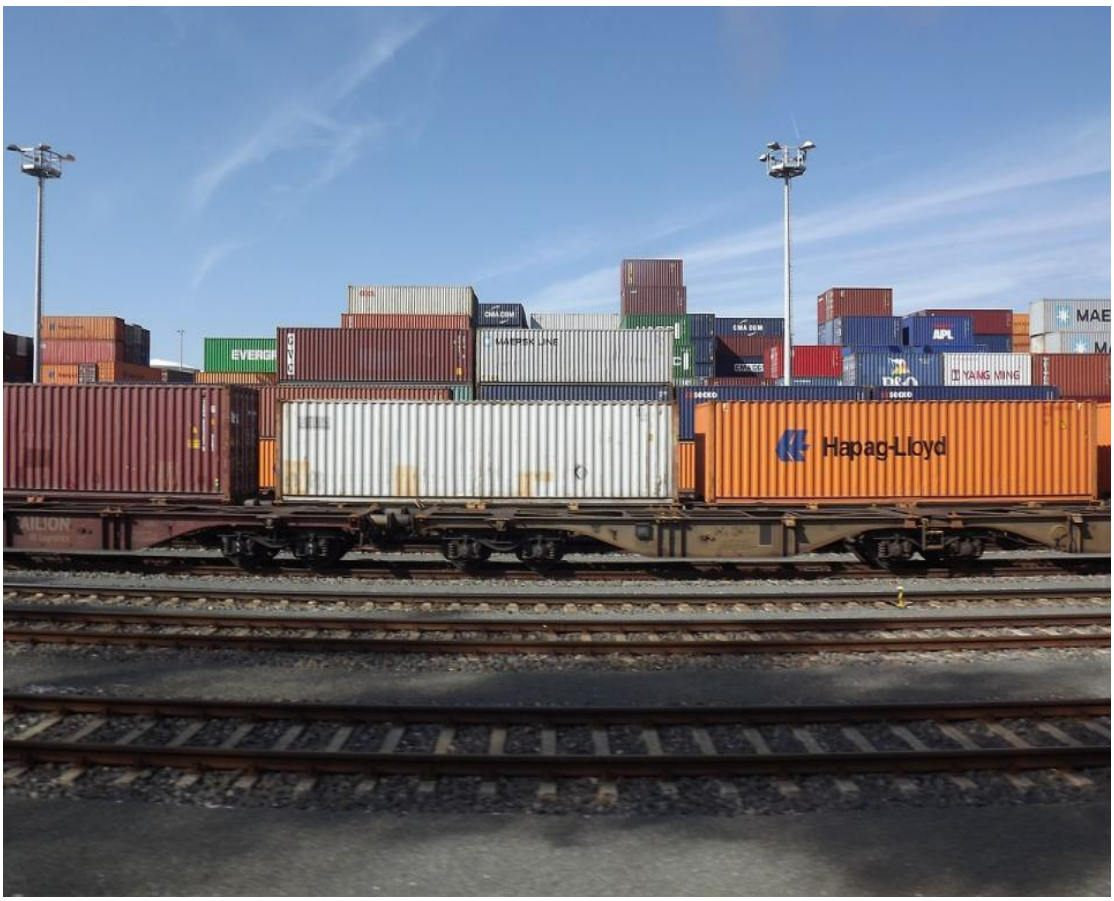
Railway Freight Identification Study (Egypt)

Baseline Report: V3

Date: November 2019



Prepared by: Menarail Transport Consultants

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- Demand Assessment

1. This Report sets out the rail freight traffic forecast for the proposed upgraded rail connection between Great Port of Alexandria (GPA) and 6th October Dry Port (DP6).
   This is a review and update of the DP6 Demand Study produced in 2016. Key assumptions are (i) freight traffic growth will be driven by growth in import containers and (ii) The majority of import containers are destined for Greater Cairo Region and southern Egypt.

Forecasts are developed for Base Case, High and Low scenarios, an assumed opening year of 2022 and a forecast period to 2060.

2. In October 2018 there were approximately 37,000 each way movements of containers through each of Alexandria and El Dekheila ports. Imports and exports roughly balanced with 3% more containers imported. Taking both ports together, this would equate to an annual each way movement of 880,000 containers.

Traffic forecast Input assumptions

3. Real GDP and forecast to 2023, sourced from the IMF World Economic Outlook database shows year on year growth has ranging from 1.8% to 7.2%, averaging 4.4% over the period 2006-2018. Based on these historic data, we have adopted 4.4% as our Base Case real GDP forecast with 3.4% as our Low and 4.9 % p.a as our high forecast.

4. The resultant forecast of containers through Alexandria and El Dekheila ports are very close to the figures in WB master plan, as shown in figure 3
5. Typically, in countries at a stage of economic development such as Egypt, the volume of imports would be expected to grow at a faster rate than growth in GDP, that is with an elasticity of import volume growth to GDP growth greater than 1. The results show elasticities of 1.19% based on the period 2006 -2016 and 1.02 % for the period 2006 -2018. We have adopted import volume elasticities with respect to real GDP 1.10% as our Base Case, 1.0% as our Low (import volume growth in line with GDP growth) and 1.2 % p.a as our high forecast**.**
6. The results of the Demand Study showed a BASE Case rail share of 21.8% and a range from 6.4% to 28.4%. The 2016 Study provides a valid basis for estimating rail market share, subject to wider regulatory and enforcement considerations. Taking a cautious view, our assumptions on rail market share are Base Case: 15%, High Case 20% Low Case 10%. This range is lower than that used in the forecast in 2016.
7. Our forecast takes a prudent view that rail movement bulk commodities will remain stable at 2017/2018 levels in the future.

8. Based on these assumptions the resultant range of traffic forecasts (trains per day in each direction) is shown in table 10 and figure 4
9. Forecasts for the assumed opening year of 2022 range from 6 to 10 trains per day, increasing to a range of between 6 and 14 trains per day by 2030. These forecasts are unconstrained by any limits to capacity which are likely to apply, especially in the high traffic case, when demand exceeds of the order of 1 train/hour in each direction.

Required regulatory environment

10. These forecasts suggest that there could be between 3 and 7 container trains/day in each direction in the opening year. Based on international experience, the distance (near 300 km) from GPA to 6th October dry port is sufficient to suggest that a block train container service can be financially viable – but it is important to note that this financial viability is marginal (a longer distance would improve the relative competitive ness of rail). A strong supportive regulatory environment will be essential to support even the low traffic forecast.
11. This supportive environment is likely, as a minimum, to consistent of:
    - Service provision by experienced rail freight operator(s)
    - Measures to ensure a level playing field for competition between road and rail
    - Suitable rail freight train paths to ensure efficient use of rolling stock

Modal Share

The consultant has conducted interviews with 2 freight forwarder companies, AAA international and Egy Trans to discuss their needs & priorities and the problems they face in the road transport. These Interviews identified strong appetite for "trunk" container train movement between GPA and DP6 – where containers would be opened for processing or re-packaging of products or de-consolidation for onward road movement to final consumers.

Interview Results suggested that the markets is looking for an improved service in terms of (i) predictable costs (ii) 24/7 operations ;(iii) higher legal weight limits/container and (iv) improved journey time reliability.

The strength of appetite for a new rail container service will vary according to the movement required (GPA to final destination) and commodity in question. Higher value commodities such as foodstuffs and Fast-Moving Consumer Goods (FMCG) moving to retail or wholesale outlets are likely to continue to move by road. Rail will be more suited to moving lower value less time sensitive[1] commodities such as semi-finished components for final assembly, automotive spares, steel and aluminium products and some construction materials.

Key to success will be achieving a 12 hour 'each way' journey time (including time for train loading/unloading). This will enable the railway to offer a 'same day' delivery offering and enable an 'out and back' journey to achieve very efficient resource utilisation and therefore lower cost.

To allow shifting from road to rail transport, operator should offer the following:

- A full package service of 'door to door' delivery.
- Cost should include door to door service and can still be 15% less than Trucking
- Offer different wagons suitable for different Categories of commodities.

Rail can offer an attractive haulage cost, although 'final mile' road haulage costs need to be added to these numbers. If an attractive cost proposition at or slightly below road haulage can be achieved, then comparison with more mature European markets shows than a movement towards 15% modal share can be achieved.

[1] It is to be noted that the rail service will be a few hours slower than road, so that the time sensitivity of good is relevant only across this narrow time difference.

Cost model

The report includes a detailed cost model which indicates that the 'door to door' cost of transportation by rail is very close to the cost of transportation by road. These costs are summarised below:

	Cost ($)	Comment
GPA lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Train cost	94	As cost in Appendix 2 cost model plus 10% margin
DP6 lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Final mile delivery cost	63	Road cost, return journey (1000 GBP)
	257	equals 4,100 EGP @16 EGP to the dollar

Two points should be emphasised from this table:

1. Rail cost is within 3% of the road cost, which as per our interviews with freight forwards is $4000 EGP for a return journey.
2. Only 39% of the 'door to door' cost of transportation is actually a rail cost ($94 out of $257 total). It should be noted that the lift costs (if any) at DP6 still have to be established.

Underlying this cost model are a number of assumptions, the most important of which are:

- Trains are filled on average at 90% of capacity
- The trains work 24 hours a day for 5.5 days a week, the remaining day and a half being used for track inspection and maintenance and locomotive and wagon maintenance
- Track infrastructure costs are split with the passenger services based on the relative number of trains which use each section of the infrastructure.

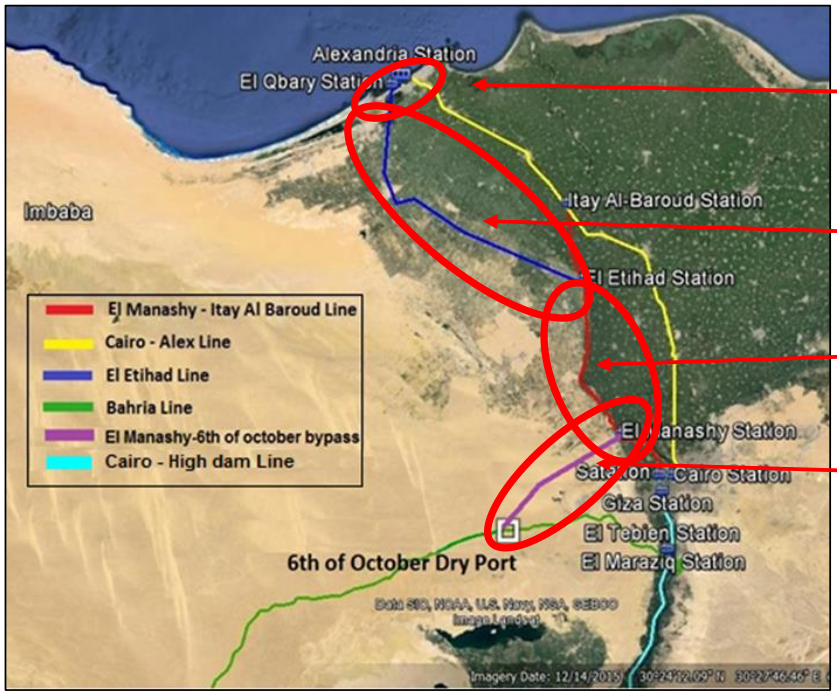
The cost model also considers two other constraints:

- The market will not allow a 40ft containers to be priced at twice the cost of a 20ft container as the road cost for transporting a 40ft container is only 25% greater than the cost of transporting a 20ft container.
- Twice as many 40ft containers pass through the port as 20ft containers.

The model reworks the cost per TEU based on the above assumptions. The cost per TEU (standard 20ft container) increases from $86 to $183 and, for clarity, a 20ft container is charged at this rate and a 40 ft container at $289 (ie $183 x 1.25). This analysis indicates some of the wider factors which need to be considered when undertaking the TEU pricing regime.

Rail infrastructure

The report describes the infrastructure by splitting it up into 4 sections, as shown below.



Port connection

El Etihad Line

El Manashy line

Proposed link Manashy- 6th of October

The Port connection consists of a short section of the coastal line and a connection into the Ports. The El-Etihad line is a single-track freight only line with mechanical signalling system which connects into the El Manashy line, which is a single line with electrical signalling system which currently sees both freight and passenger use. Both lines have stations (not used on the El-Etihad line) which are used as passing loops for trains as they cross on the single-track railways.

