

FINAL REPORT

# Economic Impact Assessment of the NAFITH Truck Control Systems in Jordan



**SUBMITTED TO**  
Nafith

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January 2011



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# Abbreviations and Acronyms

ADC	Aqaba Development Corporation
APC	Aqaba Port Corporation
ARC	Aqaba Railway Corporation
ASEZA	Aqaba Special Economic Zone Authority
CAGR	Compound Annual Growth Rate
ERR	Economic Rate of Return
GDP	Gross domestic product
JD	Jordanian Dinar
GTAP	Global Trade Analysis Project
GIS	Geographical Information System
FTZ-TCS	Syria-Jordan Free Trade Zone Truck Control System
JHRC	Jordan Hijaz Railway Corporation
LPI	Logistics Performance Index
NAFITH	National Freight Information and Transportation HUB
TEU	Twenty-foot equivalent unit
TFI	Trade facilitation impact
USTDA	United States Trade and Development Agency



# 1. Purpose and Scope

As required by the Terms of Reference for the National Freight Information and Transportation Hub ("NAFITH"), project funded by the United States Trade and Development Agency, NTELX, Inc. ("NTELX") retained Nathan Associates, Inc. ("Nathan") to conduct an independent economic impact assessment of three pilot processes implemented under the project. These include: (1) the NAFITH- ASEZA TCS (NAFITH-TCS); (2) the Truck Company Information Management System (TCIMS); and (3) the Syria-Jordan Free Trade Zone TCS (FTZ-TCS).

Under the NAFITH, NTELX demonstrated the application of its NXfolio logistics information management platform and other technologies to improving and accelerating critical business processes in Jordan's trade and transportation sectors through the design, deployment and operation of the three pilot systems.

The economic impact assessment is to address the current and future impact of the systems on the Jordanian economy. The study consisted of an economic benefit-cost analysis (EBCA) followed by an assessment of the macroeconomic impacts of the Systems on the entire Jordanian economy. The benefit-cost analysis included the direct economic benefits of each system to users and nonusers in their respective regions. The estimated benefits were compared to the costs of implementing, operating, and maintaining the systems to determine the economic value for the region. The analysis was conducted for each system individually, as well as for the systems integrated to include potential synergistic effect.

In addition to the benefit-cost analysis, which focuses on microeconomic effects, we also assessed the macroeconomic effects of the savings or efficiencies quantified during the benefit-cost analysis. To estimate the overall economic impact of reducing the time required for exports and imports as a result of the systems, Nathan applied a trade facilitation impact (TFI) calculator developed for this purpose. The TFI calculator provides estimates for the impact on GDP and formal sector employment of unskilled workers from improving trade facilitation, based on an analysis of the impact on trade from time impediments to imports and exports in Jordan.

The standard TFI calculator uses a modified version of the internationally known Global Trade Analysis Project (GTAP) computable general equilibrium model (CGE) database to estimate economic impacts for 85 countries and then applies international cross-section

regression analysis to estimate the economic impact for countries such as Jordan, where the accounting matrices needed for CGE modeling are not available. For this study, we refined the regression model to improve the precision of our estimates for Jordan.

This report outlines the methodology and results of the benefit-cost analysis and the methodology and the results of the TFI exercise, including:

- TFI estimates of the impact on GDP from reducing export and import times; and
- TFI estimates of the impact on formal sector employment from reducing export and import times;

The primary sources of data for the analysis were transport statistics, capital cost estimations, country economic statistics published by the government of Jordan, statistics in our own database, and information from other secondary sources, including interviews with stakeholders in the region and different operating assumptions. Nathan was not able to get a demand forecast for the evolution of the freight transport sector in Jordan.

In December 2010, Nathan conducted a technical visit to Amman and Aqaba to inspect the Aqaba TCS, review operations and conditions of the facilities in Aqaba, and interview Nafith's top management and other stakeholders. Because of Syrian government restrictions, we were not able to inspect the Syria-Jordan FTZ or the operations of the FTZ-TCS. In coordination with and with the support of Nafith, Nathan consulted with stakeholders of the transport sector in the region, including users and transport service providers, Ministry of Transport staff, and ASEZA representatives. These meetings allowed us to incorporate the input of each group on the past and current experience with using the systems and likely future impact. A summary of the interviews is presented in Appendix A.

Our analysis was based on economic data, traffic statistics, operating parameters, and other information provided by NTELX and Nafith. Additional data from public official and other nonofficial sources have been incorporated into the analysis. These sources are considered reliable; nevertheless, the results of our analysis could vary significantly if some sources of information prove to be inaccurate or incomplete.

## 2. Project Background

Aqaba Port has developed significantly in the past two decades. Its terminals support imports and exports of fuel and bulk and containerized cargo, and it plays a critical role in the Jordanian economy. Despite the modernization of the main port terminals through privatization and increased investment, however, trucking services in Jordan were operated under a cartel-managed queuing system that promoted inefficiency, prolonged use of old, polluting trucks, and clogged terminals and traffic arteries. Trucking services in Aqaba Port ran under an antiquated system of long queues, fixed rates, lack of transparency, and poor performance.

In 2005, the Government of Jordan launched important economic and trade modernization initiatives. These initiatives centred attention on Jordan's inefficient freight transportation and logistics system. Consequently, the Ministry of Transport and the Aqaba Special Economic Zone Authority (ASEZA) defined the principles and actions for deregulating and modernizing the sector. The initiatives also aimed to create an attractive environment for hotel, resort, and retail development by alleviating truck traffic on city streets and congestion around the port without impeding the development of the port itself.

That same year, to address the government's objectives to modernizing Aqaba Port and making it more efficient, ASEZA, with the support of Nafith, developed the NAFITH-ASEZA Truck Control System (NAFITH-TCS), consisting of a regulatory framework, physical infrastructure, and IT systems to manage the movement of commercial trucks entering the Aqaba Special Economic Zone (ASEZ) and the Truck Company Information Management System (TCIMS) to provide an IT platform for coordinating freight agents, trucking companies, and truck driver activities in a more deregulated environment. Currently the NAFITH-TCS is operated by Nafith under a long-term concession agreement.

In 2010, based on the success of NAFITH-TCS, the Ministry of Transport, again with the support of Nafith, implemented the Syria-Jordan Free Trade Zone Truck Control System (FTZ-TCS). The FTZ-TCS is operated by the Ministry of Transport with technical support from Nafith.

Most stakeholders interviewed agree that the TCS concept should be expanded to the entire Jordanian territory, and that the system should be operated by a private entity like Nafith.

## **Nafith ASEZA TCS in Aqaba**

The government of Jordan began deregulating freight transport services and putting in place a system to coordinate truck operations in Aqaba. First, the Ministry of Transport required truck owner-operators to organize under companies rather than through a cartel. Freight agents could then negotiate rates and service levels with the companies of their choosing. ASEZA and the Ministry of Transport then passed a regulation for the operation of the TCS, specifying the need for a zone entry permit and stipulating that movement within the zone would be controlled. Only trucks already contracted for services could enter the zone, pick up or discharge cargo, and then exit the zone.

In the second half of 2005, ASEZA initiated the design and development of a series of processes, capacity control measures, and checkpoints at 32 locations (principally zone entry and exit points, truck waiting areas, and terminals or destinations) where permits are issued and validated, and truck movements are monitored.

In parallel, NAFITH designed and developed the required information technology to organize TCS processes ranging from validation and acceptance of permit requests from trucking company dispatchers to monitoring of the physical movement of the trucks through the zone. To reduce congestion, the system monitors capacity utilization of roads and terminals and coordinates release and diversion of trucks to and from waiting areas and terminals. Data interfaces to Ministry of Transport, National Customs, and ASEZA Customs ensure that only trucks with valid business in the zone receive permits. The interface is intuitive and is used by dispatchers, gate operators, and ASEZA administrators, many of whom are using such a computer system for the first time.

The NAFITH TCS was launched on November 17, 2005, and by late January 2006, all trucks entering the zone were receiving permits through the system. NAFITH provides the IT platform, including servers, system software, hosting environment, and applications needed for the issuance and lifecycle management of TCS permits.

