Attachment A

CAPACITY SCENARIOS - BHP & FMG

SCENARIOS			**BHP**			**+FMG**			**150 Mt/y**			**200 Mt/y**			**250 Mt/y**			**400 Mt/y**	
BHP SYSTEM																			
Newman	Mnt		43			43			93			143			193			343	
Area C & Yandi	Mnt		57			57			57			57			57			57	
	Mnt		**100**			**100**			**150**			**200**			**250**			**400**	
FMG + Junior Explorers	Mnt		-			10			10			10			10			10	
Total	**Mnt**		**100**			**110**			**160**			**210**			**260**			**410**	
TRACK	km	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section
		num	%	km	num	%	km	num	%	km	num	%	km	num	%	km	num	%	km
Goldsworthy Jnctn - Anderson Pt	10.0	1	-	10.0	1	2%	10.0	1	2%	10.0	1	2%	10.0	1	5%	10.0	1	2%	10.0
Bing - Goldsworthy Jnctn	4.5	2	7%	4.5	2	7%	4.5	2	10%	4.5	2	13%	4.5	2	16%	4.5	2	24%	4.5
Yandi Jctn - Bing	259.2	1	**115%**	39.4	1	78%	**24.8**	1	73%	**16.6**	**2**	44%	16.6	2	53%	16.6	2	82%	16.6
Mindy Siding - Yandi	87.3	1	57%	37.8	1	67%	37.8	1	57%	**19.0**	**2**	38%	19.0	2	49%	19.0	2	81%	19.0
MindyMindy-MindiSiding	78.0	1	-	78.0	1	19%	78.0	1	19%	78.0	1	19%	78.0	1	19%	78.0	1	19%	78.0
	439.0																		
Notes			capacity exceeded			+ 3 loops			+ 4 loops			**duplication**			surplus capacity			limit of duplicated track?	
TOTAL INVESTMENT		Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**
Goldsworthy Jnctn - Anderson Pt	FMG	1	-	-	1	0.1	32	1	0.1	32	1	0.1	32	1	0.1	32	1	0.1	32
Bing - Goldsworthy Jnctn	BHP	1	0.5	26	1	0.5	26	1	0.7	26	1	0.9	26	1	1.2	26	1	1.8	26
Yandi Jctn - Bing	BHP	12	26.1	705	**15**	28.7	733	**17**	41.7	752	17	54.6	1157	17	67.6	1157	17	106.5	1157
Mindy Siding - Yandi	BHP	3	3.8	228	3	4.7	228	**5**	9.1	247	5	13.4	384	5	17.8	384	5	30.9	384
MindyMindy-MindiSiding	FMG	-	-	-	-	0.8	178	-	0.8	178	-	0.8	178	-	0.8	178	-	0.8	178
			30.4	**958**		**34.7**	**1197**		**52.2**	**1235**		**69.8**	**1777**		**87.3**	**1777**		**140.0**	**1777**
	km		**c/ntkm**	**0.6**		**c/ntkm**	**0.7**		**c/ntkm**	**0.5**		**c/ntkm**	**0.5**		**c/ntkm**	**0.4**		**c/ntkm**	**0.3**
BHP	351.0	16		958	19		987	23		1025	23		1567	23		1567	23		1567
FMG	88.0	1		-	1		210	1		210	1		210	1		210	1		210
FMG INVESTMENT SHARE		%	Bntkm	**$M**	%	Bntkm	**$M**	%	Bntkm	**$M**	%	Bntkm	**$M**	%	Bntkm	**$M**	%	Bntkm	**$M**
Goldsworthy Jnctn - Anderson Pt	FMG	100%	-	-	100%	0.1	32	100%	0.1	32	100%	0.1	32	100%	0.1	32	100%	0.1	32
Bing - Goldsworthy Jnctn	FMG	-	-	-	10%	0.0	3	7%	0.0	2	5%	0.0	1	4%	0.0	1	3%	0.0	1
Yandi Jctn - Bing	FMG	-	-	-	11%	3.2	81	7%	2.9	52	5%	2.8	60	4%	2.8	48	3%	2.7	30
Mindy Siding - Yandi	FMG	-	-	-	10%	0.5	23	7%	0.6	16	5%	0.7	19	4%	0.7	15	3%	0.8	10
MindyMindy-MindiSiding	FMG	100%	-	-	100%	0.8	178	100%	0.8	178	100%	0.8	178	100%	0.8	178	100%	0.8	178
			-	**-**		**4.6**	**316**		**4.4**	**280**		**4.4**	**290**		**4.4**	**274**		**4.4**	**250**
			c/ntkm	**-**		**c/ntkm**	**1.4**		**c/ntkm**	**1.3**		**c/ntkm**	**1.4**		**c/ntkm**	**1.3**		**c/ntkm**	**1.2**
FMG STAND-ALONE	**Mnt**		**-**			**10**			**10**			**10**			**10**			**10**	
TRACK	km	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section	Traks	Util-isation	Max Section
		num	%	km	num	%	km	num	%	km	num	%	km	num	%	km	num	%	km
Mindy Mindy - Anderson Point	439.0	1	-	150.0	1	37%	150.0	1	37%	150.0	1	37%	150.0	1	37%	150.0	1	37%	150.0
Notes						2 crossing loops													
FMG INVESTMENT		Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**	Loops	Bntkm	**$M**
Mindy Mindy - Anderson Point		2	-	-	**2**	**4.4**	**1020**	2	**4.4**	**1020**	2	**4.4**	**1020**	2	**4.4**	**1020**	2	**4.4**	**1020**
			c/ntkm	**-**		**c/ntkm**	**4.8**		**c/ntkm**	**4.8**		**c/ntkm**	**4.8**		**c/ntkm**	**4.8**		**c/ntkm**	**4.8**
UNIT COST																			
Single Track	$M/km	**2.280**																	
+ Duplication	$M/km	**1.660**																	
= Double Track	$M/km	**3.940**																	
Loops +Signals	km/loop	**4.0**																	
Single Track	$M/loop	**9.493**																	
Double Track	$M/loop	**5.134**											C:\DATA\G13\OTHERJOBS\NCC\BHPFMGTRAKCAPACITYV2.123						

Note:

Capacity estimates in this exhibit are derived by applying data and assumptions relevant to the BHP and FMG issues to the G13 Railway Operations Model.