Section I Summary of the Current Legal and Institutional Setup in ENR

Regulatory Laws governing the Egyptian Rail Sector:

The applicable laws governing the Egyptian Rail sector includes:

Law No. 152 of 1980 sets out the establishment of the ENRA which falls under the auspices of the Ministry of Transportation. According to this Law, ENRA has the exclusive right to create and operate the national railway and to establish joint stock companies in order to achieve its purposes. In this regard, the ENRA has established the Egyptian National Railways (ENR), which is a fully owned company by ENRA.

Modifications have been introduced to Law No. 152 of 1980 by Law No. 149 of 2006 allowing for private sector investment in new railways on a build-operate-transfer (BOT) basis.

Article 1 of Law No. 149 of 2006 gives ENRA the right to grant to the private sector the possibility of building and operating new railway links. In particular, the law states:

"As an exception of Article 2 of this law [No. 152 of 1980], the public utilities liabilities/obligations may be granted to the investors, whether natural or legal persons, to construct/build and operate new lines and railway networks, without adherence to the provisions of Law No. 129 of 1947 concerning concessions of public utilities, and Law No. 61 for 1958 concerning Concessions relating to the investment of natural resources and public utilities, and that is according to the following conditions and procedures:

a) The concessionaire/investor selection is subject to the principles of free competition and publicity.

b) The means of supervision, technical and financial follow-up shall be identified to ensure the proper functioning of the facility/utility regularly and steadily.

The concessionaire/investor shall maintain the lines and networks subject of the concession/investment and keep them functional for the concession period, and the ownership of the project facilities and assets shall be transferred to the State after the termination of the concession period Free of charge and in good condition and usable".

The concession shall be issued by a decree of the Council of Ministers, upon the Minister of Transport recommendation, determining its terms and conditions and their amendments, and the share of the government and the foundations of pricing for the service within the limits of the rules and procedures previously stipulated.

The concessionaire/investor shall not assign its obligations to a third party without the approval of the Council of Ministers.

These provisions are applicable to the building and operation of the links and networks of the railway according to the first paragraph of this article."

Based on the Article 1 of Law No. 149 of 2006, ENRA as a tendering public entity has the right to tender the project for the new link by any of the legal options for granting concessions or PPPs in Egypt.

However, the Law has specifically stipulated the below conditions that the Tendering Public Entity shall take into consideration:

- The concessionaire/investor selection is subject to the principles of free competition and publicity.
- The means of supervision and technical and financial follow-up shall be identified to ensure the proper functioning of the facility/utility regularly and steadily.

Nevertheless, it shall be noted that, according to the recent modifications introduced to the law, no concession shall be granted for more than 15 years. Moreover, a challenge would still be connecting the new lines/links with the old ones which are operated by the ENRA.

To conclude, the new amendments introduced by Law No. 149 of 2006 allow the private sector to build and operate new railway lines and networks at its own expense by entering into agreement with the Tendering Public Entity. In addition, the Private Sector shall maintain the new railway line during the Contract Period and at the end of this period the new line will belong to the State free of charge and in good condition. The Concession Period shall not be exceeding 15 years in all cases.

Legal Options for Project Implementation

The legal regime regulating concessions of public utilities, including railways, is governed by either the Concession Law in conjunction with Law No. 152 of 1980 as amended by Law No. 149 of 2006, or the Law No. 67 of 2010 promulgating the PPP Law. It shall be noted that the applicable laws governing the Egyptian Rail sector do not allow a joint venture ("JV") between the private sector and a public entity. That said, there are two approaches that ENRA may take to execute the Project under Egyptian law. The following points explain the different routes in detail.

Sector-Specific Laws and Concession law

Public Utilities Concessions may be granted under Law No. 129 of 1947 as amended in 1958. BOT and BOOT concessions in Egypt have been typically granted under the Concession Law. In addition, several Sector-Specific Laws have been enacted.

a) Sector-Specific Laws

The Sector-Specific Laws typically exclude the application of the general public utilities legislation and set out the legal framework for concessions in a particular sector. The Sector-Specific Laws have been enacted for various sectors in Egypt, including electricity, specialised ports, airports, railways and roads allowing for more flexibility in the concession terms and conditions. The reason for enacting the Sector-Specific Laws was to avoid the Concession Law restrictions (e.g. cap on maximum margin of profit of 10% of the invested capital) that make the concession/project not appealing for private investors.

If the Project is established through a sector specific law, the ENRA shall request the MoT to submit to the Cabinet and then to the Parliament a draft law enabling it to tender the project through a concession to the private sector for the construction and operation of the railway.

b) Concession Law

Cooperation under the Concession Law between the public and private sector is limited to construction and operation of a public utility for the ultimate benefit of the public sector – without the establishment of a Project company or any form of a joint company between them.

Under Concession Law, the Administrative Authority (ENRA in this case) is responsible for the financing of the project through the appropriations in the State budget and/or available grants. This means that the risk of financing the project rests with the Administrative Authority.

One advantage of using the Concession Law is that the Administrative Authority will not be liable for operating or maintaining the public utility throughout the duration of the concession. On the other hand, one major disadvantage of regulating the Project under the Concession Law is that the Administrative Authority (ENRA), would need to have a portion of the funds ready to finance the project upon completion of construction, and will then likely continue paying the main contractor until private operation of the concession ends regardless of the revenues of the project.

Furthermore, a concessionaire's margin of profits may not exceed 10% of the stated capital authorized by the Administrative Authority[2]. Amounts in excess of 10% of the stated capital "shall first be used in forming a special reserve for the years in which the profits will be less than ten percent. The increase of this reserve shall be discontinued once it has reached the equivalent of ten percent of the capital." Any further amounts must be reinvested into "improving and expanding the public utility".[3]

Financing of the Project under Concession Law

According to the Law, ENRA has the power to control the technical, administrative and financial aspects of a concession[4]. This means ENRA is also responsible for financing the Project through the appropriations in the State budget or any other means of finance (i.e. grants, loans). Consequently, under a traditional concession, the risk of financing the project rests with the ENRA which adds considerable risk to the feasibility of the Project, and therefore is not the preferred means forward.

PPP Law

PPP Law means the Law No. 67 of 2010. The PPP programme in Egypt was first introduced in 2006 when the Egyptian government adopted a new long-term policy of pursuing partnerships with the private sector to expand investments in infrastructure. A special unit in the Ministry of Finance, the PPP Central Unit, was established in June 2006 as the main entity responsible for the initiation and implementation of PPP projects in Egypt. With the growing interest of both public sector and private sector stakeholders, the PPP Law was enacted in 2010.

The fundamental aspects of Egypt's PPP policy framework are the use of performance-based contracts under which the private sector provides public services over the duration of the contract and is paid by the public sector, end users, or a combination of both. Output requirements are specified by the Tendering Public Entity (i.e., ENRA in the case of the Project), while the specific inputs are generally under the responsibility of the private sector partner. Under the PPP contract, the Government retains strategic control over the public services, secures new infrastructure, which is generally transferred back to the public sector at the end of the PPP contract life, and allocates project and performance risks to the parties which are best able to manage or mitigate these risks.

The PPP Law applies to all PPP projects in Egypt, excluding the application of Concession Law or Sector-Specific Concession Laws and traditional Tender Law. However, the PPP Law did not abolish the existing laws that regulate concessions. Therefore, administrative entities may still grant concessions based on the Concession Law and Tender Law.

It is clear that for the PPP Law to apply to the Project, the project has to be for the construction and operation of new lines. The Project involves cooperation between ENRA and the Project Company that shall be formed after the selection of a successful bidder to execute the Project. The Project Company is defined by Article 1 of the PPP Law as:

[2] The Public Utilities Concession Law, Article 3.
[3] The Public Utilities Concession Law, Article 3.
[4] The Public Utility Law, Article 7.

"An Egyptian Joint Stock Company established by a successful bidder, the sole purpose of which shall be to execute a Public Private Partnership Contracts."

The ENRA may not hold more than 20% of the shares of a Project company under the PPP Law.[5]

Article 2 of the PPP Law provides that "*Administrative Authorities may enter into PPP contracts to which a Project Company shall be entrusted with the finance and operation of infrastructure projects and to provide the necessary services and facilities throughout the PPP contract duration*".

Forms of PPP cooperation under the PPP law and term definitions

Articles 2 and 3 of the PPP Law permit the Administrative Authorities to enter into PPP contracts in all infrastructure and public services projects that include the construction, financing, and maintenance of projects. The duration of the contract shall not be less than five years and shall not exceed thirty years. Moreover, the Project estimated cost shall not be less than one hundred million Egyptian Pounds.

According to article 3 of the PPP Law[6], the Administrative Authority may grant the private investor the operation or utilization of the Project. Article 1 of the PPP law defines *operation* as the management, supply of products or provision of services by the Project Company **to the Administrative Authority** in return for remuneration agreed under a PPP contract. On the other hand, Article 1 of the PPP Law defines *utilization* as the management, sale of products or provision of services **to whoever the Administrative Authority specifies** in accordance with the conditions set out by the Supreme Committee for PPP Affairs.

It is therefore important to ENRA to decide whether the Project would call for *utilization* or *operation* of the Project by the Project Company.

Financing the Project under PPP Law

One of the main benefits of choosing a PPP model for the Project is that financing the PPP does not require the Administrative Authority to have allocated funds available for the Project. The Project's contract must contain mutual financial obligations and their relation to the funding mechanism for both the Administrative Authority and the private sector.[7]

The Supreme Committee for PPP Affairs is competent to monitor the allocation of financial funds to ensure that all financial obligations arising from the implementation of the Project are met.[8]

Article 38 of the PPP Law provides that the Administrative Authority may enter into direct agreements with the Project's financing institutions to regulate the method of payment of financial obligations of the Administrative Authority. This may include guarantees issued by the Ministry of Finance (Sovereign Guarantee) on behalf of the Administrative Authority.

Article 38 provides that:

"Such agreements shall include a provision regulating the right of the financing institution to step in and assume the role of the Project Company in executing the

[5] Definition of "private sector", Article 1 of the PPP Law.

[6] Article 3 provides that: *"Upon the approval of the Cabinet, based on a recommendation of the Supreme Committee for Public Private Partnership Affairs and in light of the reports prepared by the Public Private Partnership Central Unit, the Project company may utilize the project and sell the product or provide the service to whoever is specified by the Administrative Authority."*

[7] The PPP Law, Article 34.

[8] The PPP Law, Article 15.

provisions of the PPP contract, or to appoint a new investor after the approval of the Administrative Authority in case the Project Company defaults in either performing its material obligations, or meeting the quality levels established by law or in the PPP contract, in a manner that entitles the Administrative Authority to terminate the PPP contract."

Finally, the Project Company may not sell or arrange any rights over the Project's monies, assets or facilities unless it receives the prior written approval of the Administrative Authority and only for the purposes of financing the Project.[9]

Advantages and disadvantages of using a PPP model

- PPPs provide capital to deliver a project, whereby the Project Company will be responsible for the initial expenses in the planning and construction phases.
- The fact that the Project Company would receive remuneration from the Project only after the start of operation according to the specifications and standards set in the project contract incentivizes it to deliver the assets on time and provides better quality services.
- The drawbacks for using the PPP Law include the somewhat complex and lengthy process necessary to undertake a project through the PPP Law framework.
- Furthermore, the PPP Project is a long-term commitment than a Project operated under traditional procurement procedures, which may add a bureaucratic burden to the duty of the public sector to monitor PPP performance and manage the contract to ensure it is well structured and maintained.

That said, the main features of the PPP Law in comparison with the Concession Law are the following:

- flexible risk allocation;
- administrative Authority payments start after the issuance of the acceptance certificate by the Tendering Public Entity and start of operation;
- inflation and interest rate indexation;
- the Ministry of Finance may issue a credit support instrument for the contractual payments;
- more flexible conflict resolution options;
- direct agreement and step-in rights for the financiers; and
- compensation for undue termination, extraordinary events or direct impact of changes in laws.

Conclusion

If the Project is established through a sector specific law, ENRA shall request the MoT to submit to the Cabinet and then to the Parliament a draft law enabling it to tender the project through a concession to the private sector for the construction and operation of the railway. Moreover, and according to the Law, the Administrative Authority has the power to control the technical, administrative and financial aspects of a concession.[10] However, it is responsible for the financing the Project through the appropriations in the State budget or other means of finance. This means that the risk of financing the project rests with the Administrative Authority (ENRA).

If the Project is established under the PPP Law, procedures are somewhat complex and time consuming. However, the financial and investment risk is mainly allocated to the private investor instead of being borne by ENRA. Moreover, the burden on the State budget is reduced as financial obligations are shifted to the private investor and the Project Company.

[9] The PPP Law, Article 11.
[10] The Public Utility Law, Article 7.