Dispatchers request permits to enter the zone at one of five entry points and select an approved routing through the zone for the specific operation. Upon receiving notification that capacity is available, trucks proceed to the entry point where the permit is issued. The truck's movement is then monitored at critical points on the approved routes and the permit is closed when the truck exits the zone. In addition, the system allows for the following:

- Ability to control the number of trucks allowed into the zone, waiting areas, terminals, and other destinations;
- Dynamic route design and selection for specific operations in the zone;
- Verification of data for trucks, drivers, and cargo through real-time integration with external data sources; and
- Efficient permit review and validation at checkpoints.

The Aqaba TCS has become a mission-critical system for the Jordanian logistics and trade communities, the port, Aqaba, and the nation. The system is used by over 180 companies owning more than 13,000 trucks. Each day the system manages over 2,500 moves, captures 20,000 logistics events, and maintains over 99.99 percent uptime.

In addition, the TCS has several collateral benefits, including directly creating new jobs, reducing truck accidents on Aqaba's roads and pollution, as well as providing better planning data and more transparent operations.

The majority of trucking companies and drivers agree that the TCS increases their efficiency and the efficiency of the port terminals as well. Trucking costs to and from inland points have dropped significantly. The TCS has increased the efficiency and security of port infrastructure and trucking operations while minimizing the impact of truck traffic on residential, tourist, and commercial areas of Aqaba.

## **Truck Company Information Management System**

The Truck Control Information Management System (TCIMS) platform was designed to manage the movement of commercial trucks and to coordinate this activity between freight agents, trucking companies, and truck drivers in a deregulated environment.

The TCIMS information technology was designed using Java enterprise applications using an Oracle database management system, to organize TCS processes ranging from validation and acceptance of permit requests from trucking company dispatchers to monitoring of the physical movement of the trucks. To reduce congestion, the system monitors capacity utilization of roads and terminals and coordinates release and diversion of trucks to and from waiting areas and terminals. Data interfaces with several governmental agencies ensure that only trucks with valid business are issued permits. The user interface is highly intuitive; it is used by dispatchers, gate operators, and system administrators.

## **Syrian Jordanian Free Trade Zone TCS**

The Free Trade Zone Truck Control System (FTZ-TCS), launched in mid 2010, is an information and control system for coordinating the entry, movement, and exit of Jordanian trucks carrying freight to and from the Syrian Jordanian Free Trade Zone. The system is accessible to the Ministry of Transport, Jordan Customs, gate operators, trucking company managers and dispatchers, and provides data to support coordination, planning, and security monitoring as well as fee collection.

## Jordanian Economy

Jordan is a modern competitive Middle Eastern economy based in liberal economic policies implemented during the last decade. The Economy in Jordan has grown around 7 percent annually since the accession of King Abdullah in 1999.

In 2009, GDP in Jordan was US\$22.9 billion (91st in worldwide rankings), and in 2010, GDP is expected to be about US\$24.9 billion. Jordan relies on foreign trade for its energy and natural resources requirements. GDP composition includes agriculture at 3.7percent; industry at 29.9 percent; and services at 66.5 percent. The population of Jordan is about 6 million, with a labor force of about 1.7 million.

The economy of Jordan faces shortages of oil, gas, water, and a variety of other natural resources. Jordan, however, has embarked on long-term reform focusing on improving the monetary policy; continuing with privatization, and promoting trade and tourism. Government has stopped oil and gas subsidies and protectionist policies.

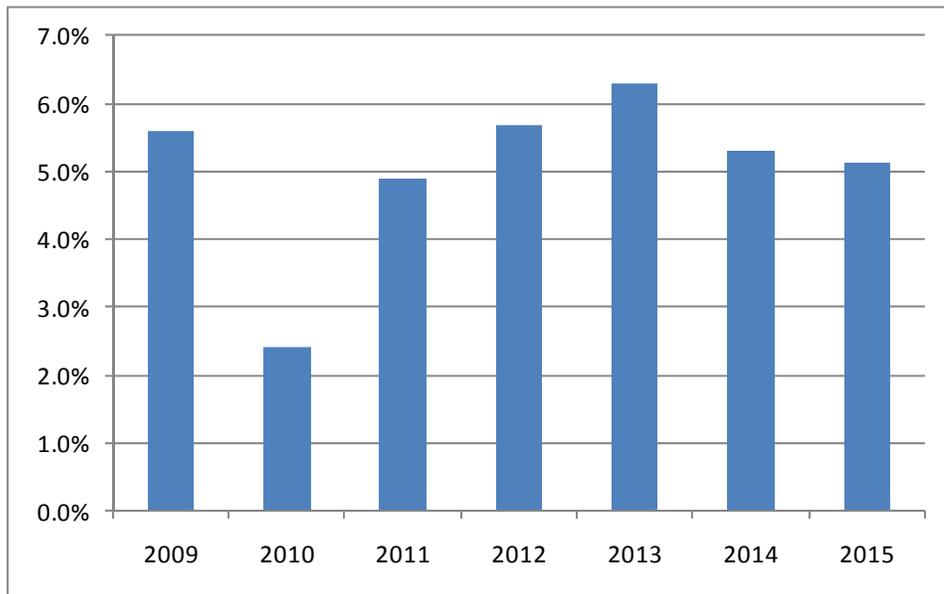
In 2009, Jordan's exports were estimated at \$6.9 billion; its main exports include clothing, fertilizers, potash, phosphates, vegetables, and pharmaceuticals. Major export partners are India at 16.2 percent, Iraq at 16.1 percent, the United States at 13.2 percent, Saudi Arabia at 6.9 percent, and the UAE at 4.6 percent. Jordan's imports for 2009 were estimated at \$12.31 billion. Its main imports include crude oil, machinery, transport equipment, iron, and cereals. Major import partners are Saudi Arabia at 21.2 percent, China at 10.4 percent, Germany at 6 percent, the United States at 4.6 percent, Egypt at 4.5 percent, and Ukraine at 4.3 percent.<sup>1</sup>

For the purpose of the EBCA, our Jordan long-term GDP assumptions<sup>2</sup> for 2015 are presented in Exhibit 4.

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<sup>1</sup> 2010 CIA World Factbook and other sources

<sup>2</sup> Nathan estiamtes based on GDP forecats (current perices) by [www.economywatch.com/economic-statistics/Jordan/GDP](http://www.economywatch.com/economic-statistics/Jordan/GDP)

**Exhibit 1***Jordan GDP Forecast in Real Terms*

Source: Nathan estimates based on GDP forecasts (current perices) of [www.economywatch.com/economic-statistics/jordan/GDP](http://www.economywatch.com/economic-statistics/jordan/GDP)

# 3. Jordanian Transport and Logistics Sector

Jordan has become to a certain extent a model for economic reform. The country's economic and trade liberalization policies, political stability, and relative security have contributed to sustained economic growth. While enjoying sustained economic growth during the past decade and despite important improvements in its transport and logistics sector, Jordan continues to confront significant logistics challenges. According to the World Bank's Logistics Performance Index (LPI), Jordan, with an LPI of 2.74, is ranked 81st of 155 countries and almost last in the Middle Eastern region in logistics performance.<sup>3</sup>

For an economy such as Jordan that relies heavily on foreign trade, efficient transport and logistics infrastructure is fundamental for keeping import and export transport costs competitive. The transport and logistics infrastructure serves the national economy along the Aqaba-Amman corridor; it also plays an important role on a regional level to transport goods to and from neighboring Syria, Iraq, Saudi Arabia, Egypt, and Israel.

The transport and logistics infrastructure in Jordan includes the following main elements:

- A road network of 7,891 km<sup>4</sup>
  - 3,249 km of main roads (including a 324 km, four-lane highway between Aqaba and Amman)
  - 2,173 km of side roads
  - 2,469 km of rural roads
- Aqaba Port, a deep sea port on the Red Sea
- Three international airports – Queen Alia International Airport (AMM), Amman International Airport (ADJ), and King Hussein International Airport (AQJ) in Aqaba
- Two railway corporations – Aqaba Railway Corporation (ARC), which transports phosphate and other mining product from the mines to Aqaba Port, and Jordan Hijaz Railway Corporation (JHRC), which is not in operation.

