TCOSMO/CORMO





a resource allocation tool for the coal line in Transnet Freight Rail

March 2009



EXPORT COAL LOADING SITES NORTH OF ERMELO MACHADODORF BELFAST **EXPORT LOADING SITES SOUTH OF ERMELO** PANBULT, HLOBANE, BALLENGEICH, DERWENT SUNBURY TALANA, ENQOLOTHI **ARNOT** DALMANUTHA MIDDELBURG **OLIFANTSRIVIER** VONDERFONTEIN HILLSIDE **WITBANK UMCEBO** EIM O OM TO PRETORIA MAFUBE **BLACKHIL** RIETKUI (SUMO) MOEDIG MINNAAR **OPTIMUM** ARBOR KOORNFONT BSX () C ROLINA FROM LEPHALALE PULLENSHOPE OGIES KENDAL DROGVALLEI (GROOTEGELUK) ARGENT GOEDEH O NEWCO DESDALE GOEDGEVONDEN GELUKSPLAAS GOEDEHOOF **VITRAND** DELMAS **LEEUWPAN** LONGVIEW HAWERKLIP HALFGEWONNEN (1.3)RI CARLCHEW **FORZANDO** OBAN EENDR/ BREYTEN **ESTANCIA KELTY** KINROSS KLIPSTAPE **WEBSRUS LEVEN** VOORSL/ **LEGEND** BETHAL Rail network To Lothair **HAMELFONTEIN** TRICHARD Road network BUHRMANSKOP GOLFVIEW **RIETVLEIRUS** Export loading sites (private) **TWISTDRAAI** Export loading sites (future) ERMELO To Amersfoort Export loading sites (leased) Small wagon loaders TO RICHARDS BAY

l Diagrammatic map freight rail Goedehoop RBCT: UTK RBCT: GH Sprint: WIR Sprint: UIK Glisa Sprint: BIK Siding: 844896 Siding: 800201 Siding: 754986 RBCT: BEL Sprint: BFZ Boord Springbok Siding: 849448 RBCT: SBK Sprint: BFI Greenside Middelburg Siding: 765228 RBCT: GRN Olifantsri Sprint: BJL SA Coal Estates Jitkvk RBCT: RLT Siding: 750727 Sprint: BJL Waterpan / Boschmans Siding: 750735 RBCT: TFT Vandyksdrift Carolina Fikeboom RBCT: VWD Optimum Sprint: MNR RBCT: CAR Blackhi Rietkuil RECT: OPT RBCT: EKB Siding: 752622 Sprint: VYF Northern Coal Sprint: CLA Sprint: PSH Sprint: PSH Siding: 754331 RBCT: WRM Siding: 603309 Siding: 643122 Siding: 741051 Pullenshope Sprint: WID Siding: 645494 Witcons Minnaai Woestalleen RBCT: WCC RBCT: OPP Sprint: SRW Witrand South Witbank Sprint: PSH Siding: 752649 RBCT: WRO RBCT: SWB Siding: 742902 Sprint: WID Sprint: SRW Siding: 652318 Siding: 752673 Tavistock Ogies Forzando RBCT: TAV Camden Tselentis / Spitzkop Sprint: SRW RBCT: FZO RBCT: CAM Camden RBCT: VSG Blinkpan (MCM Arthur Tailor Kendal Siding: 752681 Sprint: HWN Sprint: CAM Sprint: VSG RBCT: ATC RBCT: BLK Maviristad Siding: 643289 Siding: 651761 Siding: 652342 Sprint: SRW Sprint: BIK Sheepmoor Arbor Siding: 754781 Siding: 702404 Panbult Ngwempisi Welgedacht Bank RBCT: PBT RBCT: WEL Rietspruit RBCT: BNK New Clydesdale Panbult Argent Ngagane Sprint: PBT Leeufontein RBCT: RS Sprint: BAK Sprint: UCT RBCT: NCW RBCT: NGN Iswepe Siding: 652377 RBCT: LFT Sprint: KKI Siding: 751405 Siding: 645869 Sprint: BZR Wildrand Sprint: NGN Dryden (Sprint: KDL Klippen Utrecht Siding: 752592 Siding: 751553 Siding: 601101 Siding: 761435 Piet Retief Koornfontein Phoenix Broodsnyersplaas RBCT: PRC Piet Retief Springlake RBCT: PHX RBCT: BSP RBCT: KFT Sprint: PFR RBCT: BAL Mkondo Hawerklip Grootegeluk Sprint: BLG Sprint: KKI Sprint: BSX Sprint: BSX Siding: 652245 Moolman RBCT: HKL Ngagane Siding: 640123 RBCT: GGK Siding: 752584 Siding: 702412 Siding: 755575 Eerstegelu Eloff (Confidence Sprint: HAW Sprint: ERS Sikame Ballengeich Siding: 754536 Commondale Alcoekspruit Siltech RBCT: SKM Siding: 841056 Middelbura Sprint: SIA Paulpietersburg / Dumbe RBCT: BAL Sundra (RBCT: DEL RBCT: MID Milnerdale Siding: 651206 Mhulumbe Sprint: BLG Sprint: DMS Sprint: BSX Dannhauser ě Siding: 650722 Siding: 742171 Zungwini Siding: 755567 Bethal Hattingspruit Ellisras Emma's ' RBCT: BTL Glencoe Sprint: BXI Vrvheid East C Potco Tendeka. Siding: 746193 Tintasdrift RBCT: TAL Bethal Sprint: TLN Siding: 624497 Lenjanedrift Boomlaei Naudeesfontein Engogweni Slater Coal Twistdraai Komvoorhoogte RBCT: TWI Hlobane RBCT: TAL Sprint: TIT Sprint: TLN Hlobane Siding: 741582 Boomlaer Siding: 645796 Nhlazatshe RBCT: HLO **RBCT: ???** Sprint: HBN Izolof Sprint: ??? Siding: 642738 Siding: 603341 Eqwasha RBCT: ZAC Uloliwe Sprint: EQT Nbunu Maloma Ulundi Siding: 651605 RBCT: KOM RBCT: MAL Ilangakazi Sprint: KTR Sprint: LOJ Sidina: 842699 Intsamanzi Sidina: 601039 Enqolothi Umumywana Isangoyana Emakwezini Idondotha Elubana

