 to 2006, and are well placed to provide acceptable escalation factors that take into account local issues and current WA market forces.

WorleyParsons provided Union Switch & Signal with details of the routes identified in the *Initial Determination* and also provided the 2002 cost figures. From their knowledge of cost movements they were able to supply a breakdown of how costs have changed for each major activity in signalling and communications projects. These breakdowns and escalations were applied to the 2002 figures to obtain equivalent 2006 costs.

Signalling and Communications – breakdown of total cost	
Engineering	20%
Materials	40%
Installation	30%
Management	10%
Total	**100%**

Signalling and Communications – escalation factors			
	2003 to 2004	**2004 to 2005**	**2005 to 2006**
Engineering	3%	3%	5%
Materials	5%	10%	5%
Installation	5%	5%	5%
Management	3%	3%	5%

Applying these escalation factors to the 2002 costs arrives at the following results for equivalent 2006 costs for signalling and communications.

Signalling					
Forrestfield to Kalgoorlie	**Section length**	**Dec 2002 Signalling cost**	**2006 Signalling cost**	**Rate Per km**	**Total % change**
Forrestfield South Points to Midland	11	$3,351,458.00	**$ 3,909,713.71**	$355,428.52	17%
No 723 Points Midland to No 3 Points Millendon Junction	14	$5,489,887.00	**$6,404,342.97**	$457,453.07	17%
No 3 Points Millendon Junction to No 9 Points Tooday West	61	$ 7,542,625.00	**$ 8,799,007.59**	$144,246.03	17%
No 9 Points Tooday West to No 203 Points Avon Yard	26	$5,040,824.00	**$5,880,479.09**	$226,172.27	17%
No 203 Points Avon Yard to No 115 Points West Merredin	167	$ 21,735,931.00	**$25,356,506.76**	$151,835.37	17%
No 115 Points West Merredin to No 13 Points Koolyanobbing East	176	$19,202,405.00	**$22,400,968.80**	$127,278.23	17%
No 13 Points Koolyanobbing East to No 59 Points West Kalgoorlie	192	$13,618,171.00	**$15,886,563.36**	$ 82,742.52	17%
No 59 Points West Kalgoorlie to Network Boundary	6	$5,060,055.00	**$5,902,913.42**	$983,818.90	17%
Kalgoorlie to Leonora	**Section length**	**Dec 2002 Signalling cost**	**2006 Signalling cost**	**Rate Per km**	**Total % change**
No 87 Points Kalgoorlie to Malcolm North Points	236	$ 1,494,016.00	**$1,742,875.74**	$7,385.07	17%
Malcolm North Points to Leonora WMC2	23	$687,575.00	**$802,105.06**	$ 34,874.13	17%
Kalgoorlie to Esperance	**Section length**	**Dec 2002 Signalling cost**	**2006 Signalling cost**	**Rate Per km**	**Total % change**
West Kalgoorlie West to Hampton South Points	17	$3,384,439.00	**$3,948,188.39**	$232,246.38	17%
Hampton South Points to Kambalda South Points	38	$565,433.00	**$659,617.74**	$17,358.36	17%
Kambalda South Points to Salmon Gums North Points	227	$2,888,671.00	**$3,369,839.82**	$14,845.11	17%
Salmon Gums North Points to Esperance Start Esperance Port Siding	106	$1,683,500.00	**$1,963,922.28**	$18,527.57	17%
Kwinana to Bunbury Inner Harbour	**Section length**	**Dec 2002 Signalling cost**	**2006 Signalling cost**	**Rate Per km**	**Total % change**
Kwinana (No 3 Facing Points) to Mundijong Junction Points	26	$ 6,900,161.00	**$8,049,527.72**	$309,597.22	17%
Mundijong Junction Points to Pinjarra (No 25 Points)	43	$6,118,448.00	**$7,137,604.00**	$165,990.79	17%
Pinjarra to Pinjarra East	1	$418,722.00	**$488,468.94**	$488,468.94	17%
Pinjarra East to Alumina Junction	1.7	$576,141.00	**$672,109.38**	$395,358.46	17%
Pinjarra East to Pinjarra South	1	$157,419.00	**$183,640.44**	$183,640.44	17%
Pinjarra to Wagerup	33	$2,549,976.00	**$2,974,728.05**	$ 90,143.27	17%
Wagerup to Brunswick Junction	39	$8,454,823.00	**$9,863,151.32**	$252,901.32	17%
Brunswick Junction to Picton Junction	17	$3,429,468.00	**$4,000,717.91**	$235,336.35	17%
Picton Junction to Inner Harbour	4	$2,486,863.00	**$2,901,102.26**	$725,275.56	17%