Section II Demand Assessment

Introduction

1. This sets out the rail freight traffic forecast for the proposed upgraded rail connection between Great Port of Alexandria (GPA) and 6th October Dry Port (DP6).
2. This forecast provides a review and update of the DP6 Demand Study produced in 2016. This Study provided a detailed demand analysis, at a zonal level, taking account of comparative road and rail transport costs. Key assumptions, retained in this update exercise, include:
    i. Freight traffic growth will be driven by growth in import containers. The majority of export containers will continue to be returned empties. This imbalance will continue throughout the forecast period – so that the forecast of freight traffic is focussed on imports.
    ii. The majority of import containers are destined for Greater Cairo Region and southern Egypt.

3. Forecasts are developed for Base Case, High and Low scenarios, an assumed opening year of 2022 and a forecast period to 2060.
4. Dry bulk freight has been an important traffic historically for ENR. These traffic are assumed to continue in the future.
5. built up on a commodity by commodity basis, so that the impact of faster growth or the cessation of individual commodities can be assessed.

Review of data on APA website and received data from Egyptian Customs Authority

Port of Alexandria

The Alexandria Port Authority releases monthly statistics on container movement through the Port. At the time of writing the most recent statistics available were for Oct. 2018 and they report the following:

Ship Type	Imported	Exported	Handled
General Goods	432,759	111,926	544,685
Liquid Bulk	514,589	358,035	872,624
Dry Bulk	1,874,689	248,400	2,123,089
Containers	876,906	512,072	1,388,978
Total	3,698,943	1,230,433	4,929,376

TEU Containers

Statement	Alexandria Port	Dekheila Port	Total
Total Imported TEU Containers	36,453	37,778	74,231
Total Exported TEU Containers	32,449	39,689	72,138
Total Handled Containers	68,902	77,467	146,369

Containers Handling tonnage

Statement	Alexandria Port	Dekheila Port	Total
Imported Containerized Goods Total Amount	429,966	446,940	876,906
Exported Containerized Goods Total Amount	283,823	228,249	512,072
Total Handled Containerized Goods	713,789	675,189	1,388,978

Table 1: APA movement data for Oct. 2018 (tonnage)
Source: APA official website
http://www.apa.gov.eg/images/pdf/bayanat/pyanat%20asasya%202018.pdf

The following conclusions can be drawn:

1. In the month there are approximately 37,000 each way movements of containers from each of the Ports, with imports and exports roughly balancing (3% more containers imported). This would equate to an annual each way movement of 880,000 containers (from both Ports)
2. 37,000 containers are approximately 1,850 containers moved a day (based on 20 days of haulage availability a month). If 6 trains run every day each carrying 58 containers then they will move 350 containers, ie 19% market share.
3. For imported goods 74,231 containers weigh 876,906T, giving an average loaded weight of 12T/container. For exported goods 72,138 containers weigh 512,072T, giving an average loaded weight of 7T/container.

4. A 20ft container weighs 2.5T (40ft 4.0T), so a large amount of the export containers are empty as the average load is only 4.5T when the container self-weight is taken off. This is consistent with the findings of the Logistics Market study for the project, which reported that 52% of export containers are empty, as opposed to only 5% of import containers.

6th of October Imports and Exports Volumes

The customs data for traffic from 6th of October city in 2018 shows the following:
Total exports were 1.96m tonnes. The principal export commodities were fruit, tissues and glass products.
Total imports were 76,000T, only 4% of the export volumes. The principal import commodities are shown below.

Commodity	tonnage
Sulphate	1,073
Insecticides	1,472
Chemical material	847
Rubber products	2,659
Engine and compressor components	17,538
Tractor components	590
Motocycle components	37,050
Copper pipes and tubes	11,140
Miscellaneous (96 commodities < 500T pa)	3,851
Total	**76,221**

Figure 1- 6th of October import tonnages-2018
Source: Data provided by customs authority

These volumes represent a daily import volume of 300T (based on 250 working days), ie 15No. 20T lorry movements.

The principal conclusions from this analysis are:

- 6th of October city is currently acting primarily as an export terminal, receiving considerable tonnages of locally produced material for export.
- These tonnages represent potential for future containerised traffic. For example, if half of the 775KT 'fruits' volume was transported in TEUs with a 20T payload this would represent nearly 2000 TEU export movements

It should be noted that these export volumes are dwarfed by the import volumes. We identify above possibly 2000 TEU volumes each year and the GPA volume analyse shows a demand of 1850 TEU per month. This confirms the conclusions given in the Logistics Market Study which states that demand for the rail service will be driven by the importation of containers into DP6. The export part of the train will largely consist of the restitution of empty containers with some small local export volume.

Input Assumptions

1. GDP growth

Real GDP and forecast to 2023, sourced from the IMF World Economic Outlook database is shown in Table 2. Year on year growth has ranged from 1.8% to 7.2%, averaging 4.4% over the period 2006-2018.

Based on these historic data, we have adopted 4.4% as our Base Case real GDP forecast with 3.4% as our Low and 4.9 % p.a as our high forecast.

		2006	2007	2008	2009	2010	2011	2012	2013	2014
GDP, constant prices	Egyptian £	1,261	1,350	1,447	1,514	1,592	1,621	1,657	1,711	1,761
GDP, constant prices	year on year		1.07	1.07	1.05	1.05	1.02	1.02	1.03	1.03
per centage change	year on year		7.1%	7.2%	4.7%	5.1%	1.8%	2.2%	3.3%	2.9%
		2015	2016	2017	2018	2019	2020	2021	2022	2023
GDP, constant prices	Egyptian £	1,838	1,917	1,998	2,103	2,219	2,346	2,487	2,636	2,794
GDP, constant prices	year on year	1.04	1.04	1.04	1.05	1.06	1.06	1.06	1.06	1.06
per centage change	year on year	4.4%	4.3%	4.2%	5.2%	5.5%	5.8%	6.0%	6.0%	6.0%

Table 2: Real GDP 2006-2017 (Actual), 2018-2023 (forecast)
Source IMF World Economic Outlook database

Note GDP at constant prices in Egyptian £ billion. Actual 2006-2018 and forecast 2019-2023

2. Elasticity of import growth with respect to growth in GDP

The data below in Table 3 shows that total import volume increased by 70% over the period 2006-2018, incorporating reductions in 2017 and 2018, with an increase of 82% between 2006 and 2016.

	2006	2007	2008	2009	2010	2011	2012
% change on year		17.0	22.7	-0.1	-4.5	-0.4	2.7
Index 2006=100	100.0	117.0	143.5	143.5	136.9	136.4	140.1
Index 2006=1	1.00	1.17	1.44	1.43	1.37	1.36	1.40
	2013	2014	2015	2016	2017	2018	
% change on year	-0.63	6.21	13.52	8.52	-1.18	-5.60	
Index 2006=100	139.2	147.9	167.9	182.2	180.0	169.9	
Index 2006=1	1.39	1.48	1.68	1.82	1.80	1.70	

Table 3: Egypt: Import Volume growth
source: IMF World Economic Outlook database

Typically, in countries at a stage of economic development such as Egypt, the volume of imports would be expected to grow at a faster rate than growth in GDP, that is with an elasticity of import volume growth to GDP growth greater than 1. The results in Table 4 show elasticities of 1.19% based on the period 2006 -2016 and 1.02 % for the period 2006 -2018. Based on this analysis, **we**

have adopted import volume elasticities with respect to real GDP 1.10% as our Base Case, 1.0% as our Low (import volume growth in line with GDP growth) and 1.2 % p.a as our high forecast.

	GDP [1]	imports [2]	{2}/[1]
2006-2016	1.52	1.82	119.8%
2006-2018	1.67	1.70	101.9%

Table 4: Import volume: real GDP elasticities

3. Share of imports to Greater Cairo and southern Egypt

The DP6 demand Study undertook a detailed analysis based on the relative costs of transport, by road and rail, from GPA to 9 zones in the Cairo region and Southern Egypt. The DP6 Logistics Market Study reports the share of containerised imports through APA destined for these areas to be 70 %.

We have adopted a share of 60% of total containerised imports to Greater Cairo and southern Egypt as our Base Case, 70% as our High Case and 50% as our Low case.

4. Import and export container: comparison

As noted above, the DP6 Demand study reports that loaded containers account for 95% of imported containers but only 52% of exported containers. Using these proportions, the numbers of loaded containers are shown in Table 5

	import			export		
	empty	loaded	total	empty	loaded	total
Alexandria	12,051	258,356	270,407	98,429	113,730	212,159
El Dekheila	16,802	244,134	260,936	153,646	113,674	267,320
	28,853	502,490	531,343	252,075	227,404	479,479
SHARES	5.4%	94.6%	100.0%	52.6%	47.4%	100.0%

Table 5: 2014Containers handled through ports (TEU)
Source Forecast Model sheet 3 cell B20.

Based on these data, and given that most containers are returned for continued use, the demand forecast is based on imported containers. Growth in loaded export containers would have to be significantly higher than growth in imported containers for export container volume to be the determining factor in sizing rail capacity. To illustrate the extent to which export growth would have to be higher, three different export elasticities with respect to GDOP growth are investigated: Base: elasticity = 1.6, High elasticity = 1.8, elasticity = 1.4. These produce export container growths ranging from 6.1 % to 7.8 % per annum with a base case of 7.1 % per annum. These compare to the import BASE elasticity with respect to GDP of 1.1 and Base Case 4.8% per annum import container growth.

The results of this exercise are shown in Figure 2 below

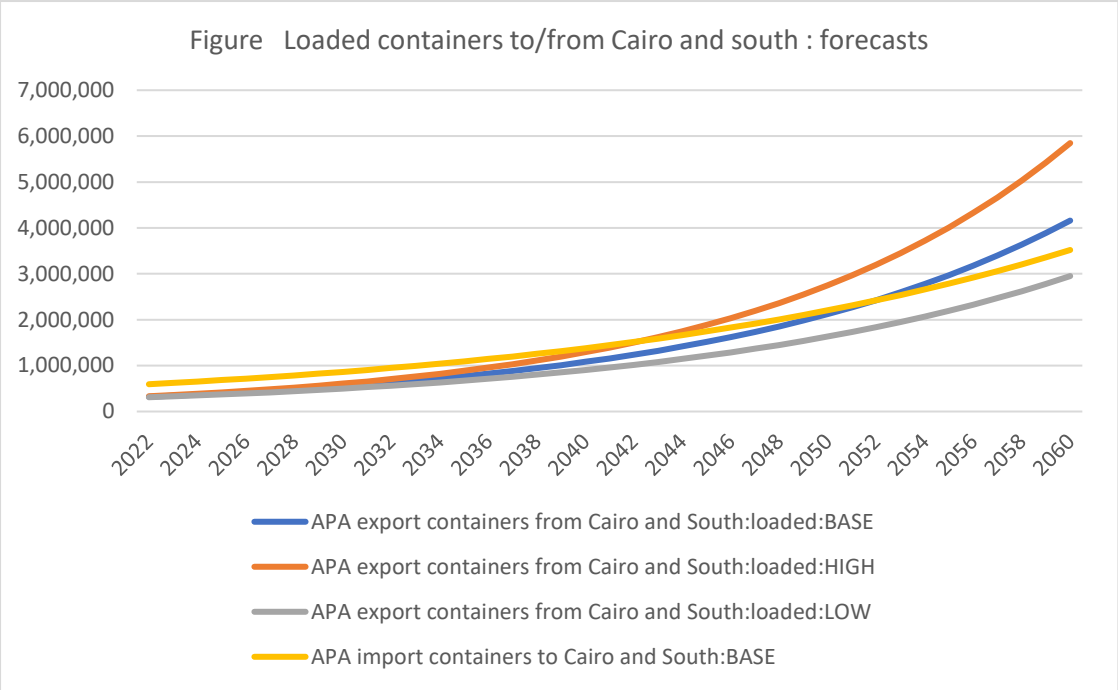


Figure 2 APA exports/imports containers from/to Cairo and South
Source: Forecast Model sheet 5 cell S139..

In the high export case, the loaded export containers exceed import containers in 2043 and in the Base export case loaded export containers exceed import containers in 2052. This suggest that it will be some years until containerised exported items exceed containerised imports and it therefore makes sense to focus on forecasting containerised imports.

It is assumed that all containers are returned as empties by rail, generating train movements.

5. Share of imports to Greater Cairo and southern Egypt by rail

The results of the Demand Study are shown in Table 6 below. Under Base Case assumptions the rail market share was forecast at 21.8%; as rail costs increased relative to road costs this decreased to 6.4%. The highest rail market share, assuming a 10% reduction in rail cost compared to the Base Case resulted in an estimated rail market share of 28.4%.