RBCT

7 Mine Types



- Loading Types
 - Rapid loaders
 - Mechanical loaders
 - Drop loads
- Location
 - Coal field system
 - DC area and Diesel served 'branch' line
 - GFB system
 - Grootegeluk
 - Natal Midlands
 - 'En routes'
 - Panbult (between Vryheid and Ermelo)
- Capability
 - Jumbo
 - Small [100 and 50]
 - [Jumbo as small]

7 Required



- Schedule for week
 - Fixed schedule portion
 - Variable portion
 - Balanced and evenly spaced
 - Optimised
- Rescheduling capability for least impact recovery

7 Scheduling Requirement



- Train schedule must:
 - satisfy the varying demand by and special requirements of the mines;
 - conform to the agreed operating philosophy of rhythm and balance without bundling
 - consider the availability and position of rolling stock as well as unavailability of infrastructure
 - be derived within a short period without dependence on individuals

Rescheduling requirement



- Existing schedule
- There have been either
 - changes in execution some planned trains did not run or ran in wrong slots
 - changed demands from mines or revised occupations
- Produce a revised schedule given the following input
 - The detail of trains actually ran (i.e. the incident recording or 'per train monitoring'
 - The changed demand
 - •the currently planned schedule for the rest of the week plus additional demand
 - in addition a revised number of trains, feeder occupation and mainline occupation
- A revised schedule should be produced (if possible) to move the remaining demand with the least impact on existing schedule

CURRENT FUNCTIONALITY



Inputs

Able

- Available capacity
- Next weeks demand
- Drop off information
- Mainline slots
- Feeder line information
- Mainline and Vryheid train information
- Crewing information
- Mine constraints
- Mine travel and dwell times
- **Feeder Occupations**
- Mainline maintenance
- Mainline travel and dwell times Transition information for rescheduling
- Business rules relating to wagon configuration
- Balancing logic
- Balanced Schedule for Mainline and to mines
- Daily services
- Result wagons detail log of planned set movements
- Indicate unallocated feeders
- Rescheduling of trains

