

## Confirmation and refinement of Scope for a Scheduling System for the Coal Freight Train Operation (RFP No:1030 72855)

In the RFP document the following summary requirement is stated:

- *A resource scheduling solution for both locomotives and wagon sets that will generate an optimised, fixed Long Term Timetable (LTT) as well as a Short Term Plan (STP) on a weekly basis which caters for additions to and alterations of the LTT, whilst considering various operational constraints to maximise throughput.*

The fundamental requirement is to provide

- A. a schedule, **optimised** for volume, given the available resources, demand, mine constraints and infrastructure constraints, for:
- trains that must be dispatched to mines from the serving marshalling yard,
  - trains that will be scheduled to arrive at all mines for which there is a demand
  - arrival details of trains back at serving yard from the mine and
  - details of departure of trains to Richards Bay on the main line from the serving yard.

In order for this to be determined, the return leg on the main line portion between Ermelo and Richards Bay plays a significant role in determining when resources will become available at yards for provision to mines, but for the purpose of The Solution no further detail on the main line portion is required; the time taken for this portion of the total cycle time should be an adjustable parameter (typically 32 hours).

- B. A facility that will adjust the schedule during the period of operation, taking into consideration the deviations that have occurred. The Solution will have to cater for real time updates in rolling stock position and related factors e.g. estimation of time of arrival at logical nodes in order to provide alternative solutions adapted for reality. It should be noted that the working at RBCT does not guarantee a first in, first out situation for wagon sets.

## Questions related with Transnet Tender for a Scheduling System for the Coal Freight Train Operation (RFP No:1030 72855)

- What is a train slot? Is it a trip with precise departure and arrival times and precise starting and ending locations? Please confirm if the following scenarios are possible: a train slot with no resources allocated, meaning that the train slot is not used; a train slot with only locomotives allocated, meaning that the train slot is used only for moving locomotives from a place to another; a train slot with both locomotives and wagons allocated, meaning that the train slot is used for productive transportation. Are there other relevant aspects related with train slots? **A train slot is a defined time in which a train can be run between 2 points with precise arrival and departure times that have been tested to be attainable under normal operations. Incidents in reality can cause trains to deviate from its designated time slot, which is then managed by Train Control Officers. The scenarios stated above are all true. There are more train slots than trains. In The Solution being sought, the train slots exist and do not have to be defined.**
- In which terms is the transportation demand (customer order) defined? Is it the amount of coal that has to be transported between each mine and Richards Bay during period of time (say a day, a week, or other)? Are there transportation demands defined between other places (that are not mines or Richards Bay)? Are there other relevant aspects related with

transportation demands? The demand is defined by the number of loads that must be moved in a week from the mine. A load is typically 100 wagons that run in a fixed consist. Mines in the Vryheid area use 50 wagon sets as a load. Some mines can take 150 or 200 wagon loads. The required solution focuses on the scheduling of the loads between mines and Ermelo, taking cognisance of the trip from Ermelo to Richards Bay and back – the latter dictating when wagons become available for distribution to mines. Transportation of loads from mines to other domestic and port destinations must be taken into consideration to ensure that loads are not bundled at mines that have a finite capacity per day.