Attachment B

ENGINEERING ESTIMATES

	TRACK CONSTRUCTION ESTIMATE							
PARAMETERS	**NEW SINGLE TRACK**				**BHP DUPLICATION BETWEEN LOOPS**			
4.0	**2** loops		438.9 track km		**15** loops		286.4 track km	
km/loop	**Quantity**	**Unit**	**$/unit**	**$**	**Quantity**	**Unit**	**$/unit**	**$**
TRACK (Excluding Signals & loops)								
Civil Works								
Environmental management	446.9	Km	10000	4469000	286.4	Km	5000	1432000
Safe working track - construct temporary paraweb fence	-	-	-	-	286.4	Km	10000	2864000
- flagmen 6 crew x 100 weeks	-	-	-	-	600	Shifts	3600	2160000
Relocate services	1	Item	100000	100000	-	-	-	-
Preservation of flora & fauna	438.9	Km	1000	438900	286.4	Km	1000	286400
Aboriginal heritage issues	438.9	Km	5000	2194500	286.4	Km	2000	572800
Relocate Wittenoom - Meekathara	3	Km	50000	150000	-	-	-	-
Construct temporary/permanent access road	438.9	Km	50000	21945000	-	-	-	-
Modify pastoral roads	1	Item	300000	300000	-	-	-	-
Tree clearing & remove vegetation	438.9	Km	10000	4389000	286.4	Km	2000	572800
Strip topsoil to cut & fill areas 150mm	804,600	M3	4.00	3218400	160,000	M3	4.00	640000
Excavate cut to fill - assume rock	2,800,000	M3	20.00	56000000	600,000	M3	20.00	12000000
Excavate cut to spoil - assume rock	2,334,500	M3	20.00	46690000	500,000	M3	20.00	10000000
Prepare borrow areas - remove 1M unsuitable	819,000	M3	3.50	2866500	200,000	M3	3.50	700000
Excavate from borrow areas & place to fill	1,638,000	M3	9	14742000	350,000	M3	9	3150000
Grade formation	3,038,920	M2	1.50	4558380	1947520	M2	1.50	2921280
Supply & place capping material x 150mm	455,838	M3	60.00	27350280	250,000	M3	60.00	15000000
Backfill unsuitable to borrow areas	819,000	M3	3.50	2866500	200,000	M3	3.50	700000
Place topsoil to batters, seed & fertlise	2,100,000	M2	1.50	3150000	1,000,000	M2	1.50	1500000
Place topsoil to borrow areas, seed & fertilise	819,000	M2	1.50	1228500	200,000	M2	1.50	300000
Culverts	1,083	No	25,000	27075000	1,037	No	10,000	10370000
Major culverts	127	No	250,000	31750000	10	No	100,000	1000000
Scour protection to batters	54,000	M	120	6480000	40,000	M	120	4800000
Construct catch drains incl topsoil & fertilise	100,000	M	30.00	3000000	60,000	M	30.00	1800000
Construct table drains incl topsoil & fertilise	700,000	M	12.00	8400000	500,000	M	12.00	6000000
Construct fauna crossings	1,000	No	5,000	5000000	600	No	5,000	3000000
Stock fencing & gates	900000	M	10	9000000	-	-	-	-
				287361960				**81769280**
Structures								
Rail bridges	1,835	m	24,000	44040000	-	-	-	28737881
				44040000				**28737881**
Trackwork	438.9	Km	-	-	286.4	km	-	-
Supply ballast 4 T/M	1755600	T	30	52668000	1145600	T	30	34368000
Supply sleepers	731500	No	105	76807500	477333	No	105	50120000
Supply rail 68kg	59,690	T	1300	77597000	38950	T	1300	50635520
Construct/install track	438,900	M	200	87780000	286400	M	200	57280000
				294852500				**192403520**
Communications	1	Item	1000000	1000000	1	Item	652540	652540
				1000000				**652540**
Total Direct Cost				**627254460**				**303563221**
Indirect Costs								
Contractor's supervision & site overheads	23%			144268526	23%			69819541
Contractor's HO overhead & profit	12%			75270535	12%			36427587
Engineering	5%			42339676	5%			20490517
Project management	3%			25403806	3%			12294310
Contingency - Civil Works & Structures	20%			66280392	20%			22101432
Contingency - Trackwork	5%			14742625	5%			9620176
Contingency - Signals & communications	20%			200000	20%			130508
Compensation to landowners	1	Item		5000000	1	Item		1000000
				373505560				**171884071**
Total Track Cost		**$M/km**	**2.280**	**1000760020**		**$M/km**	**1.660**	**475447292**
LOOPS AND SIGNALLING								
Civil Works								
Culverts	24	-	10000	240000	-	-	-	-
Earthworks	80000	m3	20	1600000	-	-	-	-
Supply & place capping material x 150mm	8,160	M3	60	489600	-	-	-	-
				2329600				**-**
Trackwork								
Supply ballast 4 T/M	32000	T	40	1280000	-	-	-	-
Supply sleepers	13300	No	105	1396500	-	-	-	-
Supply rail 68kg	1,088	T	1300	1414400	-	-	-	-
Construct/install track	8,000	M	200	1600000	-	-	-	-
Supply & install turnouts	4	No	260000	1040000	30	No	260000	7800000
				6730900				**7800000**
Signals & Communications								
Communications	1	Item	1000000	1000000	1	Item	350000	350000
Signalling	2	Item	1000000	2000000	15	Item	2600000	39000000
				3000000				**39350000**
Total Direct Cost				**12060500**				**47150000**
Indirect Costs								
Contractor's supervision & site overheads	23%			2773915	23%			10844500
Contractor's HO overhead & profit	12%			1447260	12%			5658000
Engineering	5%			814084	5%			3182625
Project management	3%			488450	3%			1909575
Contingency - Civil Works & Structures	20%			465920	20%			-
Contingency - Trackwork	5%			336545	5%			390000
Contingency - Signals & communications	20%			600000	20%			7870000
				6926174				**29854700**
Total Loops & Signalling Cost		**$M/loop**	**9.493**	**18986674**		**$M/loop**	**5.134**	**77004700**
TOTAL FOR THESE CASES			**$M**	**1020**			**$M**	**552**

