

Remotest factors for Transport of Materials and Installation



From	To	Bridge Const'n (incl materials)	Culvert Install'n	Culvert End Treatment Construction	Level Xing Construction	
Forrestfield	Kalgoorlie					
Forresfield S	Midland	1.0	1.0	1.0	1.0	
Midland	Kalgoorlie					
Midland	Millendon	1.0	1.0	1.0	1.0	
Millendon	Toodyay West	1.1	1.1	1.1	1.0	
Toodyay West	Avon Yard	1.1	1.1	1.1	1.0	
Avon Yard	West Merredin	1.2	1.2	1.2	1.1	
West Merredin	Koolyanobbing East	1.4	1.5	1.4	1.2	
Koolyanobbing East	West Kalgoorlie	1.4	1.5	1.4	1.2	
West Kalgoorlie	NRC Border	1.4	1.5	1.4	1.2	

Kalgoorlie	Leonora					
Kalgoorlie East	Malcolm	1.5	1.6	1.5	1.2	
Malcolm	Leonora	1.5	1.7	1.5	1.3	

Kalgoorlie	Esperance					
West Kalgoorlie	Hampton	1.4	1.5	1.4	1.2	
Hampton	Kambalda	1.4	1.5	1.4	1.2	
Kambalda	Salmon Gums	1.5	1.6	1.5	1.2	
Salmon Gums	Esperance	1.4	1.5	1.4	1.2	

Kwinana	Bunbury Inner Harbour					
Kwinana	Mundijong Junction	1.0	1.0	1.0	1.0	
Mundijong Junction	Picton Junction					
Mundijong	Pinjarra	1.1	1.1	1.1	1.0	
Pinjarra E	Pinjarra S	1.1	1.1	1.1	1.0	
Pinjarra	Alumina Jct	1.1	1.1	1.1	1.0	
Pinjarra	Wagerup North	1.1	1.1	1.1	1.0	
Wagerup North	Brunswick North	1.1	1.1	1.1	1.0	
Brunswick North	Picton Junction	1.1	1.1	1.1	1.0	
Picton Junction	Bunbury					
Picton Junction	Bunbury Inner Harbour	1.1	1.1	1.1	1.0	

Rail Transportation Unit Costs

Transport arranged by ARG
 Contact: John Purcell (ARG)



Item	Transport from	Comments	Rate (\$ / t-km)		
			Min	Max	Adopt
Rail	Midland	Specialised Wagons	0.10	0.12	0.10
Concrete Sleepers	Midland (or Kwinana)		0.10	0.12	0.10
Steel Sleepers	Midland (or Kalgoorlie)		0.10	0.12	0.10
Timber Sleepers					0.12
Ballast	Perth, Kalgoorlie, Esperance, Bunbury		0.10	0.12	0.10
Precast concrete culvert units	Midland (or Kwinana)		0.10	0.12	0.12

Rail prices

	\$/t		\$/m		\$/km	
	50kg	60kg	50kg	60kg	50kg	60kg
OneSteel rail prices						
Rail Cost delivered Free on Rail to Midland	1015	970	50.75	58.2	50,750	58,200
Rail Cost delivered Free on Rail to Kalgoorlie	995	950	49.75	57	49,750	57,000

No. of factory welds in 1km of rail	27.3	Assumes 27.5m lengths welded into 110m lengths				
No. of factory welds in 1km of 3-rail track	81.8					
No. of factory welds in 1km of 2-rail track	54.5					
No. of field welds (thermit) in 1 km of rail	9.1	Assumes 110m lengths welded together				
No. of field welds (thermit) in 1 km of 3-rail track	27.3					
No. of field welds (thermit) in 1 km of 2-rail track	18.2					
Assumed rate for factory weld (50kg or 60kg) (\$ per no.)	140	Rate provided by JHCE				
Assumed rate for site (thermit) weld (50kg or 60kg) (\$ per no.)	450	Average rate of 2 current contracts (Dandalup Crossing Loop, BHPIO - Yandi.) Rate also confirmed by John Holland. Rate from Barclay Mowlem higher than \$450.				