- Page 11 addresses the notion of robust timetable. Is this a goal that must be achieved as much as possible? Is there a way to say how much a timetable is robust? Robust time table refers to (a) the feasibility of the plan and (b) consideration of all applicable parameters that may influence a schedule to ensure its applicability in operations.
- In page 14 the term “reclaiming times” is referred. What does it mean? Mines have a period after loading for recharging their loading systems for the next loads. It is a minimum period of time required between the departure of a loaded train and the arrival of the next empty train for loading. It varies from mine to mine, but is a constant per mine.
- Page 14 mentions mine operation hours. What is the impact of these hours in the train vehicle allocation? The period of time between arrival and departure of a train in a mine must be totally or partially included in these hours. Most mines work 24x7, which will become the norm. Some mines only work daylight hours. Delivery of empty loads to these mines can take place outside of these hours, but will have a negative impact on shunting staff and resource utilisation.
- Page 14 mentions infrastructure capacity and constraints. Is it possible to have more detail on this? The network map will be annotated with single and double lines and forwarded. The most important constraint is that of maintenance occupations on sections that make the line unavailable.
- Page 14 refers terminal constraints. Is it possible to have more detail on this? The capacity of the terminals and yards is limited, which The Solution should take into consideration. There are thus a finite number of trains that can be accommodated in a terminal or yard, such as Ermelo. The physical number of trains in the yard/terminal should be an adjustable number.
- Is there any problem in using an approach where the allocation of locomotives is performed after the allocation of wagons and based on it? This is acceptable. The number of locomotives is a hard constraint in determining if the proposed solution is feasible. The fewer locomotives required, the better the answer, thus an optimising factor.
- Are there any constraints on forming vehicle sets with different types of train vehicles? For instance, is it possible to form vehicle sets with Jumbos and Smalls? Is it possible to form vehicle sets that mix electrical and diesel locomotives? Are there any constraints of mixing certain types of locomotives with certain types of wagons? The wagon sets consist of a fixed number of wagons of either jumbos or smalls between Ermelo and the mines. From Ermelo to Richards Bay, jumbos and smalls may be combined in the 200 wagon sets in the following combinations (where J=Jumbo, S=Small, JaS= Jumbo loaded as small): J/J, J/JaS, J/S, JaS/S, J, JaS, and S. the S/S combination is not permitted.

- Are there different types of diesel and electric locomotives? North of Ermelo on the feeder system 10E DC locomotives (4 in a set) as well as Class 37 Diesel locomotives (typically 5 per set). The diesel locomotives can be used anywhere on the feeder network, although in practice only used on the non-electrified sections. On the main line between Richards Bay and Ermelo two types of AC locomotives are used, 7E (6 in a set for 200 jumbos) and 11E (4 in a set for 200 jumbos). These sets are interchangeable for all intent and purposes. Note: The detail of the main line portion of The Solution is excluded from The Solution.

Note: TFR is in a process of upgrading the braking systems being used to an ECP (Electrically Controlled Pneumatic) system, which constrains the allocation of locomotives and combination of wagon sets during the interim period in that 2 versions of the wagons will be in use on the system (ECP and non-ECP). For the final specification of the final solution, the specification will be drawn up to take this in consideration.

- Page 14 says “the required solution should take cognizance of the demands of and possible conflicts caused by the required delivery to domestic markets”. Could you give more detail and examples about these conflicts? See attached table indicating a portion of the daily loading demand at mines. Here it is clear that some mines load for both export and domestic coal. The total demand must be used in The Solution to ensure that conflicting load slots are not allocated to a mine.
- Page 19 refers optimization of terminal working including mines, sidings, yards, exchange yards and port terminal. Could you provide more detail on the outputs of this optimization as well as the constraints involved and how to compute the cost of a solution? Refer to item above (Page 14 refers terminal constraints. Is it possible to have more detail on...). The requirement is to include the constraints of these operational areas in determining a schedule to ensure feasibility – i.e. to ensure that the number of trains entering a location such as Ermelo, is not more than the capacity of that location...
- Is it possible to have printouts of some vehicle allocation plans both for long- term and short-term? Is it possible to have printouts of plans for terminal working? The long term plan is not being used yet. An example of allocation is attached below.
- How many users (planners and other staff) will use the requested resource scheduling system? What are the main responsibilities of these users? The planning section (currently located in Empangeni; plans are to expand to Ogies as well) will consist of not typically not more than 10 people who will have update capability. The system must be open for viewing by a much larger number of staff members
- In part 3 of the document (Scope of Work) the point 1 says “A resource scheduling component that allocates locomotives, wagons and crew sets to the train plan in the most efficient way.” But in part 4 the criteria number 1 says “Does the proposed solution meet with TFR’s requirements for a resource scheduling tool for both locomotives and wagon sets {...}”. Question not clear
- Does the aim of the system include scheduling crew or is it only for scheduling locomotives and wagons? The system will have to indicate the number of crew and location where required. This demand is input to the separate crew scheduling facility that must provide for this demand. It is not required to provide a full crew scheduling capability.