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<sup>3</sup> Israel 3.41, Lebanon 3.34, Saudi Arabia 3.22, Syria 2.74, Iraq 2.11

<sup>4</sup> Ministry of Transport 2009 Annual Report

- Auxiliary facilities, including gates, yards, customs inspection facilities, scales, and IT systems.

There is an international rail connection between Jordan and Syria, which is not in operation; all international connections, including to and from Syria, are by road.

Except for part of the phosphate from the mines to Aqaba Port, the transport of freight in Jordan is done exclusively by road.

We were not able to obtain traffic counts and origin destination surveys to analyze freight transport on the roads network in Jordan.

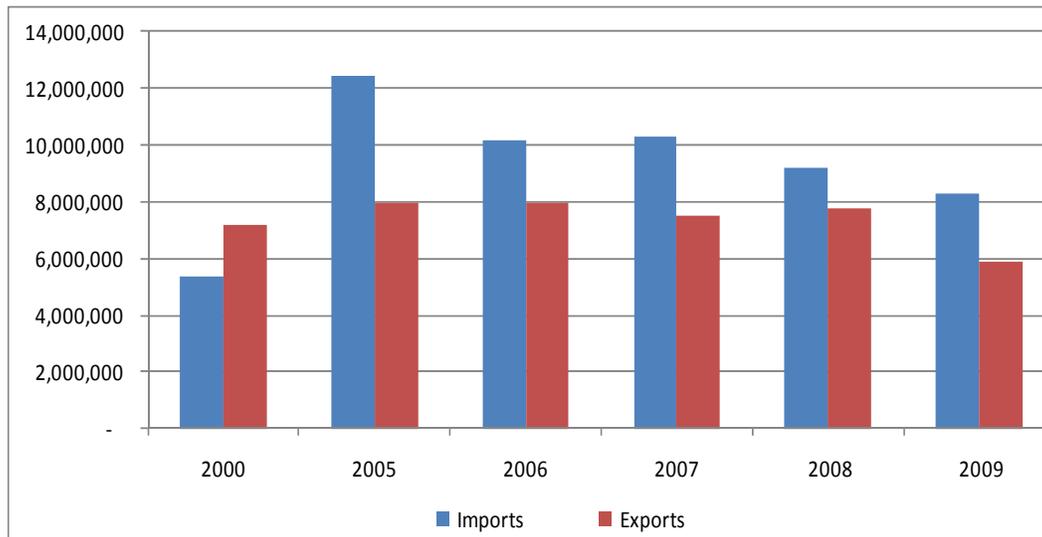
## Aqaba Port

Jordan has only one port, and the majority of imports and exports and part of transit traffic go through it. Total traffic in Aqaba Port has declined in recent years, from 20.4 million tons in 2005 to 14.2 million tons in 2009. Exports have been relatively stable, at about 7.8 million tons per year, except for in 2009. Imports, however, have declined substantially, from 12.4 million tons in 2005 to 8.3 million in 2009. Exhibit 2 summarizes traffic in Aqaba Port.

### Exhibit 2

Traffic Summary at Aqaba Port

Tons	2000	2005	2006	2007	2008	2009
<b>Imports</b>	<b>5,360,000</b>	<b>12,432,000</b>	<b>10,145,000</b>	<b>10,298,000</b>	<b>9,165,000</b>	<b>8,302,000</b>
National	4,935,000	11,614,000	9,490,000	9,911,000	8,823,000	7,858,000
Transit	425,000	818,000	655,000	387,000	342,000	444,000
<b>Exports</b>	<b>7,194,000</b>	<b>7,978,000</b>	<b>7,934,000</b>	<b>7,495,000</b>	<b>7,787,000</b>	<b>5,899,000</b>
National	6,937,000	7,875,000	7,786,000	7,364,000	7,676,000	5,752,000
Transit	257,000	103,000	148,000	131,000	111,000	147,000
<b>TOTAL</b>	<b>12,554,000</b>	<b>20,410,000</b>	<b>18,079,000</b>	<b>17,793,000</b>	<b>16,952,000</b>	<b>14,201,000</b>



Source: Ministry of Transport 2008 and 2009 Annual Reports

An important recent change has been the significant increase in container traffic. The Jordanian government prohibits the entry of containers into the country except through Aqaba Port. As a result, all containers imported to Jordan from the port of Tatous in Syria have to be emptied at the border. By reciprocity, all containers entering Aqaba and going to Syria should also be emptied at the border.

In addition to the traffic in Aqaba, the rest of international traffic can be measured by the number of trucks leaving and entering Jordan. Exhibit 3 shows the number of trucks leaving and entering Jordan at each border.

### Exhibit 3

*Number of Trucks Entering and Departing Customs Centers (2000–2009)*

Number of Trucks	2000	2006	2007	2008	2009
<b>Border with Iraq (Karama Ruweished)</b>	<b>404,000</b>	<b>205,218</b>	<b>207,492</b>	<b>185,246</b>	<b>183,612</b>
In		96,940	105,644	67,895	56,983
Out		108,278	101,848	117,351	126,629
<b>Borders with Saudi Arabia (Al-Mudawara and Al-Omari)</b>	<b>288,000</b>	<b>321,387</b>	<b>364,712</b>	<b>386,149</b>	<b>226,679</b>
In		173,137	180,236	181,470	56,962
Out		148,250	184,476	204,679	169,717
<b>Border with Syria (Jaber)</b>	<b>204,000</b>	<b>291,797</b>	<b>290,238</b>	<b>282,898</b>	<b>239,456</b>
In		156,342	163,649	145,455	150,798
Out		135,455	126,589	137,443	88,658
<b>Other borders (Jordan Valley Crossin and Al-Ramtha)</b>	<b>74,000</b>	<b>55,139</b>	<b>52,022</b>	<b>26,188</b>	<b>36,608</b>
In		27,798	26,229	12,976	19,251
Out		27,341	25,793	13,212	17,357
<b>TOTAL</b>	<b>970,000</b>	<b>873,541</b>	<b>914,464</b>	<b>880,481</b>	<b>686,355</b>

*Source: Ministry of Transport 2009 and 2008 Annual Reports*

## Freight Traffic Forecast for Aqaba Port

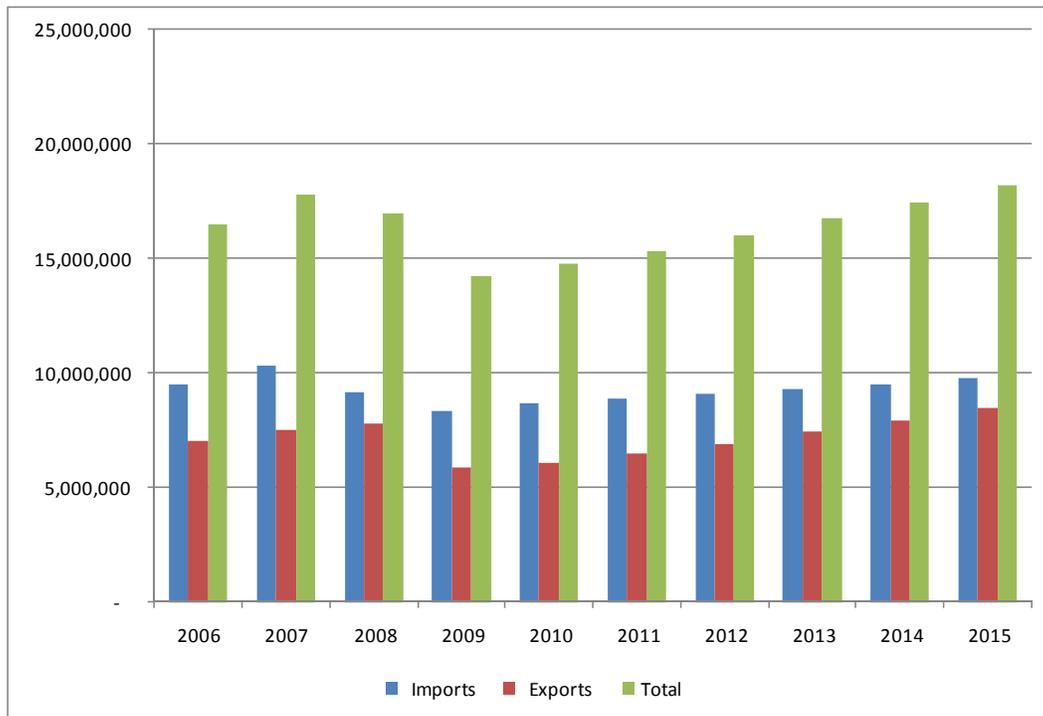
We were not able to get a traffic forecast in Jordan, and our scope of work did not cover the preparation of a traffic forecast, but we prepared a freight traffic projection to estimate the expected benefits of the TCS. The lack of data on traffic flows makes the preparation of traffic forecast for freight transport by road difficult. Therefore we used a combination of parameters, which included historical average growth rates, expected population growth rates, and GDP elasticity parameters obtained from recent studies conducted by the Jordanian government<sup>5</sup>, as well as information obtained during stakeholder interviews.