Concrete Sleeper Prices



		SG	DG	NG		
Weight (kg)		289	323	243	Adopted	
CSR Humes Prices (delivered to Midland or Kwinana)	Price includes cast in shoulders	\$65.00	\$87.00	\$56.00		
CSR estimate of loose components		\$16.00	\$24.00	\$16.00		
Total price per sleeper including fastenngs		\$81.00	\$111.00	\$72.00	Adopted	
Pandrol estimate of sleeper set	Price includes 4 shoulders, 4 clips, 4 insulators and 2 pads	21 min 24 max				
	say	\$22.50	\$33.75	\$22.50		
	Discount cast in shoulders	\$7.00	\$10.50	\$7.00		
Pandrol estimate of loose components		\$15.50	\$23.25	\$15.50	Agrees almost exactly with CSR estimate of loose components	

Timber Sleeper Prices

		SG			
Weight (kg)		66			Adopt
WestNet price (based on "limited" (ad hoc) qty's)	Includes supply, processing, treatment	\$45.88			
Adopted price (based on large qty's)		\$40.00			
JHCE estimate of 4 lockspikes and 2 plates per timber sleeper		\$24.00			
Total price including fastenngs		\$64.00			Adopt

Steel Sleeper Prices

		M7.5	M8.5	Average	
		Uninsulated	Insulated		
Weight (kg)		59	67		Adopt
OneSteel Prices (delivered to Midland or Kwinana)	Price includes cast in shoulders	\$ 65.00	\$ 70.00		
loose components	included				
Total price including fastenngs		\$ 65.00	\$ 70.00	\$ 67.00	Adopt

Ballast Quantities



	Supply Price (\$/t) from quarry at				Min Depth Ballast under Sleeper (mm)	Sleeper Type	Cross Sectional Area m ²	Volume m ³ per km	No. Sleepers per km		Weight of each sleeper kg	Volume of each Sleeper m ³	Vol of Sleepers m ³ per km	Net Volume of ballast m ³ per km	Density of Compacted Ballast t/m ³	Net weight of ballast tonne per km	
	Perth	Bunbury	Kalgoorlie	Esperance					Concrete	Timber						excludes wastage	includes 5% wastage
Forrestfield - Kalgoorlie	15.00		15.00														
per Twin Dual Gauge					300	Concrete	4.566	4,566	3000		323	0.129	388	4,178			
per Single Dual Gauge														2,089	1.65	3,447	3,620
per Single Standard Gauge					300	Concrete	2.197	2,197	1500		289	0.116	173	2,024	1.65	3,339	3,506
Kalgoorlie - Leonora			15.00														
per Single Standard Gauge					200	Timber (1:4 Steel)	1.448	1,448		1125		0.073	82	1,366	1.65	2,253	2,366
Kalgoorlie - Esperance			15.00	28.00													
per Single Standard Gauge					250	Timber (1:2 Steel)	1.676	1,676		820		0.073	60	1,616	1.65	2,666	2,800
Kwinana - Bunbury Inner Harbour	15.00	13.00															
per Single Narrow Gauge					300	Concrete	1.952	1,952	1500		243	0.097	146	1,806	1.65	2,980	3,129

Turnouts

Material supply prices from VAE



		Gauge	No.	Supply Rate	Installation Rate	Total Rate
Kwinana	Kalgoorlie					
Forrestfield	Midland	DG	58	200,000	80,000	280,000
Midland	Millendon	DG	17	200,000	80,000	280,000
Millendon	Toodyay West	DG	17	200,000	80,000	280,000
Toodyay West	Avon Yard	DG	6	200,000	80,000	280,000
Avon Yard	West Merredin	SG	25	120,000	60,000	180,000
West Merredin	Koolyanobbing East	SG	18	120,000	60,000	180,000
Koolyanobbing East	West Kalgoorlie	SG	11	120,000	60,000	180,000
Kalgoorlie	Leonora					
Kalgoorlie East	Malcolm	SG	0	120,000	60,000	180,000
Malcolm	Leonora	SG	6	120,000	60,000	180,000
Kalgoorlie	Esperance					
West Kalgoorlie	Hampton	SG	6	120,000	60,000	180,000
Hampton	Kambalda	SG	5	120,000	60,000	180,000
Kambalda	Salmon Gums	SG	9	120,000	60,000	180,000
Salmon Gums	Esperance	SG	15	120,000	60,000	180,000
Kwinana	Bunbury Inner Harbour					
Kwinana	Mundijong Junction	NG	7	118,000	60,000	178,000
Mundijong Junction	Pinjarra	NG	11	118,000	60,000	178,000
Pinjarra E	Pinjarra S	NG	0	118,000	60,000	178,000
Pinjarra	Alumina Junction	NG	1	118,000	60,000	178,000
Pinjarra	Wagerup North	NG	5	118,000	60,000	178,000
Wagerup North	Brunswick North	NG	7	118,000	60,000	178,000
Brunswick North	Picton Junction	NG	5	118,000	60,000	178,000
Picton Junction	Bunbury Inner Harbour	NG	4	118,000	60,000	178,000