- Please give some examples on how crew labour requirements limit the scheduling of these vehicles? **See above – not applicable in this application. Will be covered in a separate crew scheduling facility.**
- In the case of the drop-off mines, locomotives are detached from the wagon set after delivery of the sets to perform other operational duties. To position a locomotive in another mine, for example, to collect loaded wagon sets at other drop-off locations, does it use the fixed timetable trip slots (30 minutes interval) between Ermelo and the mines or case-by-case the system must generate dead head trips compatible with the defined trip slots? **A free movement of locomotives between mines within operational constraints is possible. Minimum run times between mines in these cases will be provided.**
- Is there a limit about the number of wagons a locomotive can pull? For example, how many locomotives are use to pull 200 wagons between Ermelo and RBCT? They will always be position in front of the train? **Yes. For the purpose of The Solution the requirement is stated in number of locomotive sets whereby 1 set is required to move 1 train. The main line portion can be excluded from The Solution.**
- Locomotives at RBCT may detach from the loaded wagon set and be attached to another wagon set already empty and return to Ermelo or waits by its wagon set get empty and returns with the same set? **Yes. There is a minimum turn around time for locomotives for preparation. The main line portion can be excluded from The Solution.**
- Is it possible to assume that TFR handles wagons as logical units of 50 wagons each and combines / splits the wagons always by these logical units? Does TFR schedule wagons considering the wagon sets or each wagon particularly? Does each wagon set have unique identification? **For Small wagons the minimum set size can be 50. These sets are then combined when sets of 100 are needed. The schedule is by wagon set, not individual wagon. Each wagon set does not have a unique identification as yet, but it may be instituted. The wagon set is identified by the transient train number in which it is being used at the moment. In the existing prototype wagon sets are numbered and allocated to train numbers.**
- How does TFR handle wagon maintenance, it takes out and carries on each individual wagon or it moves out a complete wagon set for maintenance? **For the purpose of the required solution, this is not applicable – the available number of wagon sets for the week will be an input into The Solution.**
- Is wagon (set) maintenance handled in long-term weekly scheduling or in short-term plan? **For the purpose of the required solution, this is not applicable – the available number of wagon sets for the week will be an input into The Solution.**
- Are the mine maintenance periods handled in long-term weekly scheduling or in short-term plan? **Mines normally maintain in regular repetitive time periods which can be incorporated in the long term plan. TFR must be informed of short term maintenance required that must be included in the weekly plan. Shorter term needs (normally emergencies) must be handled as deviations.**
- Which locomotive types serve the mines from Vryheid? These trains go directly to RBCT? How the slots between Ermelo and RBCT and the slots between Vryheid and RBCT combine with each other? Are they the same? **The movement from Vryheid mines to**

Vryheid is handled by a local scheduled train for which the available time slots will be specified as a parameter. The trains do not go directly to RBCT, but get added to main line trains at Vryheid; normally 100 wagon trains from Ermelo.