We have reviewed the DP6 2016 Study and believe this to be a valid basis for estimating rail market share. Whilst rail and road costs are likely to have increased in absolute terms during the period 2014-2019, we do not believe that there has been a significant change in the relative costs of rail transport compared to road transport. The 2016 Study therefore provides a valid basis for estimating rail market share, subject to the wider regulatory and enforcement considerations discussed in table 6 below. **Taking a cautious view, our assumptions on rail market share are Base Case: 15%, High Case 20% Low Case 10%.** This range is lower than that used in the forecast in 2016.

	Intermodal cost relative to road cost:				
	-10.0%	0%	10.0%	20.0%	30.0%
		Base Case			
total market (TEU)	3191	3191	3191	3191	3191
forecast rail TEU	907	695	488	319	203
rail %	28.4%	21.8%	15.3%	10.0%	6.4%

Table 6: Forecast rail container traffic and rail market share under range of cost scenarios
Source: DP6 Rail Demand Study

Note: Forecast TEU for 2016

6. Forecast Economic Assumptions: Summary

See below the estimations for APA Imports containers projections (million TEU/year), more details are found in Appendix D, based on the documents received from the WB (forecast report) the consultant found that projections for APA are very close to the figures in WB master plan, see the graph below

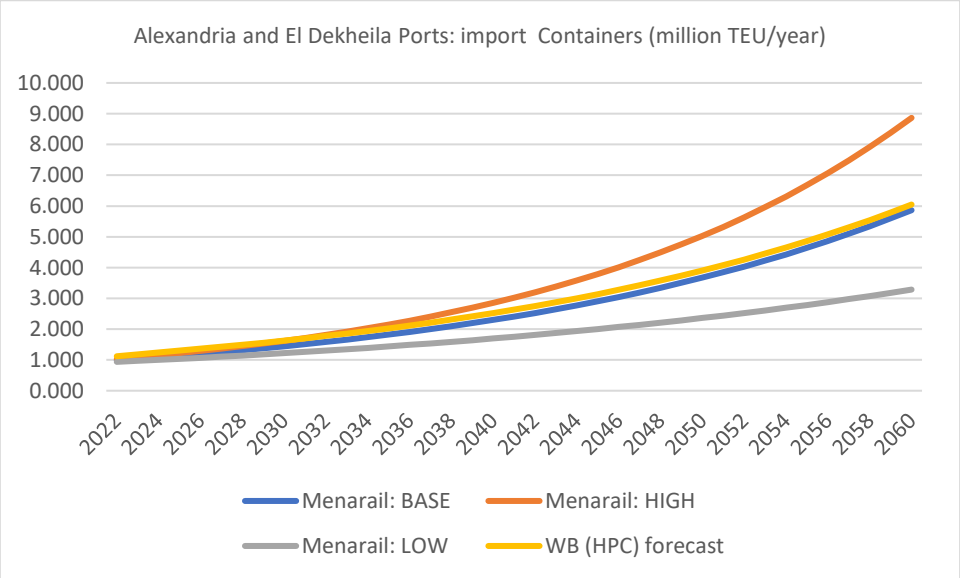


Figure 3: comparison graph for consultant estimations with the Master plan received from WB

The economic forecast assumptions are summarised in Table 7.

item		Base	High	Low
1	GDP growth (% p.a.)	3.4%	4.4%	2.4%
2	import growth elasticity	1.1	1.2	1.0
3	share of APA imports to Cairo and south	60%	70%	50%
4	share by rail	15%	20%	10%

Table 7: Economic Growth and Market Share assumptions in Base, High and Low forecasts
Sources: see above

7. Bulk Rail Traffic forecasts

The Western Cairo Railway ByPass study reports (source Report pp 16-17) bulk commodities transported by ENRA between GPA and 6th of October City in 2015/16 as follows:

- Cereals from GPA to inland silos
- Petroleum products to Upper Egypt
- Clay from aswan to km 48 Bahria Line
- Coal from El Dekheila Port to El Tebien
- Coke from El Tebien to El Dekheila
- Military and ENRA materials

The table below: Planned volumes to be transported by whole ENR network in 2015/16, and actual volumes transported by Etihad line in 2015/16

Commodity	2015/16	2015/16
	Whole ENR network	Etihad line
Cereals	1,200,000	365,000
Petroleum	600,000	78,000
Clay	600,000	64,000
coal	300,000	265,000
coke	540,000	0

Source: Railway network review, data received from ENR

Historic flows, shown in Table 8 below, indicate stable levels of demand for rail movement of molasses and petroleum, declining movements of clay and clinker and fluctuating demand for movements of coal and grains.

The volume of coke transported increased dramatically between 2016/17 and 2017/18. There is only one client for movement of coal and coke, the Government sector El Nasr company.

This company orders the transport of coal from El Dekheila to Tebien, where it is converted to coke for iron and steel production. Surplus volume is exported. According to the ENR Marketing Team, this process has been losing money and it is therefore difficult to say whether these volumes will be sustained in the future.

Reasons why there are no private company clients seeking to move coal or coke include:

1. The Egyptian Ministry of Environment applies specific requirements for transporting coal, coke, or any similar products. These requirements are very costly. As a consequence, rail finds it difficult to compete with road transport.
2. Other steel companies do not use coke for steel production
3. This type of coke is not used for electricity generation

Based on this examination of the data and discussions with ENR, we have taken a prudent view that demand for rail movement of these bulk commodities will remain stable at the average levels over the 2013/14- 2017/2018 in the future, as shown in the following table

Table 8: Bulk rail freight flows ('000 tonnes per year) for Etihad line in the last 5 years

Bulk:	2013/14	2014/15	2015/16	2016/17	2017/18	average
Molasses	40	41	43	33	37	39
Petroleum	73	70	78	68	75	73
clay	118	87	64	83	60	82
coal	401	383	265	354	438	368
coke		10	0	28	153	38
grains	132	287	365	315	294	279
clinker	12	0	0	0	0	2
Total	**776**	**878**	**815**	**881**	**1057**	**881**

Table 8: ENR freight flows '000tonnes/year in Etihad line
Source: ENR

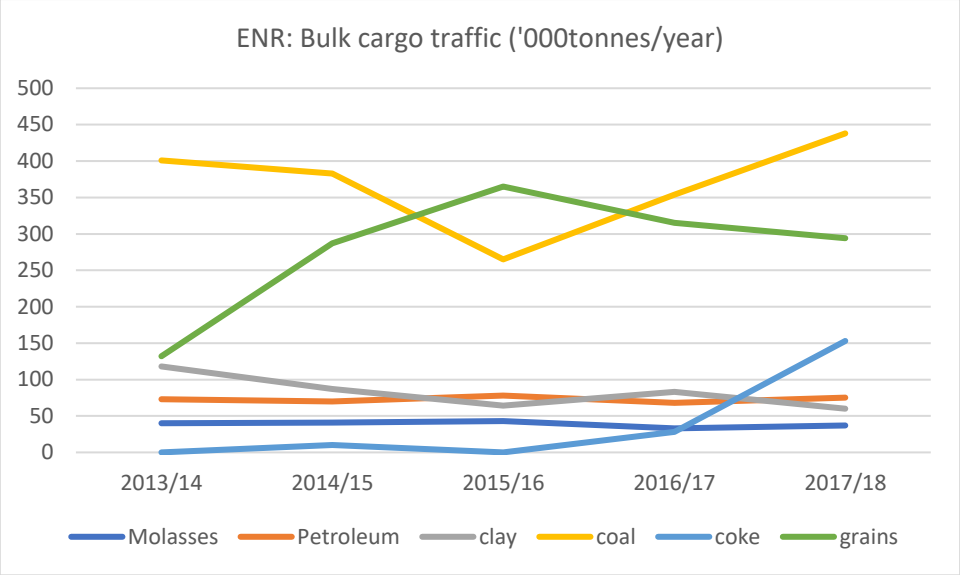
The Table 9 below shows the Change in Traffic : 2013/14-2017/18 and the expected growth in the future.

Table 9: Assumptions input to Bulk rail freight forecasts

Commodity	2017/18:2013/14	Change	forecast
Molasses	0.93	constant or fall	remain at average 2013/14- 2017/18 level
Petroleum	1.03	constant or fall	remain at average 2013/14- 2017/18 level
clay	0.51	fall	remain at average 2013/14- 2017/18 level
coal	1.09	2.2% growth p.a.	remain at average 2013/14- 2017/18 level
coke	15.3	-	N.A- remain at average 2013/14- 2017/18 level
grains	2.23	substantial growth11	remain at average 2013/14- 2017/18 level

Table 9: Change in Traffic : 2013/14-2017/18
Source: consultant calculations

[11] According to International Rail Journal (IRJ) June 2019, ENR is targeting 4.5 million tonnes agriculture products after upgrading the infrastructure



Traffic Forecasts

6. Based on the assumptions set out above, the resultant range of traffic forecasts (trains per day in each direction) is shown in figure 4 and summarised in table 10. Based on the train capacity assumptions set out in Appendix A, forecasts for the assumed opening year of 2022 range from 6 to 10 trains per day, increasing to a range of between 6 and 14 trains per day by 2030. These forecasts are unconstrained by any limits to capacity which are likely to apply, especially in the high traffic case, when demand exceeds of the order of 1 train/hour in each direction.

Caveat to forecasts: Required regulatory environment

7. These forecasts suggest that there could be between 3 and 7 container trains/day in each direction in the opening year. Based on international experience, the distance (near 300 km) from GPA to 6th October dry port is sufficient to suggest that a block train container service can be financially viable – but it is important to note that this financial viability is marginal (a longer distance would improve the relative competitive ness of rail). A strong supportive regulatory environment will be essential if ANY (low, Base or high) of these forecasts are to be realised. This supportive environment is likely, as a minimum, to consistent of:

- Service provision by experienced rail freight operator(s)
- Measures to ensure a level playing field for competition between road and rail container freight including enforcement of appropriate safety and security standards applicable on both transport modes
- Suitable rail freight path timetabling to ensure timely turnaround of wagons and locomotives
- Potential short-term subsidy in early months of container services whilst container volumes are built up to enable regular services (clock face, suitably spaced, departures throughout the day, coinciding with ship arrivals) with acceptable levels of productivity (containers per train).

Without these measures even the low traffic forecasts may not be realised.

	2022[1]	2025	2030	2040	2050	2060
Total trains/day - Base	8	8	10	13	19	28
Total trains/day - High	10	12	14	22	37	62
Total trains/day - Low	6	6	6	7	9	11

Table 10: Traffic Forecasts: selected years: Summary (trains/day in each direction)
Source: consultant calculations, Appendix D

[1] assumed opening year.

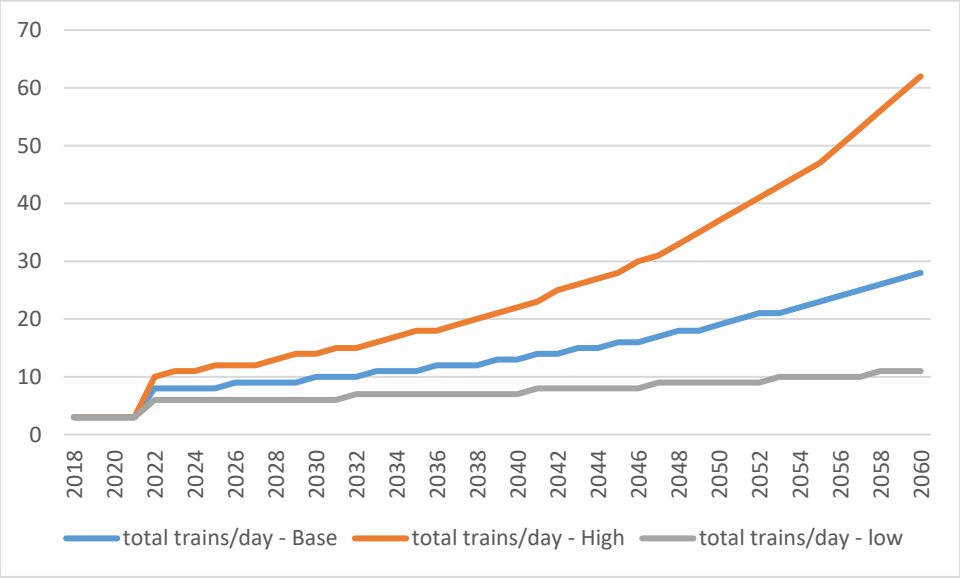


Figure 4-base, high, low forecasts: total trains/day in each direction
Source: consultant estimation

Modal Split

Rail freight already competes well with road for high volume goods flows which can move between one rail terminal and another. Consequently, rail has a virtual monopoly of moving coal and coke and a significant proportion of the grain haulage market.