ENGINEERING ASSUMPTIONS	
SINGLE TRACK	
A completely separate track built to the same level and through the same terrain with the same bridges and culverts as the existing track.	
Earthworks	A completely separate formation will be built to the underside of capping.
	Quantities have been calculated based on the plans provided.
	Formation will be to the Standard Victorian profile.
	Levels indicated on the plans is the top of capping level.
Capping	150mm thickness of capping material for width of formation top.
Culverts	Plans provided show top of formation (capping) and culvert lengths calculated accordingly
	(Lengths averaged out and showed to be approx 3 times length for track duplication)
	Costs calculated on a sliding scale.
	Allow $25,000 per culvert for small size.
	Allow $250,000 per culvert for large size.
Bridges	Equivalent bridging as for existing track and based on plans provided
	Based on costs in Victoria of $20000/m and indexed by 1.2. Assume 30% labour x 1.53 and 70% Mtl x 1.1, ave 1.2
Ballast	To standard profile with 300mm of ballast below sleepers ie 2m3 per m of track at $28.50/t plus 5% for additional cartage per m3
Sleepers	Concrete sleepers at 600mm c/c of 250mm depth plus 5% for add'itional cartage
Rail	68kg/m, $1240/t material plus 5% for add'itional cartage
Turnouts	68kg/m, 1 in 15 tangential on concrete bearers.
Signals	With two loops only, allow $1M/loop
Communications	Details largely unknown, may need new transmitters, allow $5M.
Mindy Siding to Mindy Mindy	Terrain and requirements (culverts, bridges etc) similar to last 78km of Mt Newman track
Finucane Isl - GW Jn	Terrain and requirements (culverts, bridges etc) similar to Nelson Point to Goldsworthy Junction.
GW Jn - Bing	Terrain and requirements (culverts, bridges etc) similar to existing Goldsworthy Junction to Bing.
TRACK DUPLICATION	
Track will be built adjacent to the existing with track centres of 4m.	
Earthworks	New embankment built stepped into and to the levels of the existing embankment with track centres of 4m.
	Quantities have been calculated based on the plans provided.
	Formation will be to the Standard Victorian profile.
	Levels indicated on the plans are the top of capping.
Capping	150mm thickness of capping material for width of formation extension ie 4m.
Culverts	Allow for 4m extension of the existing culverts.
	Allow $10,000 per culvert for small size.
	Allow $100,000 per culvert for large size.
Bridges	Equivalent bridging as for existing track and based on plans provided
	Based on Victoria cost of $20000/m and indexed by 1.2. Assume 30% labour x 1.53 and 70% Mtl x 1.1, ave 1.2
Ballast	Based on new track with ballast depth of 300mm below sleeper plus 5% for additional cartage
Sleepers	Concrete sleepers at 600mm c/c of 250mm depth plus 5% for additional cartage
Rail	68kg/m, $1240/t material plus 5% for additional cartage
Turnouts	68kg/m, 1 in 15 tangential on concrete bearers.
Signals	Allow to signal both ends of connections to existing loops plus the track to the next loop, $2.6M per loop.
Communications	Use existing where possible but may need additional capacity, allow $1M.
Loop Location	From train control graph provided.

\G13\OTHERJOBS\NCC\BHPFMGTRAKCAPACITYV2.123

Attachment C

KEY OPERATIONAL ASSUMPTIONS

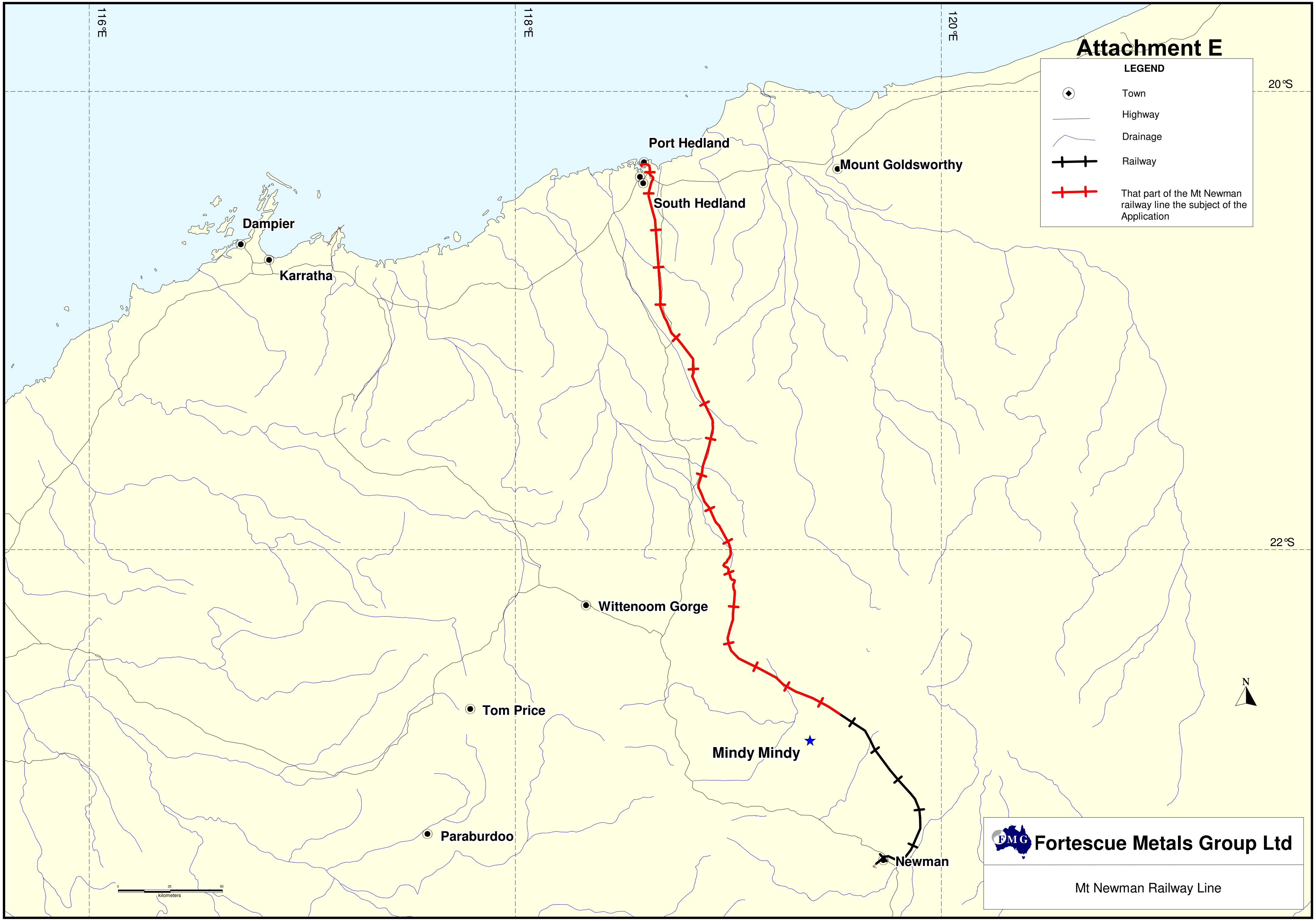
Locomotives	4200hp AC traction
Ore Wagons	Tare 21.1t load 125t
Trains	4 x locomotives + 200 wagons 5% of planned trains cancelled 51 operating weeks/year
FMG railway	78 km Mindy Mindy – near Mindy Junction 351 km parallel to BHP to near Goldsworthy Junction 10km near Goldsworthy Junction – Anderson Point
Capital charge calculations	Rate pre tax 15% Term 20 years
Train cycle	Mine 3.2 h Mainline transit 58 km/h (average) Port 6.8 h
Track maintenance	Track shut 7h/week
Track capacity dilution	10% of planned use lost through variability 20% of potential capacity unusable