Communications

Forrestfield to Kalgoorlie	Section length	Dec 2002 Communications cost	2006 Communications cost	Rate Per km	Total % change
Forrestfield South Points to Midland	11	$328,408.00	**$ 383,111.25**	$41,097.39	17%
No 723 Points Midland to No 3 Points Millendon Junction	14	$ 573,846.00	**$ 669,432.10**	$56,423.56	17%
No 3 Points Millendon Junction to No 9 Points Tooday West	61	$2,299,929.00	**$2,683,030.47**	$51,901.25	17%
No 9 Points Tooday West to No 203 Points Avon Yard	26	$ 969,616.00	**$1,131,125.91**	$51,335.71	17%
No 203 Points Avon Yard to No 115 Points West Merredin	167	$4,820,869.00	**$5,623,885.97**	$39,737.64	17%
No 115 Points West Merredin to No 13 Points Koolyanobbing East	176	$4,398,783.00	**$5,131,492.68**	$34,404.33	17%
No 13 Points Koolyanobbing East to No 59 Points West Kalgoorlie	192	$8,028,891.00	**$9,366,271.40**	$57,563.54	17%
No 59 Points West Kalgoorlie to Network Boundary	6	$ 99,506.00	**$116,080.81**	$22,829.23	17%
Kalgoorlie to Leonora	**Section length**	**Dec 2002 Communications cost**	**2006 Communications cost**	**Rate Per km**	**Total % change**
No 87 Points Kalgoorlie to Malcolm North Points	236	$5,308,837.00	**$6,193,135.29**	$30,965.68	17%
Malcolm North Points to Leonora WMC2	23	$304,697.00	**$355,450.68**	$18,236.17	17%
Kalgoorlie to Esperance	**Section length**	**Dec 2002 Communications cost**	**2006 Communications cost**	**Rate Per km**	**Total % change**
West Kalgoorlie West to Hampton South Points	17	$527,027.00	**$614,814.41**	$42,675.35	17%
Hampton South Points to Kambalda South Points	38	$1,119,022.00	**$1,305,418.61**	$40,536.68	17%
Kambalda South Points to Salmon Gums North Points	227	$6,282,420.00	**$7,328,888.98**	$38,097.31	17%
Salmon Gums North Points to Esperance Start Esperance Port Siding	106	$2,859,353.00	**$3,335,638.29**	$37,132.58	17%
Kwinana to Bunbury Inner Harbour	**Section length**	**Dec 2002 Communications cost**	**2006 Communications cost**	**Rate Per km**	**Total % change**
Kwinana (No 3 Facing Points) to Mundijong Junction Points	26	$1,279,989.00	**$1,493,198.05**	$67,768.22	17%
Mundijong Junction Points to Pinjarra (No 25 Points)	43	$2,223,493.00	**$2,593,862.45**	$71,180.41	17%
Pinjarra to Pinjarra East	1	$ 24,598.00	**$28,695.31**	$33,860.47	17%
Pinjarra East to Alumina Junction	1.7	$7,747.00	**$9,037.43**	$ 6,273.04	17%
Pinjarra East to Pinjarra South	1	$17,520.00	**$20,438.32**	$24,117.22	17%
Pinjarra to Wagerup	33	$675,896.00	**$788,480.67**	$28,194.16	17%
Wagerup to Brunswick Junction	39	$1,434,260.00	**$1,673,166.12**	$50,624.00	17%
Brunswick Junction to Picton Junction	17	$823,294.00	**$960,430.90**	$66,665.20	17%
Picton Junction to Inner Harbour	4	$222,043.00	**$259,028.92**	$76,413.53	17%

3.3.12 Maintenance

WestNet requested that WorleyParsons establish an acceptable escalation factor that can be applied to the *Initial Determination* figures to arrive at equivalent figures for 2006 maintenance costs.

The major aspects of railway maintenance are associated with the track and civil elements of the infrastructure; it is this fact that influenced the selection of escalation factor that could be applied to historical costs. Typically the equipment, skills and methodology required to maintain the railway are similar the skills, equipment and methodology required for other civil construction infrastructure.