DP6 will be established to open a new market for rail freight, namely the movement of containers from the Port of Alexandria into the Cairo conurbation. This very large market is currently 100% served by road.

To enable modal transfer rail will have to offer an attractive service proposition based on end to end journey time and service reliability at a cost which is no greater than the cost of road transport. Road transport can offer a 5-hour delivery time which rail will be unable to achieve but rail may still have a 'good enough' time proposition and offer some advantages for customs clearance and the opportunity for intermediate warehousing at DP6.

The consultant has conducted interviews with 2 freight forwards company, AAA international, AGILITY Egypt for shipping and freight, and Egy Trans company to discuss their needs & priorities and the problems they face in the road transport. Interviews with them identify the strength of appetite for "trunk" container train movement between GPA and DP6 – where containers would be opened for processing or re-packaging of products or de-consolidation for onward road movement to final consumers.

Interview Results suggested that the markets are looking for an improved service in terms of (i) predictable costs (ii) 24/7 operations ;(iii) higher legal weight limits/container and (iv) improved journey time reliability. Table 11 shows how rail can provide a superior service to road on these criteria.

Table 11, Opportunities for rail to offer a superior service, mitigating negative or undesirable aspects of road service offer.

Service requirement	Road offer	Rail offer/risk mitigation
Predictable costs	City gate fees can change suddenly. Sudden increase in the truck scale fees from 250 to 700 EGP per TEU	Rail can offer longer term contracts, with duration one year or longer
	Changing fuel prices	Rail cost/tariff can be all inclusive with option of index link to fuel prices Fuel cost is only approximately 15% of the rail haulage cost whereas for road it is likely to be nearer 30-40% There is, therefore, less exposure to changing fuel prices.

Availability	Seasonal bulk goods, there is a huge demand for transporting specific type of good in specific period in the year for example there is a great demand on wheat transportation starting from April till July. This causes shortage in the trucks availability for transporting other types of goods (petroleum products/clay/Agricultural crops	
24 hours working	Truck companies may be restricted by working hour bans – forcing additional congestion during permissible hours	ENR is entitled to operate 24/7.
Vehicle weight restrictions	New regulation in (2019) truck regulation limits trucks with gross vehicle weight greater than FIVE tonnes	Gross weights per container will be within limit of permissible load carried by rail wagons.
	Unpredictable penalties may be applied to overloaded trucks by military and road authorities (GARBLT).	Rail cost may appear higher than road cost but no "hidden" penalties.
Journey time reliability (JTR)	JTR is highly valued – road time may seem faster than rail time but is less reliable	After initial "running in" period, rail can perform better than road on JTR especially if freight not mixed (or limited mixing) with passenger services. Rail times should be more under control of ENR than road times which depend on road traffic congestion. Thus, freight trains more likely to arrive 'on-time' than road
Terminal handling charges		Terminal handling charges (THC) are included in the shipment charges for both rail &road in the majority of the ports, but some other terminals like Hutchison Port Holdings (HPH) which is inside APA applies lifting & handling fees which is around 400 EGP/TEU for rail. If these charges appear to discriminate against rail, this activity should

		be reviewed by the appropriate authorities, in the short term these will be additional costs to rail.
Safety		Rail can offer a high level of security and protection of goods from damages, vandalism, and thefts
Custom clearance	Customs clearance procedures are the same for both road and rail transport	

Table 11: opportunities for rail to offer an superior service
Source: interviews with freight forwards companies

The strength of appetite for a new rail container service will vary according to the movement required (GPA to final destination) and commodity in question. Higher value commodities such as foodstuffs and Fast-Moving Consumer Goods (FMCG) moving to retail or wholesale outlets are likely to continue to move by road. Rail will be more suited to moving lower value less time sensitive[12] commodities. Examples may include semi-finished components for final assembly, automotive spares, steel and aluminium products and construction materials. Thus, supply chains which fit with this processing profile should be identified. Chains which do not include this intermediate step are likely to continue to prefer door-to-door movements from GPA to final destinations by road.

Intermediate products for assembly or distribution (from warehouses or factories in DP6) into finished goods may be particularly suitable for containerised trunk haul by rail.

Key to success in this area will be achieving a 12 hour 'each way' journey time (including time for train loading/unloading). This will enable the railway to offer a 'same day' delivery offering and enable an 'out and back' journey to achieve very efficient resource utilisation and therefore lower cost.

<u>To allow shifting from road to rail transport, operator should offer the following:</u>

- Offer full package service.
- Cost should include door to door service and can still be 15% less than Trucking
- Offer different wagons suitable for different Categories of commodities.

The below section for the rail tariff shows that rail can offer an attractive haulage cost, although 'final mile' road haulage costs need to be added to these numbers. If an attractive cost proposition at or slightly below road haulage can be achieved, then comparison with more mature European markets shows than a movement towards 15% modal share can be achieved.

[12] It is to be noted that the rail service will be a few hours slower than road, so that the time sensitivity of good is relevant only across this narrow time difference.

Summary

Analysis of the rail freight market shows that rail competes well with road when full, heavy trains can operate over a medium distance route, which the 300km journey from Alex Port to DP6 represents. The movement of containers by rail is an established traffic on the Egyptian railway but at a very low level, with only one train running a day on average.

If an attractive customer service proposition and price can be developed, then running 6 full container trains a day would deliver around 19% market share.

There is the possible opportunity for the non-containerised rail movement of goods into the DP6 area if appropriate terminals were constructed. These could include cement and petroleum products for local consumption. The export of waste is another potential underdeveloped market. For example, in many industrial markets the export of scrap steel in 20ft containers is a well-established flow.

Rail tariff

Structure of the tariff

The end customer is only interested in the delivered cost of a TEU, rather than the cost of running a train service. For containers delivered by train to the Greater Cairo area through DP6 these costs include:

- Costs for unloading off the ship, transporting to the train within the Port, and then loading onto the train (for import containers, the reverse process for export)
- Cost of the train journey
- Unloading/loading costs at DP6
- Potential storage costs at either the Port or DP6 to meet customer's delivery requirements or ship sailing schedules (known as container demurrage, usually a chargeable service offered to Clients)
- 'Final mile' road delivery to the Customer's premises (for import, 'first mile' collection for export traffic)

This list demonstrates that the train cost is only part of the end to end delivery cost by rail. By comparison, road transport has a simpler cost structure without the need for an intermediate load/unload at DP6 or a first mile/final mile delivery cost.

There are therefore two options to offering a rail tariff; an 'all in' price to include all of these cost elements and a 'train only' price (which would usually include the Port loading and unloading costs at either end) where the customer arranges for final mile road delivery. Customer may well prefer a simple 'all in' tariff when total delivery responsibility sits with the delivery party. This could be ENR, the PSP or a Third-Party Logistics (3PL) company operating on their behalf.

The use of a 3PL is a commercial decision for ENR and the customers. They bring experience in managing total supply chains and local road haulier networks and may be willing to take some commercial risk. For this they will require a fee and may be operating competing road services.

Future rail tariffs

It is not possible for us to accurately predict the 'all-in' future haulage cost as the future lift costs at DP6 are not set. A key factor here is how the capital costs of the new facility are recovered. We do not know:

- If capital costs are going to be recovered through the lift charges
- The extent of capital costs to be recovered, eg 'just' the rail terminal or also connecting road infrastructure
- The period over which capital recovery is planned
- The capital financing costs to be recovered through the lift charges

Our estimation of this cost is given below.

	Cost ($)	Comment
GPA lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Train cost	94	As cost in Appendix 2 cost model plus 10% margin
DP6 lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Final mile delivery cost	63	Road cost, return journey (1000 GBP)
	257	equals 4,100 EGP @16 EGP to the dollar

Figure 5– 'end to end' rail tariff
Source: consultant analysis, see details in Annex C

We are advised by AAA international that the lift charge at the Hutchinson Port is $25/TEU and so we have used this figure both for the Port lift costs and (in the absence of any other data) the lift cost at DP6. This charge represents the cost of moving the container from the ship onto the train, or off the train and on to a road trailer for the 'final mile' delivery.

This cost is for a 'TEU', ie a 20ft container, and the train cost model assumed that a 40ft container will be charged at twice that rate. However, for road traffic a 40ft container can be carried on the same trailer as a 20ft and use the same driver and tractor unit, which just a marginal increase of fuel costs. So, haulage costs for 40ft containers can be no more than 25% more than the cost of 20ft containers.

The cost model therefore needs to be reworked to reflect this market reality. Rather than carry 40TEU it is better to consider that the train carries 16No 40ft containers at a 1.25 TEU cost and 8No 20ft containers at a 1.00 TEU cost.

The number of TEU cost units is therefore 16 x 1.25 plus 8 x 1.0, ie 28 TEU cost units. This also reflects the imbalance in the market with a 2:1 ratio of 40ft to 20ft containers being moved.

The cost per TEU increases from $86 to $183, as shown below. Note, for clarity a 20ft container is charged at $183 and a 40 ft container at $289 (ie $183 x 1.25).

Unit cost per TEU load unit			
TEU load unit/train (40ft = 1.25 TEUload u	28		16 40ft containers (@1.25TEU) and 8 20ft containers (2:1 ratio of 40ft:20ft)
Train fill	90%		
Cost TEU		**183.99**	Note - this is a 'return journey' cost

Figure 6 modified train cost based on restricted cost recovery for 40ft containers

Adding a 10% margin the reworked train tariff is now:

	Cost ($)	Comment
GPA lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Train cost	202	As cost in Appendix 2 cost model plus 10% margin
DP6 lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Final mile delivery cost	63	Road cost, return journey (1000 GBP)
	365	

Figure 7 revised 'end to end' rail tariff
Source: consultant analysis

Risk in the Rail Tariff

There are two key risks within the rail tariff model which should be recognised.

1/. Train fill

The model assumes each train will be 90% full. Achieving full train fill can be challenging as it requires 60 suitable TEU to be available for every journey. However, ships do not arrive evenly at Ports and customer orders can be received in batches as well. Demand can also be seasonal for a number of reasons, including fluctuating retail demand and the production of agricultural products.

However, a train fill of 90% is conservative by industry standards. The demand model shows a very strong demand for import containers so there is a revenue opportunity if the train fill is improved.

2/. There are 250 trains per year, each train capable of carrying 50 TEU on 20 wagons. This requires the pro-active maintenance of wagons and locomotive to ensure that there are no train failures and each train has the full complement of wagons. This requirement is also an opportunity, as any increase in the number of wagons hauled decreases the unit cost. It may also be possible to run the train set 6 or 7 days a week.

Market Share

Several factors will govern how the market share of rail develops over the next 30 years. These include:

1. Constraints on rail growth

Future rail growth and improved rail market share will require more trains to be run. Certain sections of the route, particularly on the El-Manashy line and within the GPA Port estate, may not be able to accommodate additional rail traffic without significant additional capital investment. This may therefore constrain rail growth.

Running additional services will also require the provision of additional locomotives and wagons by ENR.

2. Charges in fuel pricing

The cost model shows that fuel accounts for 15% of the direct cost of rail movements and it accounts for around 30-40% of road movements. Any future increases in fuel price will therefore competitively dis-advantage road users as fuel costs are a higher proportion of their total cost base.

3. Improved highway connections

At the heart of the competitive dynamic between road and rail in the ability to meet customer's expectations. If road connections improve and consequently the end to end journey time by road decreases, then Clients can reasonably expect swifter delivery. The rail offering may then be seen as too 'slow' and uncompetitive. Changes could be made to the rail network to improve this offering, such as the doubling of lines and the installation of modern signalling, which would enable a significant reduction in the currently planned end to end journey time.

As per Egy trans research report dated March 2019, The National Road Project (10 roads) 900 km at a cost of LE 12.8 billion. The most important of these roads are the development of the Alexandria Desert road.

4. Changes in the cost model.

The rail cost model contains several assumptions which may change over time. These include;

- The unit cost of infrastructure maintenance. This cost of maintenance could increase as more trains run (but not necessarily the unit maintenance cost per train) or decrease as maintenance become more efficient and more track friendly bogies introduced.
- The sharing of maintenance cost with the passenger services over the line could change as more or less passenger services are run
- Changes in the unit cost of capital depreciation for locomotives and wagons as new more expensive equipment is introduced and inflation reduces the real cost of older assets
- The level of ENR overhead assigned to the freight services

Consequently, there is both risk and opportunity within the rail cost model which could change the unit cost of delivery.