Track Laying Cost
(As per verbal advice from JHCE)



	As per John Holland (verbal advice)						Range as per Barclay Mowlem (excluding remoteness from Perth)	
	\$/t	t/m	\$/m	Remoteness Factor	Adjusted Rate \$/km	Adopt Say (\$/km)	Min	Max
Forrestfield-Kalgoorlie DG								
Lay bottom ballast (say one third of total volume)	5	1.207	6.03					
Lay Sleepers down and unload /place rail			55.00					
Lay top ballast	7	2.413	16.89					
Tamping			14.00					
Welding and Testing			5.00					
Sub-Total			96.93					
Add 25% for 3rd rail			22.72					
Total			119.65	1.05	125,633	126,000		
Forrestfield-Kalgoorlie SG								
Lay bottom ballast (say one third of total volume)	5	1.169	5.84					
Lay Sleepers down			55.00					
Lay top ballast	7	2.337	16.36					
Tamping			14.00					
Welding and Testing			5.00					
Total			96.20	1.10	105,825	106,000	90,000	120,000
Kalgoorlie-Esperance SG								
Lay bottom ballast (say one third of total volume)	5	0.933	4.67					
Lay Sleepers down			50.00					
Lay top ballast	7	1.867	13.07					
Tamping			14.00					
Welding and Testing			5.00					
Total			86.73	1.10	95,407	96,000	90,000	120,000
Kalgoorlie-Leonora SG								
Lay bottom ballast (say one third of total volume)	5	0.789	3.94					
Lay Sleepers down			50.00					
Lay top ballast	7	1.577	11.04					
Tamping			14.00					
Welding and Testing			5.00					
Total			83.98	1.10	92,383	93,000	90,000	120,000
Kwinana-Bunbury Inner Harbour NG								
Lay bottom ballast (say one third of total volume)	5	1.043	5.22					
Lay Sleepers down			55.00					
Lay top ballast	7	2.086	14.60					
Tamping			14.00					
Welding and Testing			5.00					
Total			93.82	1.00	93,817	94,000	90,000	120,000

RCBC Material and Installation Unit Cost Summary

(Installation rates based in Perth)