Attachment D

DOCUMENTS WHICH G13 HAS BEEN ASKED TO CONSIDER

1. Fortescue Metals Group Limited Application Under Part IIIA of the Trade Practices Act 1974 [with accompanying maps] (11-Jun-2004)
2. Affidavits being part of a BHP submission to the NCC in the Federal Court of Australia plus Annexures of Messrs Hoare and Ridley of BHP
3. Part of a submission by BHP to the NCC identified as “Document 3” Impacts of Third Party Access on the Mt Newman System Operational Modelling (06-Jan-06)
4. Part of a submission by BHP to the NCC identified as “Document 4” Costs of Corrective Measures and Double Tracking Due to Impacts of Third Party Access on the Mt Newman System (06-Jan-06)
5. Part of a submission by BHP to the NCC being a report Evans & Peck Pilbara Rail Network - Production Capacity Modelling (Dec-05)
6. Evans & Peck Pilbara Iron Ore Rail Access – Public Interest Study (Aug-04) a confidential report commissioned by the Western Australian Department of Industry and Resources
7. Evans & Peck FMG Rail Access to BHPBilliton Iron Ore Railway – Mindy Mindy to Chichester Ranges (Apl-05) a report commissioned by Allens Arthur Robinson
8. Letter from BHP to NCC re Non Iron Ore Trains (31-01-06)
9. NCC Council’s Summary (16-Feb-06)
10. A drawing by BHP Rail Road – Rapid Development Project Mainline Track Layout (undated)
11. A drawing by BHP Rail Road Location Plan Sidings (20-Sep-05)
12. 118 drawings by BHP Railways Track Formation – Plan and Profile (variously dated c.1967 to c.1974)

Attachment E



G13 & Associates Pty Ltd

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Tel: 08 8331 8023
Fax: 08 8364 1302
Email: mike@g13.com.au

G13 & Associates

are specialist personnel with proven records as line managers in the railway industry providing service for clients in two broad categories.

- **Operational Management:** including negotiation of resources and track access from rail authorities, acquisition of operations, equipment and property, recruitment of labour, and general management of railway operations.
- **Management Consultancy:** directed specifically at the railway industry with particular attention to railway strategy, logistics and operations.

Services Offered by G13

- Line management of people and operation and maintenance of physical railway assets.
- Devising and using business planning models to estimate capacity, derive service plans and arrange consequential physical resource needs (track, locomotives, wagons, crews).
- Financial analysis of railway operations & businesses including bulk hauls, general & inter-modal freight, & interstate passengers.
- Advice and documentation related to track access agreements, joint ventures and arrangements with governments.
- Industrial relations negotiation; and
- Safety & Accident Investigation.

Tools Available to G13

- **Railway Model** of service, economics, and cost – including train logistics and locomotive, wagon, and crew requirements.
- **Financial model** of cash flow, accounting statements and commercial analysis.
- **Train simulation** using track and vehicle data to calculate running times, loads, and fuel consumption.
- **Dynamic simulation** of complex operational and network scenarios.

Mike Purcell

LLB (Melb) BCom (Melb) CPA FAIM FCILT MAICD

Director of G13

⇒ has been a Senior Executive in transport and resources, in both the public and private sectors;

⇒ at various times, Chief Operating Officer for Hamersley Iron Railways, Westrail, and National Rail Corporation; Head of the Northern Territory Departments of Transport & Works and Mines & Energy; and Financial Controller for Mount Isa Mines;

⇒ personal skills include strategic planning, economic analysis, finance and industrial negotiation, and railway modelling;

⇒ in the railway sector has had direct executive responsibility for major national railway infrastructure construction, locomotive fleet acquisition, and overall railway operations;

⇒ has promoted and participated in privatisation of government railways.

Associates of G13

G13 operates by deploying from within a network of specialists as appropriate to clients' requirements.

G13 has special alliances with:

InterDynamics Pty Ltd
www.interdynamics.com

⇨ systems modelling, rostering & scheduling systems; interactive planning, fatigue assessment.

Asia Pacific Rail Pty Ltd

⇨ engineering consultancy and design, project management, signals & control simulation, testing & modernisation.

12 March 2005

RAILWAY & GENERAL MANAGEMENT

Michael S Purcell

NATIONALITY: Australian

EDUCATION AND QUALIFICATIONS:

Bachelor of Laws, University of Melbourne
Bachelor of Commerce, University of Melbourne

PROFESSIONAL AFFILIATIONS:

Member Society of Certified Practising Accountants
Fellow Chartered Institute of logistics and Transport
Fellow Australian Institute of Management
Member Australian Institute of Company Directors

SUMMARY

Mike has been a senior executive in transport, resources and government. He is now the proprietor of a private company providing railway management services by way of consultancy and contract management.

Mike has a record of change management. He is an experienced commercial and industrial negotiator.

Mike's previous responsibilities encompassed:

- Operations of private and public railways; government departments; and financial, commercial and IT functions of resource companies;
- Major project feasibility assessment, economic analysis and implementation;
- Management of large infrastructure projects and large capital and operating budgets.