Section III-Overview of the Existing Infrastructure & Facilities

Introduction

The designated route from the GPA to the planned site for the 6th October dry port can be broken into four sections of rail infrastructure, as shown below.

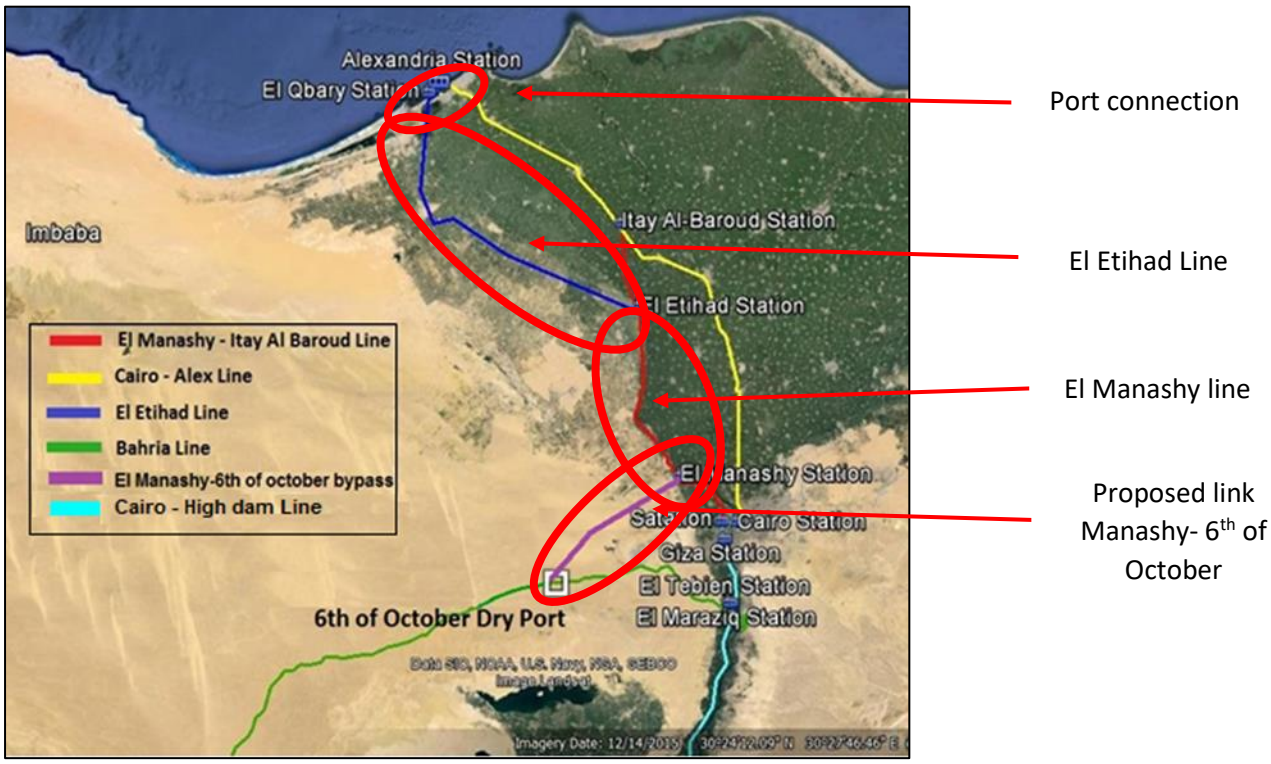


Figure 8– Designated rail connections.

In the northern section trains exit the Alexandria ports and travel on the Qabary - Matrouh coastal passenger and freight line for 17 km before joining the El-Etihad line at Tafaroa' station. This line is a freight only line which travels 122 km south before it meets the El-Manashy line at El Etihad station.

The El-Manashy line is a 99km mixed use line (ie passenger and freight) which runs parallel to the principal Cairo – Alexandria rail corridor. At El-Manashy station a new link will connect the El-Manashy line to the site of the 6th October Dry port through a new western bypass of Cairo.

This 'baseline' report will comment on the three areas of existing infrastructure, ie the Port Connection, the El-Etihad line and El Manashy line.

Port Connection

This infrastructure connects the Alexandria and Dekheila ports to the El Etihad line and is shown schematically below.

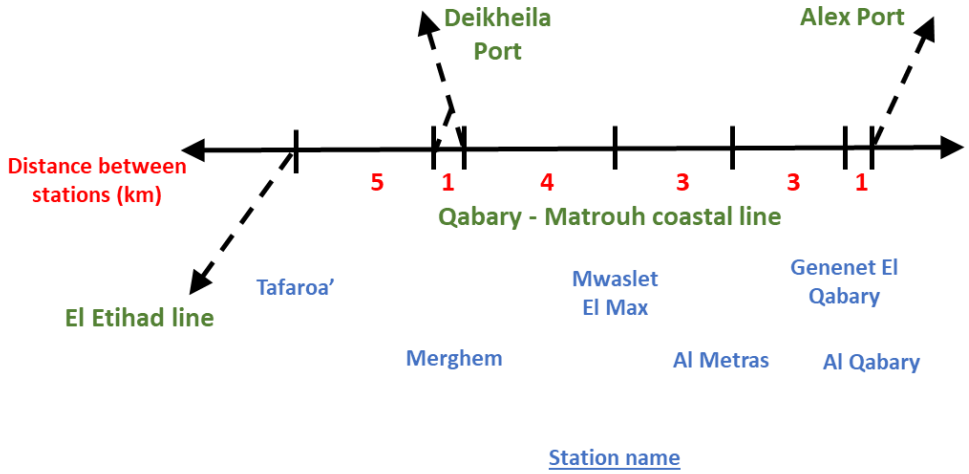


Figure 9 – schematic of the northern rail connections
Source prepared by the consultant

The schematic shows how the two port complexes in Alexandria are accessed by short rail connections from the Qabary – Matrouh coastal railway. Trains from the Port of Alexandria join the coastal railway and run 17km west through four intermediate stations to join the El-Etihad branch at Tafaroa' station.

The railway network review undertaken for the EBRD in May 2016 confirms that the rail link into Alexandria port is in operation and benefits from a 1000m long siding and two other operational tracks. Container traffic is currently not moving from Dekheila port by rail as the Port uses the rail area as a stacking area and all movements are by road.

The El-Etihad line

ENR reports that this line is 122 km long with nine intermediate stations between its connection to the El Manashy line at El-Etihad station and the connection to the coastal railway at Tarafoa' station. The route is shown schematically below.

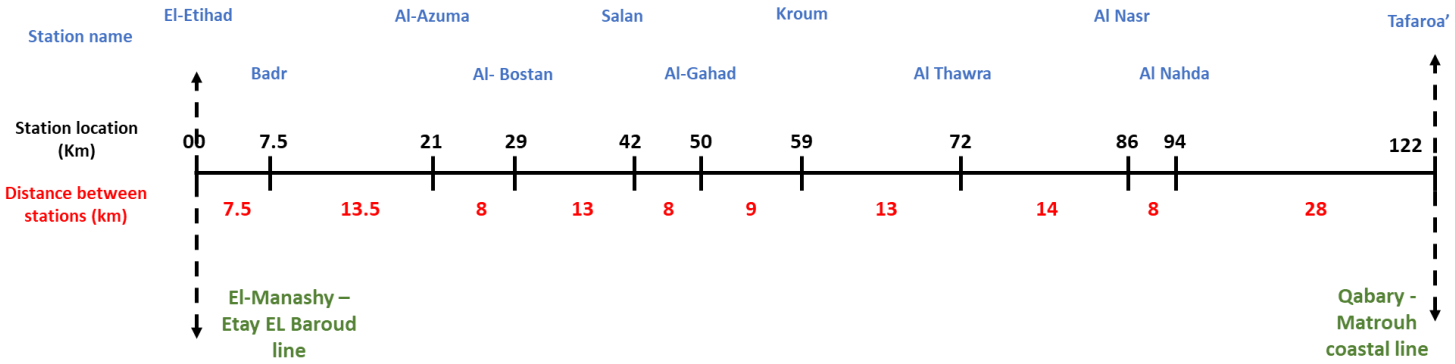


Figure 10– El-Etihad line

The route is single track with passing loops at every station. The stations are generally 8 to 13km apart except for the section between Al Nahda and Tafaroa' stations where the distance is 28km.

The picture below shows the connection into the El-Etihad line from the El Manashy line at the south end of El-Etihad line by El-Etihad station. The photograph is shown looking north from the El-Manashy line with the El-Etihad line branching off to the left in the distance.

Figure 11– Connection into El-Etihad line
Source: site visit

This photograph shows a typical cross section on the line which although only single tracked is in most places is sufficiently wide to accommodate a second track if required in the future. The section in the photograph has two lines to enable trains from either the El Etihad branch or the continuing El-Manashy line to run into Etihad station loop which is immediately 'behind' this photograph.

We are advised that the line speed is 50 km/hr which we were unable to validate on our site visit.

The El-Manashy - Etay El Baroud line

ENR reports that this line is 99km long with twenty intermediate stations and is shown schematically below.

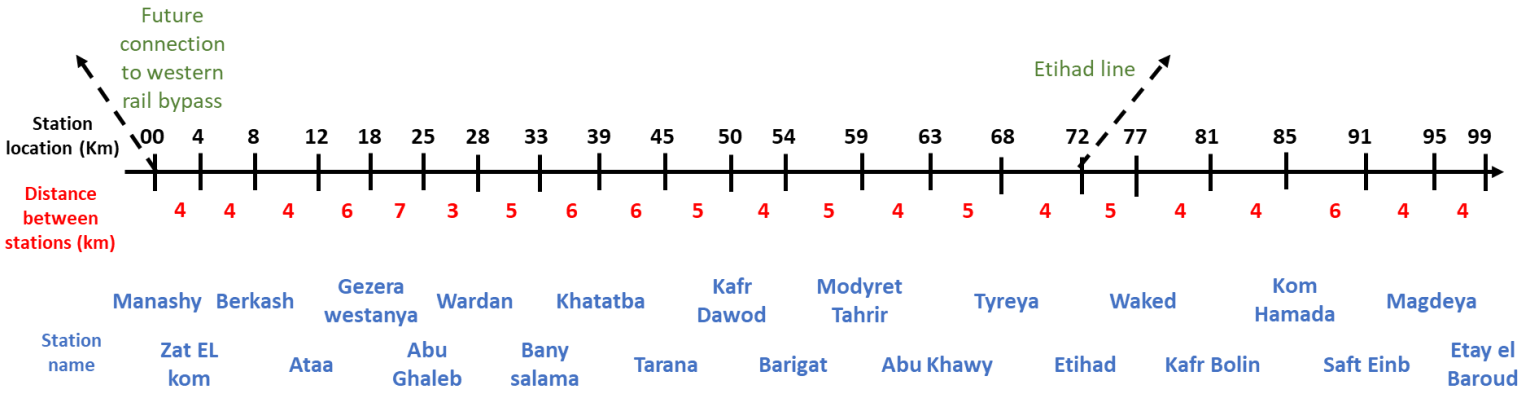


Figure 12 – El-Manashy line
Source: ENR time table

The connection to the El-Etihad line is just north of Etihad station. The new connection to the Cairo Western bypass scheme is planned to be made at Ataa station and so trains will run around 72km along this line.

This line is very different in layout to the El-Etihad line as it has numerous stations generally only around 5km apart, with the longest track section being only 7km. The infrastructure on the El-Manashy line is very similar to the infrastructure on the El-Etihad line, i.e. single track with every station forming a passing loop.

We are advised that all station loops are at least 650m long and that the line speed is 70 km/hr.

Train Control

During the site visit on the Etihad line it was noticed that the signalling system is based on the manual exchange of a 'token' (sometimes called the 'Permission') to staff at each station. Trains stop at each station where they are exchanged with the station staff to get 'permission' to enter the next section of track. One such token is shown below.