The results of our traffic projection are summarized in Exhibits 4 and 5. More detailed information about the assumption and results of our projection are presented in Appendix B.

<sup>5</sup> Import elasticity = 1.16 of GDP growth. Export elasticity = 1.25 of GDP growth obtained in the Study of the Inland Port of Amman. We also assumed 2.0 percent for annual population growth.

**Exhibit 4**

*Traffic Forecast for Port of Aqaba 2011–2015*



Source: Estimation made by Nathan using different parameters.

**Exhibit 5**

*Traffic Forecast in Aqaba Port 2011-2015*

Tons	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Concept	Historical				Estimated	Projected				
Imports	9,489,770	10,307,420	9,165,077	8,302,396	8,695,491	8,894,747	9,100,998	9,314,352	9,530,187	9,750,861
National		9,920,737	8,823,357	7,858,317	8,251,412	8,441,577	8,638,116	8,841,084	9,045,801	9,254,558
Transit		386,683	341,720	444,079	444,079	453,170	462,882	473,268	484,386	496,303
Exports	7,020,391	7,495,028	7,787,184	5,898,943	6,075,911	6,448,337	6,905,824	7,449,906	7,944,488	8,454,859
National		7,364,028	7,676,184	5,751,943	5,920,193	6,283,383	6,731,087	7,264,805	7,748,409	8,247,150
Transit		131,000	111,000	147,000	155,719	164,954	174,738	185,101	196,080	207,709
<b>TOTAL</b>	<b>16,510,161</b>	<b>17,802,448</b>	<b>16,952,261</b>	<b>14,201,339</b>	<b>14,771,402</b>	<b>15,343,084</b>	<b>16,006,823</b>	<b>16,764,258</b>	<b>17,474,675</b>	<b>18,205,720</b>

Source: Estimation made by Nathan using different parameters.

Total traffic is forecasted to rise from 14.2 million tons in 2009 to 18.2 million tons in 2015—equivalent to an annual compound growth rate of 4.2 percent. Total imports are forecasted to rise from 8.3 million tons in 2009 to 9.6 million tons in 2015—equivalent to an annual average compound growth rate of 2.7 percent. Total exports are forecasted to rise from 5.9 million tons in 2009 to 8.5 million tons in 2015—equivalent to an annual average compound growth rate of 6.2 percent.

**Timesaving Estimates for the Nafith TCS**

Using the traffic forecast presented in Exhibits 4 and 5, and assuming that most freight in Aqaba will be transported by road, we projected the number of permits of the NAFITH TCS in Aqaba Port from 2010 to 2015.

The EBCA methodology is based on comparing the without-project situation with the with-project situation. In the case of the NAFITH TCS, the with-project situation is clear—according to Nafith statistics, the average turnaround time for a truck to go in and out of the Aqaba zone was about 16 hours in 2009. The without-project situation, however, is not as clear. The opinions of the stakeholders we interviewed on the pre-Nafith situation are rather divergent. Some users mentioned a 60 percent time saving due to Nafith, which implies a pre-Nafith turnaround time of about 24 hours. Other users mentioned a pre-Nafith turnaround time of 48–72 hours. Other users mentioned a pre-Nafith time inside the port for loading of 48 hours. In the absence of hard figures, to estimate the total time savings we conservatively assumed a 24- to 36-hour turnaround for the without-project situation.

With these assumptions, the estimated historical savings varied from a range of 5–17 hours in 2006 to a range of 8–20 hours per permit in 2009. Therefore, for our EBCA, we project an average time savings per permit that varies from a range of 8–20 hours in 2009 to a range of 12–24 hours in 2015. See Exhibit 6.

### Exhibit 6

#### *Number of Permits and Time-Savings Forecast in Aqaba Port, 2011–2015*

Concept	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Historical				Estimated	Projected				
Average Permits per day	2,046	1,834	2,253	2,234	2,289	2,422	2,526	2,646	2,758	2,873
Single Movement Permits	428,906	384,548	472,282	428,466	501,179	536,457	559,664	586,147	610,986	636,547
Double Movement Permits	307,644	275,828	338,757	375,806	322,815	335,309	349,814	366,367	381,893	397,869
Total Number of Permits	736,550	660,376	811,039	804,272	823,994	871,766	909,479	952,515	992,879	1,034,416
Without Project Turnaround Upper (hrs)	36	36	36	36	36	36	36	36	36	36
Without Project Turnaround Lower (hrs)	24	24	24	24	24	24	24	24	24	24
With Project Turnaround (hrs)	19	16	17	16	15	13	12	12	12	12
Time Savings per Permit Upper (hrs)	17	20	19	20	21	23	24	24	24	24
Time Savings per Permit Lower (hrs)	5	8	7	8	9	11	12	12	12	12
Total Savings Upper (hrs)	12,519,219	13,296,777	15,698,505	15,730,844	17,498,193	20,050,621	21,827,485	22,860,351	23,829,103	24,825,981
Total Savings Lower (hrs)	3,680,619	5,372,265	5,966,037	6,079,580	7,610,262	9,589,427	10,913,743	11,430,176	11,914,551	12,412,991

*Source: Estimation made by Nathan using different parameters.*

## 4. Economic Benefit-Cost Analysis

This section presents the economic benefit-cost analysis (EBCA) of three systems in Jordan. The systems include: (1) the NAFITH-ASEZA TCS (NAFITH-TCS); (2) the Truck Company Information Management System (TCIMS); and (3) the Syria-Jordan Free Trade Zone TCS (FTZ-TCS).

The Truck Control Information Management System (TCIMS) platform was designed to manage the movement of commercial trucks and to coordinate this activity between freight agents, trucking companies, and truck drivers in a deregulated environment. In our opinion it is difficult to make an EBCA of TCIMS as a standalone system. In other words, the TCIMS does not produce economic benefits by itself; it requires to be integrated to a TCS. So we only conducted EBCA for NAFITH-TCS and FTZ-TCS, but in both cases, the Truck Control Information Management System was considered a necessary condition to obtain the projected results.

The EBCA methodology is broadly accepted for assessing the magnitude of the direct economic benefits and costs associated with transportation projects such as the truck control systems. This study uses standard benefit-cost methodology to assess the magnitude of the public benefits and costs associated with the project.

### NAFITH-ASEZA TCS

The Nafith Truck Control System in Aqaba, Jordan (NAFITH-TCS) has improved travel conditions in the Aqaba Special Economic Zone Administration (ASEZA), one of the busiest transport corridors in the region.

The NAFITH-TCS in Aqaba started operations in 2006. So we selected a 10-year evaluation period, from 2006 to 2015. The valuation horizon utilized therefore combines historical figures from 2006 to 2009, estimated figures for 2010, and Nathan projected figures from 2011 to 2015.