PROFESSIONAL APPOINTMENTS

1995 - 2005 Director: **G13** (Railway Investment & Management)

1992-1995 National Operations Manager then General Manager Infrastructure: **National Rail Corporation**

1987-1992 Financial Controller then General Manager - Corporate Development: **Mount Isa Mines**

1983-1987 Chief Traffic Manager: **Westrail**

1980-1982 Secretary of the Department of Mines & Energy; and of the Department of Transport & Works: **Government of the Northern Territory**

1968-1980 Manager-Marketing and Project Evaluation, Executive Assistant to the Chairman, Manager Railways and sometime General Manager - Operations: **Hamersley Iron**

RAILWAYS EXPERIENCE

Mike's railway work experience covers:

- Formation of **Great Southern Railways** which persuaded the Federal Government to privatise Australian National Railways.
- Establishment of **G13 & Associates**, which:
  - was prime consultant and project manager for establishment of the TNT private east-west interstate rail service;
  - provided financial and operations modelling services for three railway privatisation bids;
  - was an equity participant in a successful bid to buy the interstate passenger services of Australian National Railways;
  - provided specialist advice to numerous clients including- Australian Rail Track Corporation, Queensland Railways, ABN-AMRO, Goninan & Co, Esperance Port Authority, TNT, Carpentaria Transport, Macquarie Bank, WMC Resources Ltd, FCL Interstate Transport Services, Shell, Portman Mining Limited and various other mining companies in the WA Goldfields region, and a major iron and coal project.
  - carried out operations and financial modelling, analysis and specialist advice re negotiation of the Queensland Rail freight agreement with Queensland Phosphate Ltd;
  - planned and implemented the ARTC takeover of the interstate mainline through Victoria; and
  - was a key participant in planning and negotiating the ARTC take-over of the NSW non-urban railways; and was responsible for direct management of the subsequent transition from NSW to ARTC control.

- Establishment and management of numerous elements of **National Rail Corporation**:
  - operational headquarters and organisational support;
  - capital and operating philosophies and plans;
  - negotiation of enterprise agreement for 750 operations personnel;
  - 24 hour/day commercial control;
  - operational and engineering controls;
  - rebuild and maintenance regime and facilities for national wagon fleet;
  - federal “One Nation” railway project of $430 million; including standardisation of Melbourne to Adelaide mainline;
  - acquisition of new locomotive fleet with capital value over $300 million;
  - strategic planning and justification for acquisition of 6000 km of mainline railway together with associated communications, control and maintenance.
- Management of rail, road freight and passenger operations for **Westrail**, including several significant initiatives:
  - coordination of operational and engineering activities;
  - implementation of changed operating strategies and methods with resulting reduction in locomotive and wagon fleets (37% and 64% respectively);
  - negotiation and implementation of two man freight train operation (first in Australia);
  - dispensing with all operational employees at en route stations;
  - overall manning reductions (48% over 4 years);
  - specification and implementation of computer-based rolling stock and locomotive operating and maintenance systems.
- Management of **Hamersley Iron Railways**, including:
  - research into causes of wheel and rail wear (resulting in reduced maintenance costs of $20 million/year and track capacity increase of 50%);
  - establishment of communications and logistics for major incident management;
  - re-establishment of approximately 80 km of mainline track in 16 days in the aftermath of a major cyclone;
  - determined causes of unexplained derailments (cost reduction of $5 million/year);
  - redesign of mechanical maintenance facilities and methods (increased rollingstock availability 55% with no additional staff);
  - revised operating methods (increased haulage from 3 to 4.1 million net tons/month);
  - establishment of contract track maintenance system integrated with operations (no reduction of train running during maintenance);
  - specification and implementation of railway operations database for identification of causes of operations delays and on-line data capture and deployment of rolling stock and locomotives;
  - installation of micro computers for real time track geometry analysis and train scheduling and simulation;
  - promotion of inaugural International Heavy Haul Railways conference;
  - negotiation with WA Government to establish safety regulations for private railways.

PUBLICATIONS

- <u>Economics of a Heavy Haul Railway</u> Proc. IEA and AIMM, Heavy Haul Railways Conference (Perth, September 1978)
- <u>Modern Freight Operational Practices - Technical and Economic Considerations</u> Proc. Indorail Conference (Jakata, April 1986)

REPRESENTATION

- Queensland Government Business Mission to China (1989)
- Australian Minerals and Energy Ministerial Council meetings (1980-82)
- Delegate - International Labour Organisation Railways Committee Geneva (1980).
- Australian Trade Development Council Mission to Japan (1975)

Company Profile

AsiaPacificRail

Regional Fast Trains

Who we are

Asia Pacific Rail (APR) is an engineering consultant group committed to providing clients with specialist knowledge and expertise across the full rail and tramway spectrum. Coupled with efficient and reliable contract and project management services, APR delivers innovative, sensible, and cost effective solutions in design, construction and implementation for the rail industry.

Since its establishment in 1992, APR has built and continues to develop a strong "leading edge" reputation for project innovation and service reliability, working with the client and project parties to ensure project completion is achieved on-time, within budget and in accordance with specified quality requirements. Whether there be specialised design requirements with no industry precedent, complex stakeholder consultation and negotiation, environmental planning or statutory planning requirements, APR clients can have confidence that they will receive exceptional value, outstanding solutions and the highest level of professionalism.

Freight Operations

APR is based in Melbourne and maintains an extensive network of railway contacts throughout Australia and overseas enabling rapid sourcing of specialist requirements.

Our Philosophy

Our approach is simple. We focus on delivering appropriate, cost effective and reliable solutions. We are a first point of reference in the rail industry because we go beyond client expectations. APR engages in research, investigation and evaluation to determine "best available" design, construction and management solutions to exceed expectations.

Losing sight of the original problem or neglecting project constraints can lead to unsatisfactory project results. APR develops strong project objectives and programming methodologies at the commencement of work, manages risk and provides realistic and honest assessment reporting throughout the duration of the project to ensure that objectives are achieved. Clients know the direction of a project every step of the way.

We know that the best designs and strategies for projects are developed from intuitive insights or creative ideas that have been refined, analysed and proven with sound, logical and profound analysis. So if you are looking for an organisation that can tell it like it is, places great importance on performance, risk identification and mitigation, and has a core objective to exceed client expectations, APR should be your partner.

Our Team

The special nature of railway work demands practical, dedicated, experienced people with "hands on" attitude. APR people have diverse and extensive backgrounds gained through experience on national and international projects and possess the depth of skills to investigate, analyse and solve railway tasks.