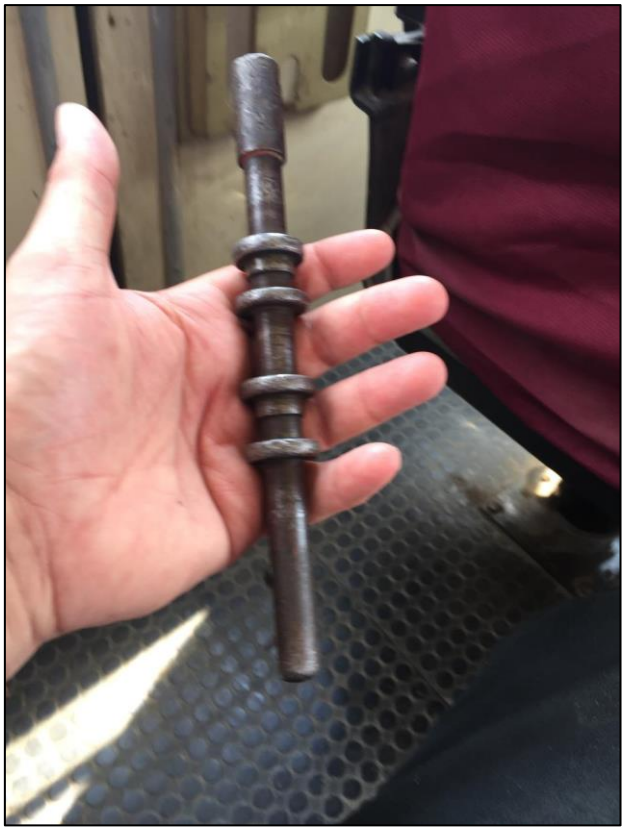


Figure 13 – permissive 'token'
Source: site visit

The movement of a train from one station to the next is confirmed by the station staff using the equipment shown below.

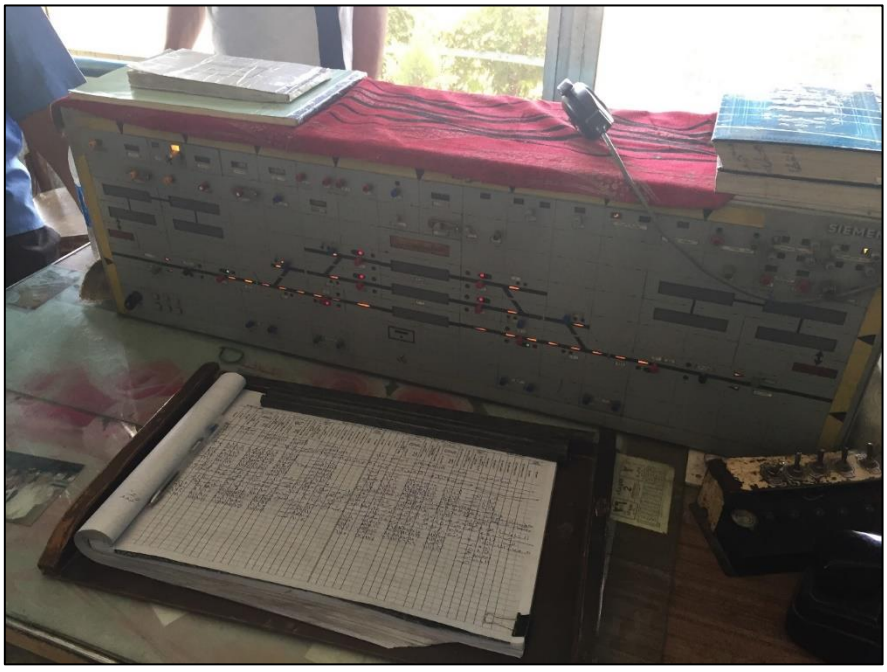


Figure 14 – train control equipment at Ataa station
Source: Site visit

The control panel shows the track circuits within the station and any train occupation. There is no signalling 'through connection' to the next station and so departure of a train to the next station is

confirmed to the next station using the buttons shown in the bottom right of the photograph. This sends an audible warning to the next station.

There is no working telephone connection between adjacent stations or any centralised signalling control. Trains move from one station to the next, stopping at each station (including freight trains) to give back a token to release the line behind it and to receive a token for the next section of line.

Each station and some level crossings have local signal control through a local departure and arrival signal, controlled by the station staff, see below.

Figure 15 – station departure signal
Source: site visit

We are advised by ENR that all station loops on both lines are at least 650m long and this is consistent with the infrastructure we observed on our site visits.

Numerous unsignalled level crossings are in use, which are often quite informal as local people cross the unfenced railway to go about their daily business.

The El-Manashy line is reported by ENR as having an electronic signalling system.

Depots and other Facilities

The following depots and other facilities are available on or near the line of route:

- Gabl Zaton depot for wagons near Qabary Station
- Hadra Depot for Locos at Alexandria station area
- Tebein depot for locos on Baharia line, near Maraziq station

Overview of Current Operations

Current Service Pattern

This El-Etihad line is a freight only line. We had been advised that the line sees 4 four freight train each way movements a day and this was confirmed on our site visit.

The El-Manashy line also has a passenger service which does not appear to have a published timetable. The Ppicture below shows the timetable displayed in the station office at Ataa station.

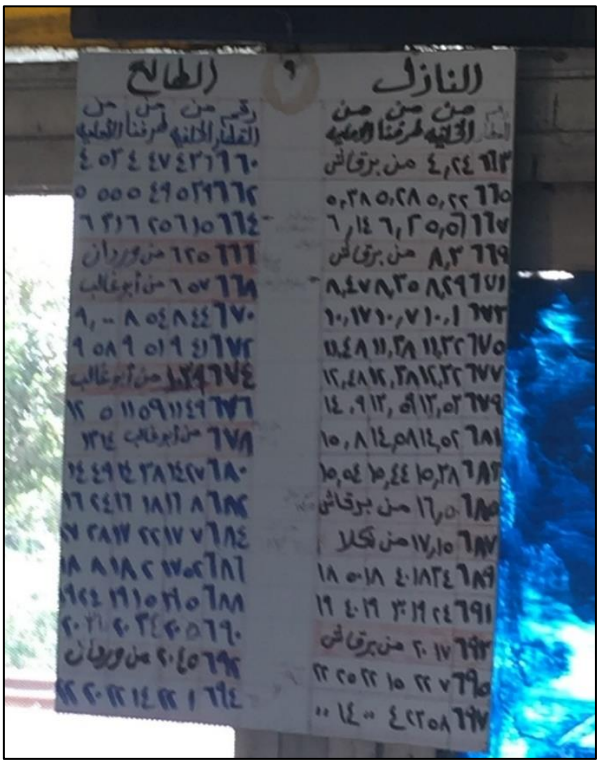


Figure 16 – Timetable at Ataa station
Source: Site visit

The picture with the table above has an indication for:

- The number of trains in the Up & Down direction which are 18 trains per day
- The time of their arrival and their departure in the up & down direction where:

In the up direction: the trains arrive to the Atta station from the previous station in 11 mins and leave Atta station and arrive to the next station in 8 mins.

In the down direction: the trains arrive to the Atta station from the previous station in 6 mins and leave Atta station and arrive to the next station in 10 mins

Figure 16 shows that there are 18 scheduled services in each direction every day. The station staff informed us that around 4 each way freight services also run each day.

Line Capacity

El-Etihad line

The limiting factor for line capacity is that only one train can be within a section of track at any time, as the track is single track. The capacity of the line is therefore limited to the time it takes to get a train through the longest section of track.

On the El-Etihad line Figure shows that this is 28km between Al Nahda and Tafaroa' stations. The train have stop at each section to exchange the permissive token and the maximum line speed is 50km/hr. If the train were able to travel 'non-stop' through the 28km Al Nadha – Tafaroa' section at 50 km/hr the journey would take 34 minutes. Allowing sometime for acceleration and deceleration at the station we consider that 45 minutes is a more reasonable time to travel through this track section.

As per Table 4 in the railway network review study - DP6 studies and the data provided from ENR, the line capacity is 32 trains per day, ie 16 in each direction.

There is no passenger service on this line and only 4 return freight movements (8 journeys) so there is capacity for another 24 each way freight journeys to be made (12 return trains).

El – Manashy line

On this line the stations are much closer together, with the longest track section between stations being 7km. Although the stated maximum line speed by ENR and DP6 studies is 100 km/hr, trains will never reach this speed and we assume that the usual average speed through the 7 km longest section is 50 km/hr.

As per Table 4 in the railway network review report, and the data provided from ENR, the line capacity is 74 trains per day.

With the current 36 passenger train movements a day there is route capacity for 36 freight trains (18 return journeys) a day, of which 4 are currently being used.

Journey Time

ENR have provided us with the timings for the freight trains on the El-Etihad line. We have used these to produce the train graph show below. This shows the path of each train as it completes a journey up or down the chart. Southbound trains are shown in black, travelling from Al-Qabary at GPA in the north to Al-Etihad station in the south. Northbound trains are shown in green.

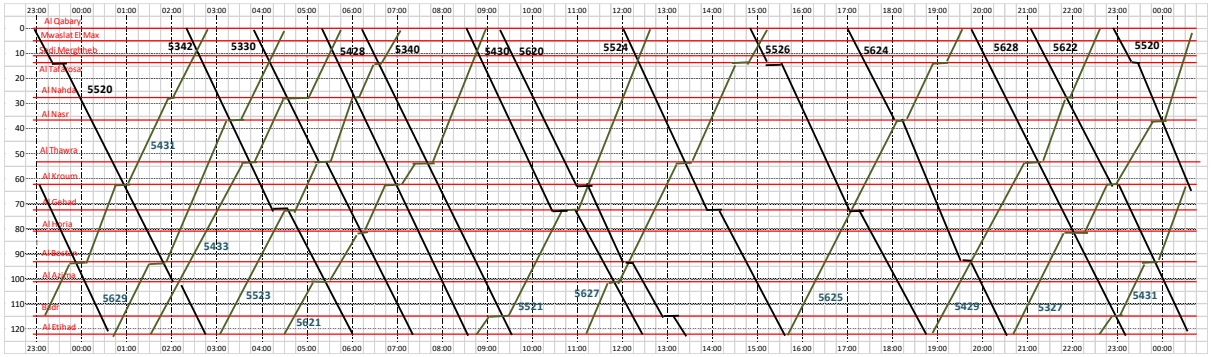


Figure 17– time/distance train graph of existing available freight train paths on the El-Etihad line
Source: consultant analysis

This figure is shown in greater detail in Appendix B.

These train paths are provided for, and suitable for us by, all types of rail freight, including the iron ore trains which currently use the line. The average speed across the network is only around 30 km/hr and this is achievable for all types of train. The only constraint on train length is the length of the passing loops at the station locations and we are informed by ENR that these are 650 m, which is suitable for all trains we envisage using the route. It should be noted that container trains are usually the longest as their wagons are longest (~20.5m for a container wagon, ~15m for an iron ore wagon). This increased length reflects the lower density of the material they carry.

Conclusions

- There are twelve timetabled paths in each direction
- Journey times for the 120km journey vary between 3 and 4 hours. There are three 'non-stop' southbound trains which are planned to do the journey in just over 3 hours.
- 10 of the 12 intermediate stations on the route are used as passing locations, giving a high level of flexibility.
- There is no regularity in the timetable within the day, such as standardised departures at the same time every xx minutes after the hour, or every second hour. This could well be because of timetable dependencies on other sections of the network beyond this section of line.
- Some trains depart within an hour of the preceding trains, but there are 6 gaps of over 2 hours at other times, indicating additional capacity could possibly be generated

Journey time down the Manashy line from Etihad to Manashy station takes around 1.5 hours to cover the 72km at the average speed of 50 km/hr.

Costs

Appendix C includes a detailed 'bottom up' cost model for the planned freight service.

It is based on a number of assumptions based on the international experience, the key ones being:

- Services are able to go 'out and back' in a day
- Fuel price at $0.4/litre
- 60 TEU capacity on the train and average 90% train fill achieved
- Infrastructure maintenance costs at $10,267/km/yr
- Management overhead at 25% and the operating margin for the haulier is 10%
- 8 trains a day (base scenario in 2022), operating for 286 days a year (52wks/year, 5.5 days/week)
- Infrastructure costs are shared with other train services which also use the lines on which the freight trains run

The cost model works by looking at the cost of providing an 8 train a day service with an appropriate manpower roster. Locomotive and wagons are fully depreciated over a 30-year period and their maintenance costs are also included.

Based on these cost assumptions the cost model gives a 'return journey' train haulage cost per TEU of $86, assuming the train fill is 90%.

To this has to be added the lift charges both at the Port and DP6 and the final mile truck haulage into Cairo. When these are added the full train haulage price is $257, as shown below.

	Cost ($)	Comment
GPA lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Train cost	94	As cost in Appendix 2 cost model plus 10% margin
DP6 lift cost	50	Return journey costs, 2 lifts @$25/lift (400 EGP)
Final mile delivery cost	63	Road cost, return journey (1000 GBP)
	257	equals 4,100 EGP @16 EGP to the dollar

Source: consultant analysis, see appendix C

Source: consultant analysis

As per our own market review and the interviews conducted with the freight forwards, we found that the appropriate cost for a TEU by truck is around 250 USD for round trip

. Our analysis shows that the rail haulage price is broadly similar, and possibly slightly higher, than this road price.