- Please explain how TFR handles the “Scheduled infrastructure maintenance windows”? How TFR receives this information? Is it handled in long-term weekly scheduling or in short-term plan? **The required maintenance period is provided through an agreement between TFR and the Infrastructure arm of Transnet Rail Engineering. It is typically every second Monday on the main line, but could be weekly. Similarly, maintenance on the feeder portion is agreed between these parties. The information is gleaned from regular agreement meetings (manual information currently). It should be included in both long term and short term plans. Emergency occupations are handled as deviations.**
- Please indicate the locomotive and wagon fleet size type. **Jumbos 5500; Small 1400; DC locomotives 15 sets; Diesel sets to be confirmed**
- The locomotives and wagon sets that are dedicated to the coal mines exportation through Richards Bay also carry out the TFR Domestic Coal Service? **No. The export fleet is dedicated.**
- Please explain the concept of “existing general freight schedule”. Is it a set of trip slots (like t slots between Ermelo and RBCT)? **Yes. The domestic trains have more constraining available time slots to mines, as compared to the export system in which trains are allocated to available slots.**
- Please explain what TFR expects with point 4 of section 1 of part 3 “A revision of all the existing business processes will be conducted as part of the scope of this initiative.” **The introduction of a new system with new inputs and outputs will require the review of the business process in which it used operationally. TFR will review and update these processes to implement the new system.**
- Please explain your concepts of “Train Countdown” and “Escalate Deviations” **Train Countdown: There is a process by which the departure of a train is managed to ensure that all aspects that must take place are attended to. Escalate deviations: (not found in the RFP – please provide exact reference).**
- Will all individual wagons be fitted with tags or readers in order to determine its position on the network, or only the wagon sets? **Both wagons and locomotives will be fitted with tags.**
- Please explain what does TFR expect with point 8 of section 1 of part 3 “All work relating to the implementation of the intended solution must be fully documented and provided to TFR as part of the scope of this initiative”. Does this include software source code? **Full user documentation must be provided required to operate the system. Source code is not required since TFR do not intend maintaining it. This should be covered by a licensing and maintenance agreement.**



LOAD MATRIX (PORTION) INDICATING EXPORT AND DOMESTIC COAL INTERACTION AT A SINGLE LOADING POINT

Day	Loads	603309 CAROLINA 643289 ERMELO YARD SDG.FORZANDO  652342 VOORSLAG SDG 1  652377 PANBULT SDG 1  720038 PULLENS HOPE  741582 TRICHARDT SDG.SASOL COAL  742171 DELMAS SDG.KUMBA RESOURCES  743348 BLACKHILL SDG. EXXARO  749907 RIETKUIL SDG.MAFUBE COLLIERY  750662 BLINKPAN SDG.ESKOM  750727 BLACKHILL SDG.APEX MINES LIMITED  750735 BLACKHILL SDG.ANGLO OPERATIONS LTD  751405 BROODSNYERSPLAAS SDG.BANK COLLIERIES  751553 BEZUIDENHOUTSRUS SDG.NEW CLYDESDALE  752592 KROMKLIP SDG.RIETSPRUIT COLLIERY  752622 MINNAAR SDG.XSTRATA SOUTH AFRICA PT  752649 SAAIWATER SDG.WITBANK CONSOLIDATED  754331 VANDYKSDRIF SDG.DOUGLAS COLLIERY 1																		
		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
2009/03/10 Tuesday	1	Map	RBCT	Sugr	Papr	Map	RBCT	Mjba	RBCT	RBCT	Mjba	Powr	RBCT	RBCT	RBCT	Mjba	Papr	RBCT	RBCT	
	2			RBCT	RCB		RBCT	Stl			Mjba	Stl	RBCT	RBCT		RBCT	Powr		RBCT	
	3				Sugr			Stl												
	4				Sugr			RBCT												
	5				RBCT															
	6																			

Typical allocation result

<b>Loading Point&gt;</b>	<b>BYY</b>	<b>LDY</b>	<b>GHM</b>	<b>GGK</b>	<b>BZR</b>	<b>EIY</b>	<b>PSH</b>	<b>etc</b>
<b>MON</b> <b>2009/02/09</b>	08:30	03:30	13:30	19:15	00:30		10:30	
		12:30					22:30	
		20:00						
<b>TUE</b> <b>2009/02/10</b>	18:00	02:00	00:30	19:15				
		08:00	15:00					
		14:00						
		22:00						
<b>WED</b> <b>2009/02/11</b>	07:30	04:30	03:00		17:00	22:00	01:00	
		10:30	14:30				13:30	
		19:00						
		23:00						
<b>THU</b> <b>2009/02/12</b>	19:30	07:30	05:30		22:30		01:30	
		14:30	18:00				13:30	
		23:30						
<b>ETC.</b>								