Subscribing to our philosophy of "exceeding expectations", APR people can integrate seamlessly at both site and management level, from ganger to project director. Our people continue to remain at the forefront of overseas developments and trends, and engage in work and study roles within Australia, Europe, United States and Asia.

APR can provide clients with a team of the best, experienced and talented railway track, civil, rolling stock, signals and communications specialists. It can also provide project management and finance consultants of proven ability. With a friendly collaborative working style and strength in analytical and technical details as well as on-site supervision, APR represents an excellent choice to undertake a successful project partnership.

Signals and Communications

Attachment H

Train Operations Centre

Our Capabilities

The extensive skills and experience and breadth of knowledge of our consultants in rail track works, civil works, rolling stock, signalling, communications and operations ensures that Client needs can be delivered and that assignments are progressed expediently, accurately and completely. Our experience encompasses the technology generations of the past through to contemporary electronic and software based solutions.

APR's capabilities include:

- Planning, Estimating, Feasibility Studies and Concept Development
- Tender Specification, Evaluation and Award
- Project Management
- Program Management
- Contract Administration and Legal Advice
- Financial and Cost Management
- Design and Documentation
- Procurement
- Construction and Installation
- Testing and Commissioning
- Operations and Maintenance
- Risk Management
- Safety Analysis, Assessment and Accreditation
- Incident Investigation and Reporting
- Quality and Safety Assurance
- Technical Authority for Track, Civil, Signalling, Communications and Product Development

Rail Gauge Standardisation

Our Projects

APR have been working with government departments, developers, owners, operators and contractors on numerous rail infrastructure projects. Samples from our project portfolio are:

- Australian Rail Track Corporation, NSW, Train Control Consolidation - Concept design, pre-design, business case preparation, due dilligence, field investigation, cost estimation.
- Westgate Ports Rail Access, Westgate Ports - Track and signal design of new rail facility, project management.
- West Swanson and Appleton Docks, Port of Melbourne Corporation - Strategic management, design and documentation, management of material supply, construction supervision.
- Department of Infrastructure, Victoria, Standardisation of Victoria's Rail Lines – Track, civil and signal concept development, contract development, track design, materials procurement and construction supervision.
- Department of Infrastructure, Victoria, Regional Fast Rail project – Technical and project adviser, concept development, contract development, evaluation and award.
- ARTC, Management of the NSW Defined Interstate Network – Due diligence, concept and business case development for signalling and train control.
- Freight Australia, Signalling and Remote Control for Corio, Geelong, West Footscray and Tottenham – Concept development, contract development, evaluation and award and Superintendent Representative.
- Goninan, Spotswood Locomotive Maintenance Facility – Track and signal design, materials procurement and contract supervision.
- Baulderstone Hornibrook, Macaulay and Flemington Bridge Changes for City Link – Rail technical adviser, track, civil and signal design, installation and commissioning.
- National Rail, "One Nation" Perth to Brisbane gauge standardisation – Concept development, contract planning, standards formulation, materials management and construction supervision.

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AsiaPacificRail

HENRY VAN GINKEL

Attachment I

Qualifications:	• Assoc Diploma Civil Engineering FTC • Fellowship Diploma Civil Engineering RMIT • Fellow Institution of Engineers Australia	
Experience:	• Asia Pacific Rail • Public Transport Corporation	Since 1993 33 years

Responsibilities:

- Co-ordination & interface between Contractor & Rail Authority
- Project Manager, new station (and surrounds) construction
- Project Director, Third Track study

- Manager Track Services
- Senior Project Manager
- Principal Cost Controller
- Manager Track Works, Heavy & Light Rail
- Project Manager
- Manager Regional Maintenance
- Manager Works Maintenance
- District Engineer
- Senior Bridge Inspecting Engineer
- Setting and Application of Standards
- Management, Infrastructure Construction & Maintenance (650 staff)
- Management Track, Building & Bridge Construction & Maintenance

Projects:

- Marshall Station Construction
- Regional Fast Rail Project
- Rail Gauge Standardisation Project
- Sydney Freight Terminal – Major expansion
- Studies into Rail Operations and Tram Collisions
- Port Kembla, Yard Lighting
- Transport Reform Unit – Privatisation of Public Transport
- Westernlink section of CityLink
- Melbourne Freight Terminal, track maintenance
- Gauge Standardisation, Melbourne to Adelaide
- Gas and Fuel Relocation Project
- Tram track renewal
- Building Design and Construction, Gas & Fuel
- National Rail, Melbourne Operations Terminal, Rearrangement
- Ticket Issuing Machines

- Geelong Station Upgrade
- Metropolitan Track Work heavy and Light Rail
- Victorian Railway System Track Related Works
- Ballast Discharge Wagons
- Sleeper Discharge System
- Tram and Train Track Maintenance for the Metropolitan area
- Manage Civil, Rolling Stock, Signal & Communications maintenance for 1/3 Victoria
- Design, specification preparation, purchase & inspection of transportable buildings

Henry van Ginkel is a qualified engineer with extensive heavy and light rail track experience and well developed skills in Construction, Project Management & Supervision of all relevant levels of personnel covering a large variety of rail functions and buildings. He is well known for bringing projects in on time, within budget and to required standard.

Attachment J

ROM

G13

RAILWAY OPERATIONS MODEL

Contents

ROM

G13

RAILWAY OPERATIONS MODEL

1 PURPOSE

This paper describes the G13 Railway Operations Model (ROM) by reference to its evolution, purpose, outputs and inputs.

2 WHAT ROM DOES

In summary, ROM behaves thus:

- **It asks**
  - What and how much cargo is to be transported;
  - What type of train is to be provided;
  - Which route is to be taken; and
  - Who am I[1]?
- **It then computes**
  - The amount of rolling stock, fuel and crews required;
  - Track utilisation in terms of haulage and capacity used;
  - Above-rail and below-rail cost; and
  - Freight and track access revenues.
- **Finally it produces**
  - Summary tables of physical inputs and outputs;
  - Maps showing track utilisation, cost, and revenue by segments;
  - Statements of cash flows, earnings and balance sheet; and
  - Such other detail and summary reports as may be specially required.

3 WHAT USE IS ROM?

ROM creates scenarios which are mostly used for:

- Negotiation or investment evaluation;
- Annual or medium term business plans;
- Comparison between railway operational and infrastructure options; or
- Comparison with alternative transport modes.