Unable

- Does not cater for the location of locomotives
- Does not have a parameter for the maximum number of trains at the yards (EML, VYD and RBCT)

Does not allow the scheduling of sets that are larger than 100 wagons up to the mines

Balanced Schedule for the Natal trains

 Does not balance schedule through consideration of availability of locos (especially light loco scenario)

Scheduled throughput

 Does not generate graphical representation of schedule

Generates

1 Detail Requirements in Scheduling (1)



Demand by the mine:

- Number of loads per week (eg. 190 trains to 40+ mines)
- Type and size of load (Jumbo or Small (100 or 50 sets) or Jumbo loaded as small)
- Days when required (or any day)
 - Maximum loads that can be accepted per day OR "At least" number of loads to be allocated per day
- Days or period within a day when trains can not be accepted by the mine.





			Total		Train type &	Maximum number of trains	Maximum number of trains	Maximum number of trains	Maximum number of trains	Maximum number of trains	Maximum number of trains	Maximum number of trains
MineID	Code	Mine	trains	code mine	#wagons	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	J VST	TSELENTIS	-	VST	J100	99	99	99	99	99	99	99
2	JS VST	TSELENTIS	-	VST	J100	99	99	99	99	99	99	99
3	S VST	TSELENTIS	4	VST	S100	0	0	1	0	1	1	1
4	S5 VST	TSELENTIS	-	VST	S50	99	99	99	99	99	99	99
5	J KOY	KOORNFONTEI	5	KOY	J100	0	0	0	1	2	1	1
6	JS KOY	KOORNFONTEI	-	KOY	J100	99	99	99	99	99	99	99
7	SKOY	KOORNFONTEI	-	KOY	S100	99	99	99	99	99	99	99
8	S5 KOY	KOORNFONTEI	-	KOY	S50	99	99	99	99	99	99	99
9	J MED	MIDDELBURG	16	MED	J100	3	3	3	3	3	3	3
10	JS MED	MIDDELBURG	-	MED	J100	99	99	99	99	99	99	99
11	S MED	MIDDELBURG	-	MED	S100	99	99	99	99	99	99	99
12	S5 MED	MIDDELBURG	-	MED	S50	99	99	99	99	99	99	99

	• .	"must be" feeders		"must be" feeders				
	train	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	8300		Ü	Ü	Ü	Ü	Ü	U
	5800	0	0	0	0	0	0	0
	5800		0	0	0	0	0	0
	2900		0	0	0	0	0	0
	8300		0	0	0	0	0	0
	5800		0	0	0	0	0	0
	5800		0	0	0	0	0	0
	2900	0	0	0	0	0	0	0
	8300	0	0	0	0	0	0	0
00	5800		0	0	0	0	0	0
	5800	0	0	0	0	0	0	0
	2900	0	0	0	0	0	0	0

1 Mine constraint



MINE LOADING AVAILABILITY

								IVIIIV	<u> </u>		1110	<u> </u>	VIL /	DILI	<u></u>													
		= Mi	ine r	ot a	vail	able	fron	n tha	at tin	ne o	nwa	rds	Sta	ndby	/ :	Sam	pie v	van d	len E	AH:	083 3	303 89	931					
reclaimiı (days)	ng time	0.1	0.1	0.1	0.5	0.3	1.0	0.5	0.1	0.1	0.1	0.1	0.1	1.0	0.5	0.2	0.5	0.5	0.1	0.2	0.5	0.2	0.1	2.0	0.5	0.5	0.2	0.2
requeste	d # trains	10	24	15	1	4	5	1	5	5	16	18	10	2	2	6	3	2	2	7	5	5	9	1	1	2	13	4
RBCT c	ode	BNK	RLT	GH	GRN	GGK	NCD	EKB	ОРТ	KFT	MID	VDD	RS	BSP	WAL	TFT	wcc	PHX	SWB	TAV	UTK	FZO	ATC	SBK	ANT	ОВ	TWI	VST
		BYY	LDY	GHM	GSE	GGK	BZR	EIY	PSH	KOY	MED	VYF	RSY	вѕх	WAL	MNR	SRW	PHX	SWD	OUT	UIT	FOR	ATC	SBK	ANT	овк	TIT	VST
Mon	00:00															•												
	01:00	_																										
	02:00	_																									1	
	03:00	_																										
	04:00	_																										
	05:00	_																										
	06:00	_																										