The primary sources of data for the analysis were 2006–2010<sup>6</sup> data collected in the Nafith database, information obtained from the Ministry of Transport, capital cost estimations obtained from ASEZA, and operating assumptions based on interviews with stakeholders and

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<sup>6</sup> In most cases 2010 includes only January-to-Mid-December figures.

our own experience in similar cases. The EBCA assessed the economic benefits to users and nonusers in the Aqaba region. The estimated economic benefits were then compared to the estimated economic costs of constructing, operating, and maintaining the NAFITH-TCS to determine if it produces economic value for the community around ASEZA.

Benefits and costs are spread over the selected evaluation period. The base year is 2006, the first year of operations. So a discounting procedure was necessary to consider the time value of money. This discounting procedure enables an evaluation of future benefits and costs in terms of their present value. This is a standard way of giving the appropriate weight to the time value of expected cash flows.

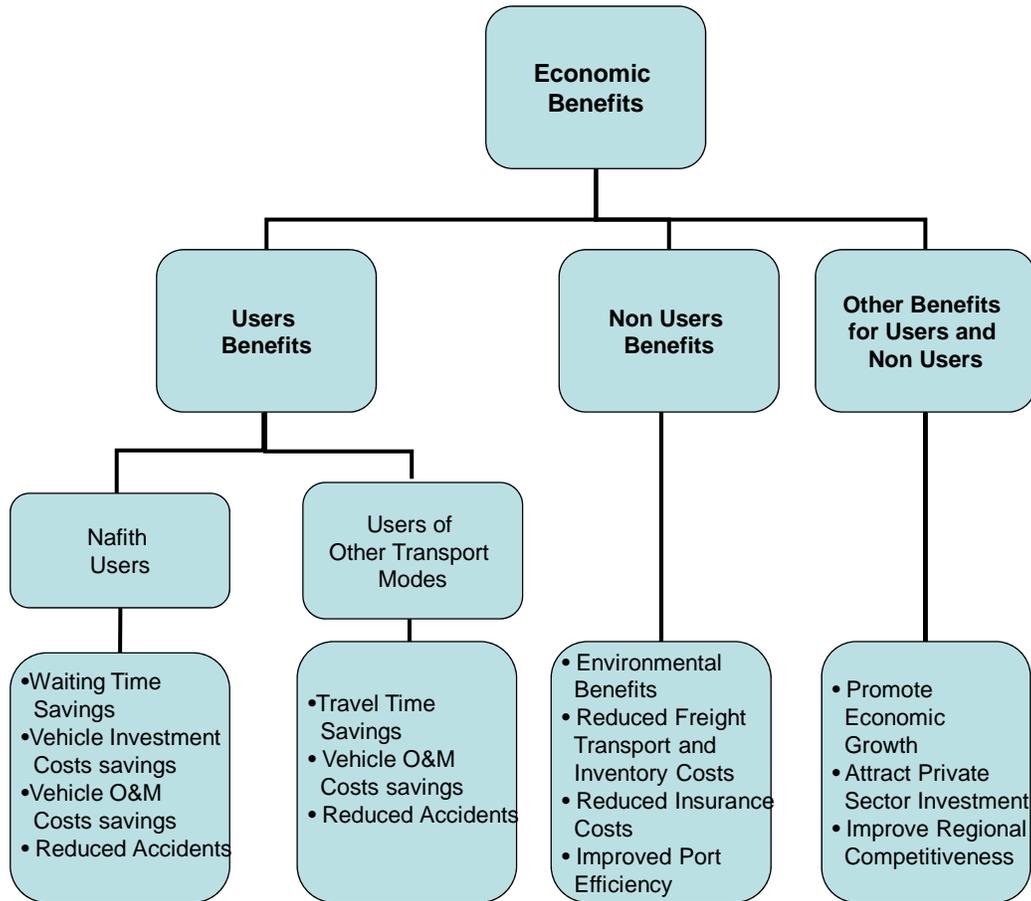
The economic impact of the project was determined by comparing the present value of the benefits to the present value of the costs.

The EBCA framework for this study is conceptually compatible and consistent with models used internationally. Our methodology has considered standard benefit-cost analysis techniques to compare the economic value and return on the proposed investments to the public and private sectors.

## **Economic Benefits of the Project**

The NAFITH-TCS has proved its capability for saving time and money, thanks to a more organized management system of trucks entering Aqaba Port. These include less congestion on roads, higher projected speed, better accessibility to terminals, and improved reliability. The EBCA identified these benefits and included them in the analysis of corridor improvements. Time savings reduce the cost of a trip in terms of travel-time costs and out-of-pocket costs such as fuel. These savings include the value that users place on timesaving, out-of-pocket cost savings, more efficient use of material and human assets, and the value of safety and a cleaner environment, as well as more reliable service for the freight owner. Exhibit 7 shows how the economic benefits of the project can be broken down into various categories.

In addition to benefits to Nafith users (truckers), the TCS produces benefits in the transportation system in the region for users of other transport modes. The NAFITH-TCS improves the efficiency and reduces costs for all users of streets and highways in the zone. At the same time, benefits for nonusers also result from a more efficient and reliable transportation system. For example, reduced vehicle miles traveled or reduced time in traffic jams reduces vehicle emissions, thereby improving environmental quality and associated health effects for the community in general.

**Exhibit 7***Breakdown of Main Economic Benefits (Illustrative)*

Travel condition improvements to the street and highway system benefit freight service operating in the Aqaba Corridor. In addition, the freight operators benefit from higher average speeds and lower waiting times on the corridor. Higher average speeds and lower waiting times in effect increase the labor and capital productivity of freight transport.

A major difficulty in developing benefit-cost results lies in the monetary valuation of transportation benefits. It is not questioned that transportation investments in general and the TCS in particular can produce time savings, reduce traffic congestion, reduce emissions, and enhance safety. Room for controversy arises, however, when monetary values are assigned to these items.

Reaching consensus on the proper value of time, value of air quality improvements, and reduced accidents is not easy. Extensive research has been conducted in all these areas to try to reach conclusions about the proper values for these items. Values of time are typically based on average income. Emission reductions are valued on the basis of vehicle miles

traveled, combined with average speeds and fuel consumption rates to estimate emission rates by type. Volumes of emissions are then assigned an economic value, and total environmental cost savings are calculated. Accident costs are valued according to an economic estimation of fatalities, injuries, and property damage avoided.

Most assumptions in this analysis are based on region-specific data and the experience of the consultant in similar cases. Explanations and sources for assumptions and assigned values can be found in Appendixes B and C.

Some of the other benefits to users and nonusers are difficult to assess in monetary terms, especially with the lack of information in Jordan. The assessment of these macroeconomic benefits is going to be considered in the next section.

## **BENEFITS TO NAFITH-TCS USERS**

User benefits are usually estimated in terms of the impact on users of a particular transportation system before and after an investment. In this case, the most direct economic benefits of the NAFITH-TCS are to truck operators and truck owners. In the case of the Nafith TCS we consider the following direct economic benefits:

*Traveling and Waiting Time Savings for Truckers.* The NAFITH-TCS improves travel and waiting times of users compared to the previous, non-controlled situation. These benefits were expressed in monetary terms by applying a value of time for drivers and equipment to the average time savings per permit estimated in the previous section. The assumptions in this benefit category were estimated using information obtained during interviews in Jordan and assumptions made by Nathan on the basis of our experience in comparable cases. We assumed value of time for drivers at \$1.21 per hour and value of time for equipment at \$1.26 per hour plus 40 percent of operating and maintenance costs. These unit costs per hour were multiplied by the projected average time savings per permit per year. Savings of 2 percent in fuel were also considered as benefits. Finally, a discounting procedure was applied to yearly benefits to estimate the 10-year present value. The applied annual discount rate was 5.7 percent, which is equivalent to the weighted average of the coupon rates of the 2007–2010 Public Entities Bonds and Bills published by the Central Bank of Jordan.