4 EVOLUTION

This model was originally conceived by Mike Purcell for the mining industry in 1971. At that time, it modelled mining activity (mine / railway / port / shipping / processing) as inputs to:

- Feasibility studies and investment appraisals; and
- Corporate plans.

[1] i.e. ROM might be the “above rail operator”, the track owner, or both. This status will determine the basis of costs and revenues and what will be the focus of reports of physical output.

ROM evolved continuously until, by the mid-1990s, the predominant application was in the railway industry. The “back-end” cash analysis / accounting / finance component had not needed to change significantly. But the “front-end” had become preoccupied with railway and related transportation.

During this evolution, ROM has been based on various software platforms[2]. These have been successively replaced as computing technology has evolved. Parameters and computations changed incrementally as industries and issues changed. With each change, the validity of ROM was re-tested.

Throughout its evolution, ROM has been used to expedite resolution of real problems and as the basis for commercial and strategic decisions. At most times, use of ROM has been urgent. In this environment, complexities introduced into ROM have been a response solely to pragmatic needs. Where data surrogates and simple algorithms have proved to suffice on grounds of materiality and practicality, they remain in place. In 2005, what is now the G13 Railway Model is robust and comprehensive; and is a practical tool.

5 GENERAL SCOPE

The fundamental role of ROM is to:

- Postulate, in physical terms, business scenarios and inputs;
- Mathematically simulate business activity and calculate physical outcomes;
- Apply $ costs and $ revenues to inputs, simulations, and outcomes; and
- Express results in both physical and financial terms.

As it has now evolved, ROM calculates the economic and financial consequences of Train Services and Track Infrastructure characteristics. Key attributes of the current version include:

- Coverage of the total Australian standard gauge network and most train services currently known or postulated;
- Detail inputs and outputs for a 7 year horizon, with general extrapolations for up to 60 years;
- Options for ROM to run from the viewpoint of either a track owner, an “above-rail” operator, or both integrated;
- Ability for the user of ROM (User) to specify train services (in terms of cargo, origin / destination, type of train, etc) and, then, have ROM determine the physical and financial consequences of the train services;
- A Network defined by individual track segments from junction to junction; with origins / destinations possible at any location along a segment;
- Already populated with default price, cost and productivity data values relevant to most existing Australian standard gauge railway services, operations, locomotives, rolling stock, track capacity, and labour productivity;
- Outputs of physical and financial consequences answering questions related to:
    - Individual services and/or infrastructure scenarios; or
    - Aggregate scenarios as suitable for corporate, regional or national plans.

[2] Originally Cobol, currently Lotus.

6 TRAIN SERVICES

The key concept of ROM is Train Services.

Train Service is a discrete transportation task[3], defined in terms of:

- Quantum of cargo;
- Period of the task; and
- Forecast growth.

It is, of course, axiomatic, that provision of a Train Service requires both:

- Trains; and
- A Track.

The attributes of Train Services are a consequence of the inter-relationship between Trains and Track. This interplay is complex; and is the reason a comprehensive (but pragmatic) model is needed to understand and assess train transportation scenarios.

There is usually a large number of Trains required for each service. ROM considers that the number of trains depends, inter alia, on:

- Total volume of cargo to be transported (which is the parameter which initiates ROM);
- The attributes of the Track traversed by Trains
- Payload of the train which ROM considers to be a function of the configuration of both:
    - Trains; and
    - Track;
- Cancellations; and
- Cycle Times[4].

7 TRACK

7.1 *A Route*

A Train Service from an Origin to a Destination must choose a Route to traverse. The Route is a series of contiguous Segments of railway Track.

Users can map a Route by nominating Segments. As with all Model data, the User can choose to accept the default Routes contained in ROM.

7.2 *Nodes*

ROM considers Track to be composed of Segments which connect two nodes.

A node can be:

- A junction[5];
- A location where the capacity of Track changes; or
- A major terminal.

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[3] e.g. Transport 600 kt/y containers Melbourne-Brisbane, and return with 400 kt/y

[4] Transit times and turnaround at terminals.

[5] i.e. Locations where trains have a choice of route.

7.3 *Segments*

ROM considers Segments in terms of:

- Capacity; and
- Cost

Capacity is considered to be mostly a function of:

- Number of tracks;
- Speed / axle load capability;
- Grade;
- Safe working system; and
- Headway.

Cost is input on the basis of:

- Formulae (with constants derived from precedent) of fixed cost, variable cost, and investment with capital charges; and/or
- Specific engineering and operational estimates to override or supplement the formulae.

7.4 *Access Charges*

Access Charges are calculated by applying:

- A price matrix[6] of track segment v train type to:
  - Distance[7] to get “Flagfall”; and
  - Mass x Distance[8] to get Usage Charge; AND/OR
- Service charge formulae related to train origin and covering various cost elements including provision of electric power for traction.

8 TRAINS

As with all data required by ROM, Trains can be defined by the User, either by accepting the default values in ROM or by changing some or all of the default values. The values in this context are the attributes of the components of Trains; viz:

- Rolling Stock[9];
- The mix of Rolling Stock (Consist); and
- Train Crew.

8.1 *Rolling Stock*

Cargo carrying capacity is a function of the design of the Rolling Stock utilised. ROM contains a database of generic types of rolling stock typical of existing equipment in terms of technical attributes and cargo suitability.

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[6] The Model stores all known prices current on the Australian standard gauge network

[7] $/km

[8] c/gtkm

[9] Wagons & Locomotives (including rail cars)

8.1.1 Wagons & Locomotives

For both wagons and locomotives, the key attributes considered by ROM are:

- Mechanical availability;
- Planned operational utilisation;
- Design axle load[10];
- Tare;
- Length; and
- Capital and operating cost.

8.1.2 Locomotives

For Locomotives, the key attributes considered by ROM are:

- Power;
- Operational priority in terms of speed or load hauling; and
- Fuel efficiency

8.2 *Train Crew*

For crews, the key attributes considered by ROM are:

- Crew configuration[11]
- Roster[12]; and
- Remuneration.

8.3 *Consist*

ROM considers that the mix of Rolling Stock and Cargo is a key determinant of the carrying capacity of a Train. This is derived from:

- User specification of the mix of wagons and cargo;
- If, and where, the Train will change[13] en route; and
- Model computation of the length, weight and locomotive requirement.