Detail Requirements in Scheduling (2)



•Mine details

- Running time to and from yard
- Loading period at the mine
- Reclaiming time: Minimum time between trains at mines to cater for replenishment at the mines. This is also considered between weeks, i.e. first train of week 2 should consider last departure in week 1.
 - Check for consistency between times and number of loads is done
- Hard and soft constraint
 - If the number of trains per day or the mine constraint can be considered as a request only, the scheduler could be set to attempt requested parameters first and than slackening constraints

7 Mine Details



Code	MineID Mine	total #	Time before new train (loading time at mine + reclaiming time)	Driving time yard ->mine	Driving time mine - >yard	loading time at mine	reclaiming time
VST	1 TSELENTIS	4	0 09:57	0 00:50	_	0 04:57	0 05:00
KOY	2 KOORNFONTEIN	5	0 05:45	0 01:48	0 01:55	0 02:45	0 03:00
MED	3 MIDDELBURG	16	0 04:36	0 02:02	0 01:55	0 02:36	0 02:00
FOR	4 DORSFONTEIN	5	0 09:00	0 01:30	0 01:17	0 04:00	0 05:00
PSH	5 OPTIMUM	5	0 06:16	0 01:59	0 01:58	0 03:16	0 03:00
TIT	6 TWISTDRAAI	13	0 09:01	0 02:00	0 02:20	0 04:01	0 05:00

constraint (=0)	mine constraints hard constraint (=0) or "request" (=1)	"To" Mine No.	"From" Mine No.	Yard	Departure 00:00 = slot 96 (1=yes,0=n o)
0	0	98	99	EML	0
0	1	40	41	EML	0
0	1	36	37	EML	0
0	1	0	1	EML	0
0	1	2	3	EML	0
0	1	98	99	EML	0

1 Detail Requirements in Scheduling (3)



Constraints

- Infrastructure occupations
 - Where and when occupations will be taken on the feeder lines when trains cannot be dispatched
 - Periods when main line occupations will be taken.
- Standard mine constraints: Regular weekly occupations and maintenance periods when trains cannot be accepted.
- Other mine constraints: When trains cannot be accepted at mines for other irregular reason.

7 Occupations



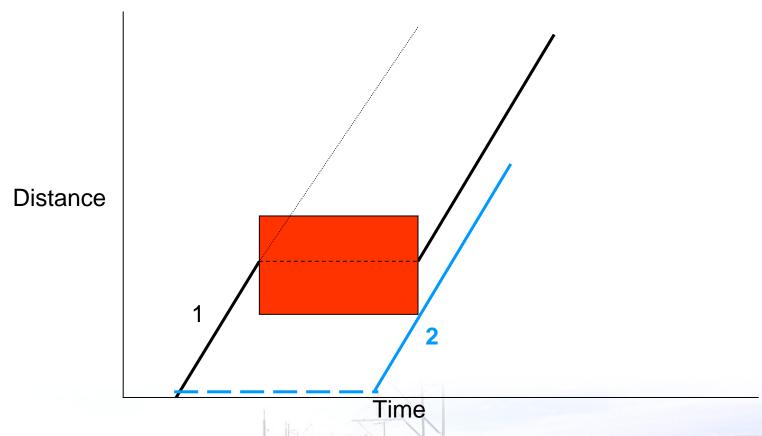
Occupations specified for the week of schedule AS WELL AS week following schedule for correct handling of overflow trains