*Reduction in Traffic Accidents.* Traffic accidents in Jordan are a major health and economic problem. They are the second-leading cause of death. The number of traffic accidents increased seven-fold from 1987 to 2007—from 15,884 accidents in 1987 to 110,630 accidents in 2007,<sup>7</sup> while for the same period, the population doubled and the number of vehicles tripled. According to 2007 statistics, the fatality rate in Jordan was 12 per 10,000 registered vehicles, compared with 1.6 fatalities per 10,000 registered vehicles in the United States. Traffic accidents cost Jordan JD 220 million in 2005, JD 258 million in 2006, and 281 million in 2007. Truck involvement rates in traffic accidents for the period 2005–2007 were approximately 25

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<sup>7</sup> Jordan Journal of Civil Engineering, Volume 3, No. 4, 2009. Traffic Accidents in Jordan Hashem R. Al-Masaeid

percent. In 2008, in response to the drastic increase in traffic accident casualties, the Jordanian government established a strategy to control traffic accidents and casualties. Two safety policies were implemented in February 2008: stiffer penalties on driving violations, particularly speeding, and intensification of traffic police enforcement. These policies have continued to the present time. Safety measures undertaken in 2008 reduced total traffic accidents by 14 percent and fatalities by 26 percent. In addition to reducing fatalities, the measures had economical benefits. In 2008 the safety measures reduced accidents by about 16,434 accidents with economic savings of approximately JD 42 million (US\$60 million).

According to the director of public relations at the Central Traffic Department, the death toll from road accidents dropped from 929 in 2007 to 676 in 2009, and the number of serious injuries and casualties caused by accidents also decreased. He also said that speeding is the leading cause of accidents in Jordan.<sup>8</sup>

A representative of the Jordan Traffic Institute said<sup>9</sup> "The number of road accident fatalities decreased by 13 percent in 2009 compared to 2007," noting that this achievement was made although there was an 18 percent increase in the number of vehicles during 2008 and 2009. Economic losses incurred as a result of road accidents stood at JD258 million in 2009.

Most stakeholders mentioned the reduction in accidents in the Aqaba Zone as a benefit of NAFITH-TCS. Before Nafith, truck drivers speeded to gain a better position in the waiting queue. In addition, frequently trucks did not meet the required safety specifications of the randomly assigned cargo loads.

Nathan had no access to official accident reports in the Aqaba area, but using these statistics and others gathered during the study, we conservatively estimate that economic gains due in accident reductions attributable to Nafith in ASEZ amounted to about US\$1.8 million. This figure was reached using the projected permits growth rate. A 5.7 percent discounting rate was applied to the yearly benefits to estimate the 10-year present value.

## **BENEFITS TO USERS OF OTHER MODES OF TRANSPORTATION**

Benefits to users of other transportation modes are usually estimated in terms of the impact on nonfreight-vehicle users with and without the project. In this case, the benefits of the Nafith TCS are to nonfreight operators owners. For the Nafith TCS, we consider the following direct economic benefits to users of other modes of transportation in the Aqaba Zone:

- **Travel time savings.** These benefits were calculated on the basis of a reduction in travel time for nonfreight users due to the alleviation of congestion caused by trucks in Aqaba. These included vehicle operating cost savings, calculated for all users of nonfreight vehicles. These benefits were expressed in monetary terms by applying a value of time for drivers and vehicles to the estimated time savings for nonfreight vehicles. The assumed

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<sup>8</sup> Jordan Times

<sup>9</sup> Jordan Times

value of time for drivers was \$2.02 per hour, and the assumed value of time for equipment \$0.23 per hour plus 40 percent of operating and maintenance costs. These unit costs were multiplied by the average time savings per trip. Benefits also considered savings of \$0.84 in fuel per hour of saved time. The number of nonfreight vehicles in the Aqaba Zone was estimated on the basis of Ministry of Transport statistics. Average time savings per trip was estimated assuming three trips per day, with an average time per trip of 15 minutes, two occupants per vehicle on average, and average time savings per trip of 20 percent. All assumptions in this benefit category were estimated using information obtained during interviews in Jordan and assumptions made by Nathan on the basis of experience in comparable cases. Finally, a 5.7 percent discount rate was applied to the yearly benefits to estimate the 10-year present value.

- ***Street and highway safety benefits.*** These benefits were calculated based on a reduction in accidents resulting from truckers not speeding or making wrong driving decisions to gain a spot in the queue or to gain a load that is not compatible with the characteristic of the vehicle. Using the Ministry of Transport statistics and accident statistics, we conservatively estimate that economic gains due to saving in accidents reduction of non-freight vehicles due to Nafith in the ASEZ are around \$170,000 USD per year. Considering an average cost per accident of \$3,550 we are considering savings of about 50 non-truck accidents per year due to the NAFITH-TCS. This figure was projected using the projected number of vehicles in Aqaba. Finally, a 5.7 percent discount rate was applied to the yearly benefits to estimate the 10-year present value.

## **BENEFITS FOR NONUSERS**

Nonuser economic benefits are benefits to individuals who do not use the transportation infrastructure directly. The most important NAFITH-TCS nonuser benefits are:

- ***Environmental cost savings.*** Less congestion and shorter waiting times contribute to lower net vehicle emissions.
- ***Highway expansion and maintenance cost savings.*** To the extent that truck routes are managed to make the most efficient use of infrastructure to avoid unnecessary expansion and maintenance expenses on the roads network.
- ***Cargo operating costs savings.*** A shorter average turnaround time improves the productivity of labor and capital assets. A shorter waiting time reduces the labor required for each trip.
- ***Value of reliability and service quality.*** Reliability reduces the need for large inventories and allows just-in-time operations.
- ***Travel time savings for freight.*** Freight owners can reduce travel times.
- ***Savings for freight owners.*** Shorter turnaround times increase the infrastructure capacity and allow reduced travel times and costs for freight operators and owners.
- ***Saving in insurance costs*** due to better transparency and accountability.

- *More efficient port terminal operations and savings in vessel turnaround time.*
- *Creation of jobs and income* for residents in the region.
- *Enhancement of the competitive advantage of the region in attracting investors*
- *Economic growth* in the region.

These benefits were not expressed in monetary terms as part of the direct economic benefits in this EBCA, but the economic impact of some of the benefits is captured by the macroeconomic impact analysis of the NAFITH-TCS addressed in the following section.

Exhibit 8 summarizes present value of the economic benefits of the *NAFITH-TCS* for the 10-year period 2006–2015.

### Exhibit 8

*Summary of NAFITH-TCS Economic Benefits, NPV, 2006–2015 (\$US million)*

Type of Benefit	Lower	Upper
<b>F O R U S E R S</b>		
Truck time savings	\$73.4	\$163.7
Operating and maintenance savings	\$29.3	\$65.5
Driver savings	\$76.8	\$171.4
Fuel savings	\$32.8	\$32.8
Accident reduction savings	\$15.9	\$15.9
Total benefits for users	\$228.2	\$449.4
<b>F O R N O N U S E R S</b>		
Other vehicles time savings	\$1.1	\$1.1
Operating and maintenance savings	\$0.4	\$0.4
Driver/passenger savings	\$12.9	\$12.9
Fuel savings	\$2.7	\$2.7
Accident reduction savings	\$1.5	\$1.5
Total benefits for nonusers	\$18.6	\$18.6
<b>T O T A L E C O N O M I C B E N E F I T S</b>		
Total economic benefits	\$246.9	\$468.1

*Source: Nathan estimations*

## Estimated Economic Costs and Investments

The project's economic costs for users are the tariffs or fees paid by the users of NAFITH-TCS to obtain a permit to have access to the port. Tariffs are estimated as \$10.5 per double movement ( $\$5.25 \times 2$ ) and \$3.5 per single movement. The present value of total economic costs for users is estimated at \$20.6 million.

ASEZA's economic costs are the project's capital investments and operating and maintenance costs. According to information provided by ASEZA, the project's capital investments are infrastructure and buildings with a present value (in 2006) of \$11.9 million. We assumed a present value of future expansion and rehabilitation expenses of \$6.4 million and maintenance expenses of \$4.8 million. The present value of expected operating costs was estimated at \$23.9 million.

The present value of the project's economic costs is estimated at \$67.5 million. The project's economic costs are summarized in Exhibit 9.