It should be noted that the actual train haulage price is only 37% of the total haulage price ($94 out of $257) and that the lift prices are not set yet for DP6, and only levied at the Hutchinson Port in APA.

Section IV PSP Option Selection

Introduction

Common PSP models are shown in Table 12. The focus of this task is to identify barriers to Private Sector Participation in the freight railway.

Model type	Definition
DBO/DBOT/DBFO	Private sector specifies detailed asset design and constructs. It may organise finance. It may transfer back to public ownership after construction. Typically, a different private company may operate.
BTO/BOT	Public sector retains ownership. This may happen through transfer at the end of the construction period (BTO) or at the end of an operation and maintenance contract (BOT).
BOO	Private retains ownership of the asset.
Concessions	**Concessions** are PPPs where users pay for the use of an asset. User charges reimburse the concessionaire for the costs incurred which may include construction, operation and maintenance. The asset reverts back to public ownership at the end of the concession period.

Table 12: Models of Private Sector Participation (PSP)[13]

A PSP or Public Private Partnership (PPP) arrangement is a legally enforceable contract. It is likely to involve:

- A long-term partnership (with exception of BTO), recognising whole life costs
- Risk allocation – with each risk allocated to the party best qualified to manage it
- Performance-based specification, incentivising efficiency
- Clear payment mechanisms, defining how the private sector is paid, usually related to performance.

1. Key factors to consider

In the operation of railways key factors to consider will include:

- The existence of well proven PPP law
- The institutional status quo – especially whether Railway infrastructure and operational assets (rolling stock) are separated
- The opportunity for physical separation of some parts of the Railway, such as spur lines that could be demarcated for PSP financing as physical separation will facilitate cost allocation;
- Potential for creation of a PPP enabling environment (see Box A below)

[13] PSP is used interchangeably here with Public Private Partnership (PPP)

Box A : Features of a PPP enabling environment

The Asian Development Bank draws on many years' experience to set out processes that can create the foundations for successful PPPs. Key points to consider are:

I. "PPP is one tool available to decision makers in reforming infrastructure or service delivery. It is most effective when it is accompanied by other sector reform activities to underpin and reinforce the PPP and support sustainable improvement. A successful PPP is designed with careful attention to the context or enabling environment within which the partnership will be implemented. Thus, in designing a PPP process and selecting a form of PPP, it is important to consider the reform objectives, policy environment, the legal regulatory and institutional frameworks, financing requirements and resources of the sector and the political constraints and stakeholder concerns;

II. Specifically, the sector diagnostic will include:
   - Technical issues
   - Legal, regulatory and policy frameworks,
   - Institutional and capacity status
   - Commercial, financial and economic issues"

It will be in the context of these factors that the scale of barriers to PSP in the freight Railway will be assessed.

2. Gross Cost or Net cost compensation model?

A key strategic consideration for the Managing (contracting) authority will be to determine the optimal contractual basis, from a National viewpoint, under which rail freight operations would be procured. At the core of this strategic decision will be the preferred allocation of risk to private sector operators:

- Higher risk will mean, to excite appetite, higher reward must be on offer
- Lower risk, perhaps through gross cost payments (to operators) or availability fee payments (to infrastructure providers) will mean lower risk owned by private partners but potential for financial cost/low profitability will fall on the State.

3. Checklist of questions required for consideration of potential for PSP in rail freight operations

At a more detailed level, a check list of questions to be addressed to assess potential for private sector involvement in rail freight operations might be as follows:

a) `Develop ranges of 30-year freight traffic forecasts
b) Determine cost "explanatory" variables:
   - Freight vehicle axle loads
   - Freight train track occupancy (hours per year)
   - Freight train length (m)
   - Passenger train track occupancy (hours per year) (on shared track)
   - Freight train value of commodity carried * tonnes per annum
   - Other explanatory variables
c) Develop cost allocation model for recent year

d) Estimate 30-year whole life rail infrastructure costs based on anticipated changes in overhead and traffic related costs
e) Advise on any regulations (for example axle load limits, train length limits) that might be introduced to manage future costs
f) Develop schedules of charges related to (i) standing costs: annual licence granting track access and (ii) usage costs: related to infrastructure use. *The private sector will seek a strong indication of the level of track access charge it will be expected to pay.*

5. Scoring

Scoring against these questions will determine the costs of movement by rail and, taking account of (i) comparative costs by road and (ii) value of commodities to be transported, will provide answers to assess potential for financially feasible rail freight operations.

Government choice as regards the degree of risk transfer will involve a complex set of issues especially where commodities to be carried may be assets of national importance and/or where rail freight charges may be regulated.

In broad terms, the following features will support a positive case for private sector involvement:

- A robust traffic forecast (high in terms of annual volume, or distance in excess of 200km)
- Higher value product
- High costs by road transport (product not suited, in large volume) for truck movement
- Pre-dominant point-to point movement (for example port to rail based inland industrial zone)
- Supportive institutional environment (rail-based customs, border checks, safety and security regime – at reasonable and transparent cost to the shipper).

List of references

No.	Name:
1	DP6- Logistics Market study in 2016
2	Forecast report- Master plan received by WB
3	DP6 Demand Study in 2016
4	Western Cairo Railway Bypass study report in 2017
5	DP6-Railway network review in 2016
6	Customs data by ECA - Imports and exports volumes in 6th of October city.
7	IMF World Economic Outlook database
8	APA official website
9	Egy trans research report dated March 2019
10	International Rail Journal June 2019

List of Appendices

Appendix A	Train Capacity Assumptions
Appendix B	Time-Distance Train Graph of the El-Etihad line
Appendix C	Freight Cost Model
Appendix D	Rail freight forecast model

Appendix A-Train Capacity Assumptions

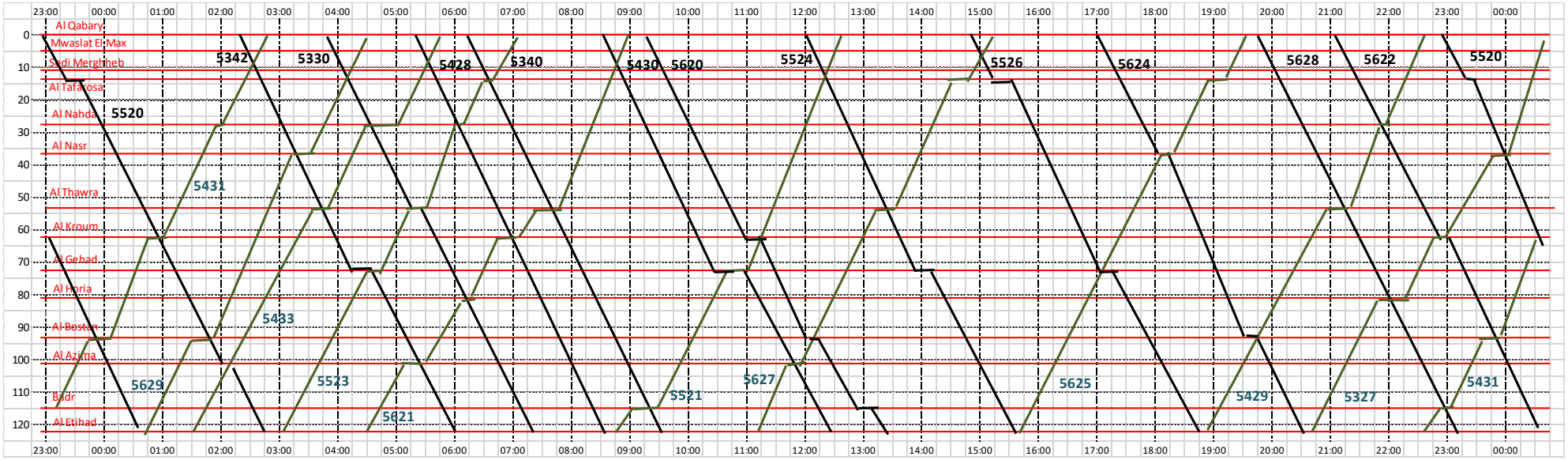
Following a meeting with the World Bank we were advised to follow the international standards of 90 TEUs per train, (3 TEU/wagon, 30 wagons). This is too much for the existing rolling stock in ENR and will need upgrading of the rail infrastructure. Previous DP6 Studies assume container train capacity is 60 TEUs/train as per the current existing fleet/capacity in ENR.

Our recommendation is that the 60 TEUs/trains is more realistic as a base assumption and could be increased to 80 TEUs in the future after upgrading the infrastructure. For bulk cargoes we suggest a payload of 1,080 tonnes is appropriate.

	Train type	
	Container	Bulk
TEU / Train	60	n.a
Tonnes / wagon	n.a	40
Wagons/train	26-30	30
average load factor	90%	90%
Estimated train load: TEU/train [1]	54-58	n.a.
Estimated train load: tonnes/train	n.a.	1080

Notes:
TEU: twenty-foot equivalent unit
n.a not applicable
[1] DP6 Study assumes maximum container train capacity 60 TEU

Appendix B – Time-Distance Train Graph of the El-Etihad line



Appendix C – Freight Cost Model

					Number	Unit cost $		Category sub total $	Total category cost $	% of direct cost	Comments
Direct train cost											
Labour											
	Train crew										
		Driver			48	3,000	144,000				Assumption: 8 trains a day, 3 staff/train (=24), double for leave/training/sick
		Driver assistant			48	2,000	96,000				Assumption: 8 trains a day, 3 staff/train (=24), double for leave/training/sick
		Train conductor			48	2,500	120,000				Assumption: 8 trains a day, 3 staff/train (=24), double for leave/training/sick
								360,000			
	Station staff										
		Staff/station			9					9%	
		Number of stations			27						
		Cost/staff				2,500					
		Percentage freight			55%						11 stations on El Etihad branch freight only, other mixed
		Total cost						334,125			100% of freight, 25% on mixed lines
	Adminstration employees				40	2,000		80,000	774,125		
Fuel											
	Loco average consumption				4	litres/km					
	Fleet annual mileage				1372800	km					
	Fuel consumption				5491200	litres				26%	
	Fuel cost					0.4	$/litre				
	Annual cost							2,196,480	2,196,480		
Main line locomotive											
	Capital cost					4,000,000					Consultant assumption
	Lifespan				30						
	Depreciation cost					133,333					
	Number of locos				11					24%	8 in service, 3 maintenance spares
	Fleet capital costs							1,466,667			
	Annual maintenance cost/loco					50,000					This is 'low' European norm
	Fleet maintenance costs							550,000	2,016,667		
Shunting locomotive											
	Capital cost					2,500,000					Consultant assumption
	Lifespan				30						
	Depreciation cost					83,333					
	Number of locos				3					5%	
	Fleet capital costs							250,000			
	Annual maintenance cost/loco					50,000					This is 'low' European norm
	Fleet maintenance costs							150,000	400,000		
Wagons											
	Capital cost					120,000					Consultant asumption
	Lifespan				30						
	Depreciation cost/year					4,000					
	Number of wagons				276					16%	
	Fleet capital costs							1,104,000			
	Annual maintenance cost/wagon					1,000					Consultant asumption
	Fleet maintenance costs							276,000	1,380,000		
Infrastructure track maintenance cost											
	Maintenance cost/km					10,267					Consultant calculation
				% intermodal							
	Port connection		20	25%	5						Other passenger
	El Etihad		122	75%	91.5						Other freight
	Manashy		72	25%	18					20%	Other passenger
	WCRB		38	100%	38						
	Baharia		20	75%	15						Other freight
				Weighted km	167.5						
	Cost							1,719,667	1,719,667		
Total											
						Direct cost			8,486,938		
						Overhead	25%		2,121,735		Consultant assumption
						Total			**10,608,673**		
Unit cost per TEU											
	Trains per day				8						
	Distance per train (return) (km)				600	300	km each way				
	Days per year				286						52 weeks x 5.5 days/week
	Distance travelled by the fleet				1372800						
	Trains per year				2288						
	Cost train								4,637		
	TEU/train				60						30 wagons, 2 TEU/wagon
	Train fill				90%						
	Cost TEU								**85.86**		Note - this is a 'return journey' cost
Unit cost per TEU load unit											
	TEU load unit/train (40ft = 1.25 TEUload u				28						16 40ft containers (@1.25TEU) and 8 20ft containers (2:1 ratio of 40ft:20ft)
	Train fill				90%						
	Cost TEU								**183.99**		Note - this is a 'return journey' cost

Appendix D -Rail freight forecast model (attached)