9 TERMINALS

ROM can identify key terminals with train services so as to:

- Report terminal usage; and
- Calculate cost of the terminals to the Train Service in terms of unit cost related to cargo types.

10 TRAIN RUNNING

The engine of ROM is activated when Trains run. This is the process whereby the prescription of Trains is related to the prescription of the Tracks to elicit Train Service outcomes.

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[10] nb The Model will determine axle load permitted by reference to both the characteristics of wagons and the specification of the track along the route to be traversed.

[11] Number of persons at each stage of the train cycle.

[12] Pattern of working and idle hours

[13] Acquire or relinquish cargo and/or wagons

10.1 *Cycle Times*

ROM computes the cycle time of a Train by reference to

- Cargo requirement and forecast growth;
- Distance;
- Speed of the train having regard to:
  - Locomotive power;
  - Track Segment grade;
  - Train mass (cargo + tare);
  - Wagon design speed;
  - Axle load;
  - Track speed rating;
- En route delays for:
  - Acquiring or relinquishing cargo or wagons;
  - Conflict avoidance;
  - Congestion;
- Dwell at terminals for:
  - Loading and discharging;
  - Equipment and crew servicing;
  - Idle time.
- Optional User nomination of a cycle time[14];

10.2 *Train Consists*

The size of trains and, therefore the number of Train Cycles/year[15] is computed by an iteration which considers:

- Cycle time;
- The annual transport requirement;
- Allocation of consists;
- Track passing length; and
- Axle load permitted by Track and Wagon specification.

11 ANSWERS

At this stage, ROM has derived (for all Train Services considered) three key Train performance statistics:

- Weight;
- Frequency; and
- Distance.

It is, thereby, ready to describe Train Service scenarios:

- Across a spectrum of:
  - Individual Trains and
  - Network aggregates; and
- In one, or all, of three dimensions:
  - Train Services;
  - Track Segments; and
  - Time Series.

[14] The Model will adopt the greater of the nominated or calculated Cycle Time

[15] Times a train starts and finish

11.1 *Reports of the Physical*

Reports of physical outcomes are almost always tailored for the User specific requirements in the circumstances. ROM structure is highly convenient in this respect. Such reports can be in tabular, graphical and mapped formats.

Standard output reports by year, for Train services and Track Segments, include:

- Train frequency (trains / period);
- Locomotive and wagon fleets (numbers & types);
- Weight and distance (gtkm, ntkm);
- Crew establishment (numbers by location);
- Fuel consumption (kl/cycle); and
- Track capacity & utilisation (trains/day, % utilised).

11.2 *Financial Reports*

11.2.1 Revenues and Costs

The base Model calculates revenues and costs which are a direct consequence of use and maintenance of Trains and Track. These are:

- Freight and Track Access Fees;
- Track Access charges
- Infrastructure Maintenance:
    - Inspection and Remedial
    - Major Periodic;
- Network Operations;
- Above Rail:
    - Locomotives;
    - Wagons;
    - Crew;
    - Fuel;
- Terminals; and
- Rolling stock capital

Corporate Overheads can be derived by ROM from:

- A benchmark labour, office and equipment profile;
- Estimates of external oncost as a proportion of revenues and direct costs.

The base Model also gathers, from external sources:

- Infrastructure capital estimates;
- Costs of any category to supplement or replace costs computed in ROM.

12 FINANCIAL MODEL

The Financial Model has a dual role:

- Financial analysis and reports; and
- Mathematical projection of the Base Model scenario (of physical production, capacity and infrastructure investment) for periods beyond 7 years.

12.1 *Financial Analysis*

Base estimates of revenue and cost[16]are imported by the Financial Model.

12.1.1 Cash Flow

Base estimates are converted to comprehensive Cash Flow estimates with addition of:

- Escalation & Inflation;
- Grants & Subsidies;
- Equity and Debt;
- Working Capital (inventory, debtors, creditors);
- Debt & Equity Capital Servicing Charges;
- Income Tax; and
- Dividends.

12.1.2 Accounting Statements

The Cash Flow is converted to Earnings Statements and Balance Sheets by reference to calculations based on classification of capital by depreciation categories.

12.1.3 Economic Analysis

The economic analysis is a summary in terms of

- NPV (net present value);
- IRR (internal rate of return);
- Payback; and
- Several accounting ratios.

Inputs include the various components of conventional WACC[17] formulae.

12.2 *Long Term Extrapolation*

Projections beyond Year 7 are mathematical projections based on rate assumptions of;

- Growth;
- Input productivity;
- Price levels; and
- Unit costs of track capacity increments.

Infrastructure capacity[18] increments are triggered at times when installed capacity will be exceeded by traffic growth computed by ROM.

12.3 *Who Am I?*

Where relevant, and particularly with respect to financial issues, output will reflect the answer to the original question "Who am I?"[19].

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[16] Essentially Earnings before Interest, Tax, Depreciation & Amortisation (EBITDA)

[17] Weighted Average Cost of Capital

[18] Measured in terms of "train paths"

[19] Eg. If the answer is "above rail operator", revenue will be freight charges; but if the answer is "track owner", revenue will be access charges.

13 MODEL PERIPHERALS

13.1 *Customer Analysis*

ROM logic is based on Train Services and Types of Cargo. It does not identify ownership, or the identity of customers, because these distinctions do not materially affect economic and strategic fundamentals.

But for the purpose of preparing commercial plans, it can be desirable to identify customers so as to permit comparison and reference to conventional accounting reports which identify revenue by customer.

To this end, the Base Model exports revenue and operational outputs to an ancillary customer Model which:

- Dissects Train Services according to a customer profile; and
- Produces customer focussed reports.

13.2 *Mapping*

ROM is partly an exercise in economic geography. The outputs are, therefore, usefully exhibited by maps for review and exposition. To this end, output from ROM is exported to an ancillary Mapping Model.

14 MODEL INTEGRITY

ROM attempts to avoid error by use of three internal devices:

- Checks of logic and adherence to rules which, if failed, cause ROM to exhibit error messages;
- Cross checks for underlying consistency between differing views of data and outputs;
- Exhibit of key outputs, both interim and final, to alert the User to unexpected, and therefore suspicious, results.

The integrity of ROM is, however, primarily the consequence of its maturity and evolution over a long period of continual use in demanding situations.

G13 Pty Ltd

January 2006