### Exhibit 9

*NAFITH-TCS Estimated Economic Costs, NPV, 2006–2015(\$US million)*

Concept	US\$
<b>F O R U S E R S</b>	
Double movements	\$13.8
Single movements	\$6.8
Total economic costs for users	\$20.6
<b>F O R G O V E R N M E N T</b>	
Infrastructure and buildings	\$11.9
Expansion and major rehabilitation	\$6.4
Maintenance	\$4.8
Operational costs	\$23.9
Total economic costs for government	\$47.0
<b>T O T A L E C O N O M I C C O S T S</b>	
Total economic costs	\$67.5

*Source: Nathan estimations*

## Benefit-Cost Analysis Evaluation Criteria

The EBCA evaluation criteria compare all benefits and costs of the project and are derived from principles that are widely accepted for evaluating public sector policies, investments, and programs. This EBCA forecasts the full range of impacts from the project and estimates the net economic value of users and nonusers of the Nafith TCS in the region, in monetary terms, over the useful life of the project.

Project feasibility was assessed using NPV,<sup>10</sup> ERR<sup>11</sup> and the benefit-cost ratio.<sup>12</sup> The project is economically advantageous if the NPV is greater than zero and the rate of return meets or

<sup>10</sup> NPV is the present value of benefits minus the present value of costs. A NPV greater than zero indicates the benefits outweigh the costs.

exceeds the “cost of money” for the Jordanian government. Of course, whether a project that deserves to be built is feasible must be assessed on the basis of other financial factors as well, such as availability of public funds and the financial viability of the project.

## Economic Cost- Benefit Analysis Results

A 10-year stream of benefits to of the NAFITH-TCS users, users of other modes of transport, and the corridor community as a whole were compared to the stream of economic costs associated with constructing, operating, and maintaining the service. The EBCA results are given in Exhibit 10, and our detailed assumptions and calculation are presented in Appendixes B and C.

### Exhibit 10

*NAFITH-TCS Summary Benefit-Cost Analysis Results NPV, 2006–2015 (US\$ million)*

Concept	Lower	Upper
Total economic benefits	\$246.9	\$468.1
Total economic cost	\$67.5	\$67.5
Total economic NPV	\$179.4	\$400.5
Benefit-cost ratio	3.7	6.9
Economic rate of return	100.5%	249.4%

*Source: Nathan estimations*

The results of the analysis show that total economic benefits exceed total economic costs for the proposed valuation scenario. The results confirm that this project is worthy of public investment. The NPV shows the discounted value of benefits net of costs over the 10-year analysis period. The benefit-cost ratio exceeds 1, and the ERR exceeds the discount rate, reinforcing the positive benefit-cost results.

## Syria-Jordan Free Trade Zone TCS

The Free Trade Zone Truck Control System (FTZ-TCS) is an information and control system for coordinating the entry, movement, and exit of Jordanian trucks carrying freight to and from the Syrian Jordanian FTZ.

The FTZ-TCS started operations in mid 2010. So we selected a 10-year evaluation period, from 2011 to 2020. The valuation horizon utilized Nathan projected figures from 2011 to 2020.

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<sup>11</sup> ERR measures the profitability of the investment in economic terms. Typically, projects must meet a "hurdle rate" of return to be considered. Economic rate of return is equal to the discount rate at which NPV equals zero.

<sup>12</sup> Benefit-cost ratio is estimated as the present value of benefits divided by the present value of costs. A benefit-cost ratio greater than 1 means that for every dollar invested, more than one dollar of benefits is derived.

The primary sources of data for the analysis were June–December 2010 data collected in the Nafith database, information obtained from the Ministry of Transport, operating assumptions based on interviews with stakeholders and our own experience in similar cases. Stakeholders estimate timesaving of 4-6 hour per operation. They also comment that a truck yard is required outside the FTZ. Capital costs were estimated using the Aqaba TCS experience. Benefits and costs are spread over the selected evaluation period. The base year is 2010, the first year of operations. So a discounting procedure was necessary to consider the time value of money.

Most assumptions in this analysis are based on some available region-specific data and the experience of the Aqaba TCS. Explanations and sources for assumptions and assigned values can be found in Appendixes B and C.

Exhibit 11 summarizes present value of the economic benefits of the *FTZ-TCS* for the 10-year period 2011–2020.

#### **Exhibit 11**

*Summary of FTZ-TCS Economic Benefits, NPV, 2011–2020, (\$US million)*

Type of Benefit	Lower	Upper
<b>F O R U S E R S</b>		
Truck time savings	\$1.8	\$2.7
Operating and maintenance savings	\$0.7	\$1.1
Driver savings	\$1.9	\$2.9
Fuel savings	\$0.5	\$0.5
Accident reduction savings	\$0.9	\$0.9
Total benefits for users	\$5.8	\$8.1
<b>F O R N O N U S E R S</b>		
Other vehicles time savings	\$0.1	\$0.1
Operating and maintenance savings	\$0.0	\$0.0
Driver/passenger savings	\$1.3	\$1.3
Fuel savings	\$0.3	\$0.3
Accident reduction savings	\$0.1	\$0.1
Total benefits for nonusers	\$1.9	\$1.9
<b>T O T A L E C O N O M I C B E N E F I T S</b>		
Total economic benefits	\$7.7	\$9.9

*Source: Nathan estimations*

The *FTZ-TCS*'s economic costs are summarized in Exhibit 12.

**Exhibit 12***NPV of Estimated Economic Costs of the FTZ-TCS, 2011–2020 (\$US million)*

Concept	US\$
<b>F O R U S E R S</b>	
Double movements	\$0.4
Single movements	\$0.6
Total economic costs for users	\$1.0
<b>F O R G O V E R N M E N T</b>	
Infrastructure and buildings	\$1.2
Expansion and major rehabilitation	\$0.4
Maintenance	\$0.3
Operational costs	\$1.0
Total economic costs for government	\$2.9
<b>T O T A L E C O N O M I C C O S T S</b>	
Total economic costs	\$3.9

*Source: Nathan estimations*

A 10-year stream of benefits to FTZ-TCS users, users of other modes of transport, and the community in the region as a whole were compared to the stream of economic costs associated with constructing, operating, and maintaining the service. The EBCA results are given in Exhibit 13, and our detailed assumptions and calculation are presented in Appendixes B and C.

**Exhibit 13***FTZ-TCS Summary Benefit-Cost Analysis Results NPV, 2011–2020 (US\$ million)*

Concept	Lower	Upper
Total economic benefits	\$7.7	\$9.9
Total economic cost	\$3.9	\$3.9
Total economic NPV	\$3.8	\$6.0
Benefit-cost ratio	2.0	6.9
Economic rate of return	45.9%	63.8%

The results of the analysis show that total economic benefits exceed total economic costs for the proposed valuation scenario. The results confirm that this project is worthy of public investment. The NPV shows the discounted value of benefits net of costs over the 10-year analysis period. The benefit-cost ratio exceeds 1, and the ERR exceeds the discount rate, reinforcing the positive benefit-cost results.

## 5. Economic Impact Analysis

In addition to the cost-benefit analysis in Section 4, we analyzed the broader economic impacts of the reduction in time to trade resulting from the implementation of the TCS–NAFITH-TCS, TCIMS, and FTZ-TCS—on the Jordanian economy. Specifically, we estimated the effect on GDP and employment of unskilled workers in Jordan’s formal sector economy by improving export and import times through the introduction of the three systems.

To estimate the broader economic impact of reducing the time required for exports and imports as a result of the systems, we used the Trade Facilitation Impact (TFI) calculator, a tool that we developed that relies on a modified version of the widely used comprehensive Global Trade Analysis Project (GTAP) computable general equilibrium (CGE) model database for 85 countries to generate our initial economic impact estimates. We then applied international cross-sectional regression analyses to extrapolate the results to estimate the broader economic impact for Jordan, whose social accounting matrix is not yet available and thus not broken out specifically in the GTAP model. Our models estimate the impact on GDP and formal sector employment of unskilled labor of improving export and import times by one day each. We then deduce the effect on Jordan’s economy of the improvements in time savings we estimated in Part I of implementing the truck control systems.

### Methodology

The detailed methodology of our TFI exercise is available in the 2008 paper *Estimating the Economic Impacts of Improving Trade Facilitation* that Nathan Associates developed for a USAID project. Below we summarize this three-step methodology that we used to derive the economic impact estimates.