MINE LOADING AVAILABILITY

		occu	pati	on o	n fe	eder	· line	•	Sta	ndby	/: {						
reclaiming (days)										0.1	0.1	0.1	0.1	1.0	0.5		
requested	l # trains	10	24	15	1	4	5	1	5	5	16	18	10	2	2		
RBCT co	de	BNK	RLT	GH	GRN	GGK	NCD	EKB	ОРТ	KFT	MID	VDD	RS	BSP	WAL		
		BYY	LDY	GHM	GSE	GGK	BZR	EIY	PSH	KOY	MED	VYF	RSY	BSX	WAL		
Mon	00:00			II.							I						
	01:00	_															
	02:00																
	03:00																
	04:00	_															
	05:00																
	06:00	_															
	07:00	=		-				1							S	Start main	
	08:00				M										li	ine	End main line
	09:00	2015				1		11111		Sect	ionID	Se	ectio	า	O	ccupation	occupation
	10:00		and the		7							1		VH[00:00	1 00:00
	11:00		A	int								2	VHD			00:00	1 00:00
	12:00											3	RBC			00:00	1 00:00
	13:00	_										4	VHE	о-ЕМІ	_ 1	00:00	1 00:00

Occupations options





Options [user selectable]:

- 1. Trains are scheduled "into" occupations or
- 2. not departed from yard if an occupation will be encountered

Mine Constraints (Temp and std)



reclaimi (days)	ng time	0.1	0.1	0.1	0.5	0.3	1.0	0.5	0.1	0.1	0.1	0.1
request	ed # trains	10	24	15	1	4	5	1	5	5	16	18
RBCT c	ode	BNK	RLT	GH	GRN	GGK	NCD	EKB	ОРТ	KFT	MID	VDD
		BYY	LDY	GHM	GSE	GGK	BZR	EIY	PSH	KOY	MED	VYF
Mon	00:00			•	l .				ı		1	
	01:00											
	02:00											
	03:00											
	04:00											
	05:00											
	06:00	_		1								
	07:00	4/	7	-								
	08:00	The	and l									
	09:00											3 3 3
	10:00	1						- Fun	-			

1 Detail Requirements in Scheduling (4)



- Parameters
 - Throughput times dwell time in yards and running time in between
 - Number of sets
 - Jumbo, Smalls and S50
 - Max wait for 2 sets
 - Max number of feeder trains per day
 - Total
 - *[@EML,VYD,Main line]
 - Soft constraints
 - Day end balancing

Parameter	Unit	Val	ue
Througput time			
EML-Loaded dwell	d hh:mm	0	03:45
EML-VHD	d hh:mm	0	04:59
VHD-Loaded dwell	d hh:mm	0	01:15
VHD-RBH	d hh:mm	0	04:31
RBCT dwell	d hh:mm	0	07:15
RBH-VHD	d hh:mm	0	04:21
VHD-Empty dwell	d hh:mm	0	01:41
VHD-EML	d hh:mm	0	04:21
EML-Empty dwell	d hh:mm	0	03:05

number of J100 train sets	161
number of S100 train sets	37
number of S50 train sets	4
maximum number of trains per day	30
run model with consistency errors (0=no, 1=yes)	0
"soft" constraints for all mines (=0) or selected mines(=1)	1
maximum number of feeder trains at EML	60
maximum number of feeder trains at VHD	30
maximum number of main line trains	30
day-end balancing on (=0) or off (=1)	0

*[not used]

Detail Requirements in Scheduling (5)



- Drop Off Group
 - "If you send a train to a mine in one of these groups (let's say to OBK in group 1) then the scheduler tries to allocate another feeder to one of the mines in the same group in the given time window. The reasoning behind this was to bring a feeder to the first mine, run back the locomotive and catch another feeder train and bring it to the second mine."