It was assumed that other civil construction work is similar to railway maintenance, and we have made use of readily available cost indexes to apply to the *initial determination* to arrive at the equivalent 2006 cost.

In support of using escalation factors for determining cost movement over a number of years, it is known that other Rail Access Regulators around Australia (Queensland and Victoria) have accepted or are in the process of accepting the use of escalation factors to demonstrate increases in maintenance costs.

It was considered preferable to use escalation factors from a source that has the ability to be used in future reviews and can provide consistency in the basis of the calculated increase; for this purpose WorleyParsons made reference to Australian Bureau of Statistics (ABS) to obtain suitable cost escalation factors.

The relevant indices which have been utilised are *Non Building Construction* and *Road and Bridge Construction*, both of which show cost increases of **17.4 %** between Dec 2002 and Mar 2006; it is this figure that has been applied to the 2002 costs to arrive at equivalent 2006 costs.

Maintenance – ceiling price schedule			
Forrestfield to Kalgoorlie	**Section length**	**Initial Determination Maintenance ceiling price schedule cost**	**2006 Maintenance cost**
Forrestfield South Points to Midland	11	$ 901,073.00	$1,057,859.702
No 723 Points Midland to No 3 Points Millendon Junction	14	$ 920,354.00	$1,080,495.596
No 3 Points Millendon Junction to No 9 Points Tooday West	61	$ 2,035,147.00	$2,389,262.578
No 9 Points Tooday West to No 203 Points Avon Yard	26	$ 1,121,563.00	$1,316,714.962
No 203 Points Avon Yard to No 115 Points West Merredin	167	$ 2,954,980.00	$3,469,146.520
No 115 Points West Merredin to No 13 Points Koolyanobbing East	176	$ 2,629,818.00	$3,087,406.332
No 13 Points Koolyanobbing East to No 59 Points West Kalgoorlie	192	$ 2,803,643.00	$3,291,476.882
No 59 Points West Kalgoorlie to Network Boundary	6	$ 341,965.00	$ 401,466.910
Kalgoorlie to Leonora	**Section length**	**Initial Determination Maintenance ceiling cost**	**2006 Maintenance cost**
No 87 Points Kalgoorlie to Malcolm North Points	236	$ 1,825,131.00	$2,142,703.794
Malcolm North Points to Leonora WMC2	23	$ 273,773.00	$ 321,409.502
Kalgoorlie to Esperance	**Section length**	**Initial Determination Maintenance ceiling cost**	**2006 Maintenance cost**
West Kalgoorlie West to Hampton South Points	17	$ 309,062.00	$ 362,838.788
Hampton South Points to Kambalda South Points	38	$ 443,930.00	$ 521,173.820
Kambalda South Points to Salmon Gums North Points	227	$ 2,105,912.00	$2,472,340.688
Salmon Gums North Points to Esperance Start Esperance Port Siding	106	$ 1,138,426.00	$1,336,512.124
Kwinana to Bunbury Inner Harbour	**Section** length	**Initial Determination Maintenance ceiling cost**	**2006 Maintenance cost**
Kwinana (No 3 Facing Points) to Mundijong Junction Points	26	$ 418,807.00	$ 491,679.418
Mundijong Junction Points to Pinjarra (No 25 Points)	43	$ 735,479.00	$ 863,452.346
Pinjarra to Pinjarra East	1	$ 71,299.00	$ 83,705.026
Pinjarra East to Alumina Junction	1.7	$ 85,507.00	$ 100,385.218
Pinjarra East to Pinjarra South	1	$ 31,114.00	$ 36,527.836
Pinjarra to Wagerup	33	$ 308,209.00	$ 361,837.366
Wagerup to Brunswick Junction	39	$ 533,763.00	$ 626,637.762
Brunswick Junction to Picton Junction	17	$ 348,113.00	$ 408,684.662
Picton Junction to Inner Harbour	4	$ 156,426.00	$ 183,644.124

4. REFERENCES

Title	Author	Date
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Floor and Ceiling Costs to Apply to WestNet Rail	Office of the Rail Access Regulator	24 September 2003
APM Unit Rate Review to Worley.xls	Geoff Brook WestNet Rail	March 2006
Australian Construction Handbook 2006	Rawlinsons	2006
Australian Bureau of Statistics website (www.abs.gov.au)	Australian Bureau of Statistics	2006