RCBC size	Unit Material Cost (\$/m)	Unit Plant & Labour Installation Cost (\$/m)	Unit Weight Materials (kg/m)
300X150	113	90	364
375X225	140	112	451
450X150	157	126	506
450X225	165	132	531
450X300	179	143	577
450X450	199	159	641
600X225	193	154	622
600X300	207	166	667
600X375	216	173	696
600X450	227	182	731
600X600	246	197	792
750X300	342	273	1,100
750X375	350	280	1,127
750X450	358	287	1,154
750X600	373	299	1,202
900X300	642	513	2,067
900X375	650	520	1,542
900X450	658	527	1,705
900X600	673	539	1,750
900X750	692	553	1,780
900X900	708	567	1,995
1200X300	1,133	907	2,540
1200X375	1,150	920	2,590
1200X450	1,163	930	2,640
1200X600	1,198	958	2,690
1200X750	1,221	977	2,770
1200X900	1,268	1,014	2,888
1200X1050	1,275	1,020	3,010
1200X1200	1,283	1,027	3,160
1500X900	1,251	1,001	3,430
1500X1200	1,325	1,060	3,728
1500X1500	1,406	1,125	4,050
1800X900	1,323	1,058	3,717
1800X1200	1,395	1,116	4,005
1800X1500	1,447	1,157	4,322
1800X1800	1,536	1,229	4,720
2100X1200	1,570	1,256	4,536
2100X1500	1,648	1,318	4,853
2100X1800	1,746	1,397	5,199
2100X2100	1,841	1,473	5,546
2400X1200	1,704	1,363	4,959
2400X1500	1,790	1,432	5,284
2400X1800	1,889	1,511	5,636
2400X2100	1,974	1,579	5,956
2400X2400	2,066	1,653	6,324
2700X1500	1,893	1,514	5,958
2700X1800	1,971	1,577	6,269
2700X2100	2,083	1,667	6,711
2700X2400	2,180	1,744	7,111
2700X2700	2,289	1,831	7,527
3000X1800	2,119	1,695	7,023
3000X2100	2,212	1,769	7,343
3000X2400	2,313	1,851	7,711
3000X2700	2,429	1,943	8,127
3000X3000	2,533	2,027	8,514
3300X1800	2,880	2,304	9,003
3300X2100	2,949	2,359	9,324
3300X2400	3,053	2,442	9,692
3300X2700	3,168	2,534	10,137
3300X3000	3,273	2,618	10,495
3300X3300	3,330	2,664	10,797
3600X1800	3,167	2,533	9,846
3600X2100	3,241	2,593	10,167
3600X2400	3,250	2,600	10,535
3600X2700	3,355	2,684	10,922
3600X3000	3,475	2,780	11,309

Culvert End Treatments: Use \$1000/m3 applied to RC volumes

RCP Material and Installation Unit Cost Summary

(Installation rates based in Perth)



RCP dia	Unit Material Cost (\$/m)	Unit Plant & Labour Installation Cost (\$/m)	Unit Weight Materials (kg/m)
300	40	44	80
375	57	63	110
450	78	86	160
525	97	107	210
600	121	133	255
675	159	175	330
750	195	215	365
825	235	259	430
900	275	303	500
1050	350	385	665
1200	442	486	830
1350	544	598	1,000
1500	642	706	1,330
1650	780	858	1,665
1800	912	1,003	1,965
1950	1,087	1,195	2,365
2100	1,261	1,387	2,830

Culvert End Treatments: Use \$1000/m³ applied to RC volumes

Level Crossings



Classification	Crossing Width
Major A	12
Major B	12
Major C	8
Occupational	2
Public Gravel	3

No. Tracks crossed	Crossing Length
4	18
3	14
2	10
1	6

	Materials Unit Cost/m2 (in Perth)	Labour Unit Cost/m2 (in Perth)
Surface Crossing		
Surface Xing: Bitumen	40	40
Surface Xing: Concrete	50	25
Surface Xing: Gravel	25	35
Surface Xing: Metal Dust	10	15
Surface Xing: No Available	10	15
Surface Xing: Rock Ballast	10	10
Surface Xing: Timbered	20	15

Earthworks - Embankment and Capping Construction



Unit Rates		Embankment Construction using cut material	Embankment Construction using imported material (One way haul up to 3km)	Construct Capping Layer	
Contract	Unit	m3	m3	m2	
Contract 1 (BHPIO)	Bing	9.05	11.72	9.67	
	Gillam	10.53	13.77	11.24	
	Coon	8.43	10.95	9.01	
	Garden	8.39	10.74	8.96	
	Gidgi	9.62	12.53	10.28	
	Yandi	10.08	13.09	10.77	
	Mindy	8.00	10.79	8.55	
	Totals	64.10	83.59	68.48	
	Averages	9.16	11.94	9.78	
Contract 2 (Dandelup)			22.00	8.05	\$35.00/m3 for 230mm thick
Average of Contracts 1 & 2		9.16	16.97	8.92	
JHCE (H Abbott)			20.00	7.50	JHCE: \$35-\$40/m3 min for 200mm thick
Adopted Rates			17.00	8.50	
	Unit		m3	m2	

Quantities	Single Track	Twin Track			
Sectional Area of bulk earthworks (m2)	9.995	14.074			
Capping Width (m)	6.000	10.000			
Volume of bulk earthworks (m3/km)	9,995	14,074			
Volume of bulk earthworks (m3/km) - Adopted	10,000	14,000			
Area of Capping (m2/km) - Adopted	6,000	10,000			