		Start to select other	End to select other
		mine in group	mine in group
Drop-Off		(departure + d	(departure + d
group	MineID	hh:mm)	hh:mm)
1	OBK	0 01:00	0 15:00
1	GSE	0 01:00	0 15:00
1	MNR	0 01:00	0 15:00
1	UIT	0 01:00	0 15:00
2	SWD	0 01:00	0 15:00
2	BZR	0 01:00	0 15:00
2	BSX	0 01:00	0 15:00
3	OUT	0 01:00	0 15:00
3	SRW	0 01:00	0 15:00
3	PHX	0 01:00	0 15:00
4	WAL	0 01:00	0 15:00
4	EIY	0 01:00	0 15:00

1 Detail Requirements in Scheduling (6)



- Main Line Slots
 - Define which trains must be used on main line

	Monday	Tuesday	Wednesday	Thursday	Friday (1=on,	Saturday	Sunday
Departure		(1=on, 0=off)				(1=on, 0=off)	
00:00		1	1	1	. 1	1	1
01:00	1	1	1	1	1	1	1
02:00	0	0	0	0	0	0	0
03:00	1	1	1	1	1	1	1
04:00	1	1	1	1	1	1	1
05:00		0	0	0	0	0	0
06:00		1	1	1	1	1	1
06:30		1	1	1	1	1	1
08:00		0	0	0	0	0	0
09:00		1	1	1	1	1	1
10:00		1	1	1	1	1	1
11:00		0	0	0	0	0	0
12:00		1	1	1	1	1	1
13:00		1	1	1	1	1	1
14:00		0	0	0	0	0	0
15:00		1	1	1	1	1	1
16:00		1	1	1	1	1	1
17:00		0	0	0	0	0	0
18:00		1	1	1	1	1	1
19:00		1	1	1	1	1	1
20:00		0	0	0	0	0	0
21:00		1	1	1	1	1	1
22:00		1	1	1	1	1	1
23:00	0	0	0	0	0	0	0

1 Detail Requirements in Scheduling (7)



- Feeder and main line trains
 - Train numbers and times of feeder trains

	1. tr	ain ID		2.	nd trai	n ID				EML	Train no	RBCT	Train no
		back to		back to	from		to			Departure	to RBCT	departure	from RBCT
MineID	to mine	yard	to mine	yard	(inclu	ding)	(incl	uding)		0 00:00	8801	0 00:00	8800
PBT	8800	8801	8800	8801		00:15		00:15		0 01:00	8803	0 00:30	8802
HBN	3102	3103	3102	3103		00:15		00:15		0 02:00	8805	0 02:00	8804
SIA	3104	3105	3104	3105		00:15		00:15		0 03:00	8807	0 03:00	8806
EQT	1816	1817	1862	Departi	ure	EML Sm	nall	EML Jum	bo	0 04:00	8809	0 04:00	
TAL	2853	2854	2843	0	00:00	80	0000	9	0000	0 05:00		0 05:00	
BLG	2853				00:30	80	0200	9	0200	0 06:00	8813	0 06:00	8812
WED	2853				01:00	80	0400	9	0400	0 06:30		0 07:00	8814
NGN	2853			0	01:30		0600		0600	0 08:00		0 08:00	
GGK	8942				02:00	80	0800	9	0800	0 09:00	8819	0 09:00	
	00.=	30.10	00.0	0	02:30	8	1000	9	1000	0 10:00		0 10:00	
				_ 0	03:00	8	1200	9	1200	0 11:00	8823	0 11:00	8822
				0	03:30	8	1400	9	1400	0 12:00	8825	0 12:00	8824
				0	04:00		1600	9	1600	0 13:00	8827	0 13:00	8826
					04.20	0.	4000		1000	0.44.00	0000	0.44.00	0020

EML			
Scheduled		Planned	Planned
departure	TrainID	crews	return
0 00:00	8801	EMR	8802
0 01:00	8803	EMR	8804
0 02:00	8805	EMR	8806
0 03:00	8807	EMR	8808

VHD							
Scheduled departure	TrainID	Planned crews	Planned return				
0 00:14	8837	VYD	8814				
0 01:14	8839	VYD	KOMBI				
0 02:14	8841	RCB	8842				
0 03:14	8843	VYD	8814				
0 09:00	836	600	93600				

	RBCT			
	Scheduled departure	TrainID	Planned crews	Planned return
	0 00:00	8800	RCB	8847
	0 00:30	8802	VYD	8825
	0 02:00	8804	VYD	8827
	0 03:00	8806	RCB	8805
_	22.00	0.47	0.22.00	004

7 Output / Result



 Summary of schedule – To Mines, from Mines and arrive at RBCT

Week tonnages scheduled / planned dept from mines									Tatal			
		E	rmelo mine	es	Natal		Panbult		Total tonnages		Total	T-1-1
Day	Date		Jumbos				Jumbos		planned daily		Ermelo	Total
Day	Date		as				as		,,	Daily Tempo	Trains	Trains
		Jumbos	Smalls	Smalls	Smalls	Jumbos	Smalls	Smalls		for the week	per day	per day
Mon	11/02/08	21	2	4	0	0	0	0	209,100	72,348,600	27	27
Tue	12/02/08	21	4	4	1	1	0	0	231,900	80,237,400	29	31
Wed	13/02/08	17	4	8	2	2	0	0	233,100	80,652,600	29	33
Thu	14/02/08	18	2	6	1	0	0	0	198,700	68,750,200	26	27
Fri	15/02/08	19	3	5	0	2	0	0	220,700	76,362,200	27	29
Sat	16/02/08	20	3	3	0	0	0	0	200,800	69,476,800	26	26
Sun	17/02/08	19	5	7	0	0	0	0	227,300	78,645,800	31	31

Ŋ	2008/02/11	174,300	11,600	23,200	0	0	0	0
iges mines	2008/02/12	174,300	23,200	23,200	2,900	8,300	0	0
tonnages ed to min	2008/02/13	141,100	23,200	46,400	5,800	16,600	0	0
nna I to	2008/02/14	149,400	11,600	34,800	2,900	0	0	0
~	2008/02/15	157,700	17,400	29,000	0	16,600	0	0
Daily plann	2008/02/16	166,000	17,400	17,400	0	0	0	0
Dig	2008/02/17	157,700	29,000	40,600	0	0	0	0

Total trains for the week	204
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Total tonnages planned for the week from the mines

1,521,600

Total tempo planned for the week

79.12

Schedule to be shown on tempo

75.21

Mt/a

7 Output (2)

2008/02/11



	train	schedules
not alloc.		

not anoc.					
requested	10	24	15	1	4
LoadPt.	BNK	RLT	GH	GRN	GGK
	BYY	LDY	GHM	GSE	GGK
	91434	90852	96410		8942
MON	97034	93452			

95852

	DEPARTURE		00:00	00:30	01:00	01:30	02:00
		TRAIN NO.	80012			80698	90852
	MON	DESTINATION	BZR			KPL	LDY
	2008/02/11	WAGON TYPE	S			S	J
$\left\{ \right.$							
		COMMENT					

NATAL SERVICE		2008/02/11	2008/02/17	8/02/17		
DAY	Train no	Time	Mine	Supply Train	5/7 1/3	
	0		BLG	0	0	
MON	0		EQT	0	0	
2008/02/11	0		HBN	0	0	
	0		PBT	0	0	
	0		SIA	0	0	
	2853	23:00	TAL	8826	50	
	2853	20:30	BLG	8820	50	
TUE	1862	21:30	EQT	8820	100	
2008/02/12	0		HBN	0	0	
	8800	6:00	PBT	8824	100	

0298		90842
TIT		VYF
JS		J

7 Challenges



Bunching on return

• The system allocates trains to departure slots to the mines. Due to varying load and run times, trains may arrive back in same time slot, causing bunching which must be solved in the schedule

7 Considerations



- Running times between yards
- Dwell time in yards due to agreed processes.
- Running times between yards and mines
- Number of train sets (jumbo and small) available.
- Main line slots available for usage
- Where locomotives should drop loads for loading and continue to pick up loaded trains.
- Number of locomotives sets available
- Train personnel required

7 Required end state



- 'Rugged' system conforming to TFR CIO standards
- System Integrated with TFR systems
 - Resources
 - Demand
 - Personnel
 - etc
- New Functionality
 - Rescheduling System ability AND replanning process
 - Locomotive scheduling integrated with Drop-off logic
 - Consider crewing
 - Locomotive and Train diagram plot
 - Other wagon configurations i.e. 200 wagons to mines