#### STEP 1

We obtain weighted average tariff equivalents of a one day delay in imports and a one day delay in exports by using the World Bank’s Doing Business reports that measure the time required to import and export in 175 countries. To express time delays in dollar terms, we apply a method to convert time costs into ad valorem, or tariff-equivalent, terms.

To do this, we estimate the value of one day saved in transit for each product, drawing on trade and shipping data that reveal how much consumers value timely delivery of each good.

We then calculate the per-day value of time savings for each country, based on the goods it trades or might one day trade. Finally, we calculate tariff equivalents for import and export waiting times by combining each country's per-day value of time savings with the Doing Business data.

## STEP 2

Next, we use these tariff equivalent data to shock a modified version of the standard GTAP CGE model, simulating the efforts of exports and import times on GDP and unskilled formal sector employment. Two modifications to the standard GTAP model were made. First, we aggregated the economy into two sectors, merchandise and services, because we are interested only in the overarching effects of time changes in trade. Second, we assumed that there is an infinite supply of unskilled labor in low- and middle-income countries. The second assumption steers away from the standard GTAP CGE model in which all markets, including the labor market, are in equilibrium. This assumption allows us to introduce unemployment into the model, and hence estimate the impact of change in time to trade on formal unemployment of unskilled labor.

To obtain export and import shocks for each country, we calculated a trade-weighted average by country of the tariff equivalents for exports and imports of delays in time to trade. We then used the export shocks to obtain our export-effect estimates by shocking the demand curves for merchandise exported from each country or region to all countries and regions in the model. The resulting changes in GDP and employment of unskilled labor in the formal sector were summed for each country, providing us with our initial economic impact estimates from improved export times. To obtain our economic impact estimates from improved import times, we shocked the demand curves for merchandise imported from each country or region from all countries and regions in the model.

## STEP 3

In order to produce estimates for Jordan, which does not have its own social accounting matrix, we used four simple ordinary least-squares regression models to extrapolate the results from Step 2 for 187 countries. After examining many economically relevant potential regressors, the following four equations were both theoretically sound and provided the best fit:<sup>13</sup>

1.  $EEG = \alpha_1 + \beta_1 \text{GDP} + \beta_2 \text{MExp} + \beta_3 \text{Trade} + \beta_4 \text{EShockEShare} + \varepsilon_1$
2.  $IEG = \alpha_2 + \mu_1 \text{DevCo} + \mu_2 \text{LogGDP} + \mu_3 \text{Trade} + \mu_4 \text{IShockIShare} + \varepsilon_2$
3.  $EEE = \alpha_3 + \delta_1 \text{TradeBal} + \delta_2 \text{EShockEShare} + \delta_3 \text{BulkExp} + \varepsilon_3$
4.  $IEE = \alpha_4 + \eta_1 \text{IShockIShare} + \eta_2 \text{BulkExp} + \eta_3 \text{LogGDP} + \eta_4 + \varepsilon_4$

When  $\alpha$  is a constant term, GDP is GDP per capita in current international dollars, MExp is the share of merchandise exports in GDP, EShockEShare is the interaction term between the

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<sup>13</sup> Outliers were removed from the model. A list of these is available upon request.

shock on exports and the share of merchandise exports in GDP, DevCo is a 0-1 dummy for high-income and non-high-income countries, LogGDP is the logarithmic variable for GDP per capita, Trade is total trade as a percentage of GDP, IShockIShare is the interaction term between the shock on imports and the share of merchandise imports in GDP, BulkExp is the share of bulk exports in total merchandise exports, and  $\varepsilon$  is the error term.

Equation 1 estimates the effect on GDP of improving export time by one day. Equation 2 estimates the effect on GDP of improving import time by one day. Equation 3 estimates the effect on employment of unskilled workers in the formal sector of improving export time by one day. Equation 4 estimates the effect on employment of unskilled workers in the formal sector of improving import time by one day.

The regression results are summarized in Exhibit 14. These results were used to extrapolate the estimates for Jordan. The regressions also provide us with standard errors, which we have used to develop an estimate range, rather than a simple point estimate for economic impacts.

#### Exhibit 14

##### *Summary of Regression Results*

	Equation (1)		Equation (2)		Equation (3)		Equation (4)	
	Estimate	T-Stat	Estimate	T-Stat	Estimate	T-Stat	Estimate	T-Stat
$\alpha$	0.43	5.43	-0.64	-2.77	0.09	2.66	-0.24	-1.22
$\beta_1$	-6.31E+06	-3.3						
$\beta_2$	-1.31	-5.62						
$\beta_3$	0.001	2.49						
$\beta_4$	2.98	10.62						
$\mu_1$			0.24	4.22				
$\mu_2$			0.05	2.07				
$\mu_3$			8.05E+04	2.2				
$\mu_4$			1.13	12.83				
$\delta_1$					-0.47	-4.38		
$\delta_2$					1.66	13.67		
$\delta_3$					-0.16	-2.37		
$\eta_1$							1.54	10.77
$\eta_2$							-0.25	-2.33
$\eta_3$							0.05	2.14
Adjusted R <sup>2</sup>	0.65		0.7		0.83		0.73	
Regression SE	0.18		0.15		0.09		0.16	

## Results

Using the regression estimates from Exhibit 14, we were able to predict the effect on GDP and formal sector employment of unskilled labor in Jordan of a one-day change in time to export and a one-day change in time to import. Finally, to estimate the impact of the truck control system specifically, we make three assumptions:

1. According to the estimates in Section 3, the average improvement in time savings from the Jordan truck control systems—NAFITH-TCS, TCIMS, and FTZ-TCS—ranged from 8 to 20 hours per permit in 2009.
2. According to information obtained during interviews with stakeholders, traffic handled by the Jordan truck control systems represents about 75 percent of all international trade traffic in Jordan. So the average improvement in time savings from the Jordan TCS on the entire international trade traffic in Jordan is estimated to range from 6 to 12 hours. We also estimate that time savings for imports range from 6.9 hours to 13.7 hours, and time savings for exports range from 4.3 hours to 8.5 hours.<sup>14</sup>
3. The savings in time to trade resulting from the introduction of the truck control systems has a constant marginal effect on the economic impact on GDP and employment of unskilled workers in the formal sector.

These assumptions help tailor our regression results specifically to the case of the truck control systems. For instance, using 2009 GDP figures for Jordan of US\$25,092 million<sup>15</sup>, we estimate that the change in GDP resulting from reduction in export time by one day is between US\$145.8 million and US\$175.3 million. The corresponding change in GDP resulting from the reduction in import time by one day is between US\$188.6 million and US\$227.9 million. Similarly, we estimate that a 10-hour reduction in time to export would result in an increase in the percentage of employed unskilled labor in the formal economy by 0.56 percent to 0.63 percent. A summary of results of the economic impact of improving Jordan's trade facilitation is presented in Exhibits 15 and 16. All estimate ranges presented here are based on a 95 percent confidence interval.

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<sup>14</sup> According to Nafith statistics, during 2009 Imports in Aqaba accounted for 67 percent and Exports for 33 percent of total foreign trade operations. Our import/export time savings allocation are as follows: 6.9 (67%) + 4.3 (33%) = 6 hours and 13.7 (67%) + 8.5 (33%) = 12 hours

<sup>15</sup> World Development Indicators Database, 2010. GDP figure is in current US dollars.

**Exhibit 15**

*Estimated Effect on GDP of Improvements in Time to Export and Time to Import (US\$ million)*

	Lower Bound	Upper Bound
<b>F O R E X P O R T S</b>		
4 hours	\$32.30	\$37.20
6 hours	\$48.40	\$55.80
8 hours	\$64.50	\$74.30
10 hours	\$80.60	\$92.90
12 hours	\$96.80	\$111.50
<b>F O R I M P O R T S</b>		
4 hours	\$24.30	\$29.20
6 hours	\$36.50	\$43.80
8 hours	\$48.60	\$58.40
10 hours	\$60.80	\$73.10
12 hours	\$72.90	\$87.70

**Exhibit 16**

*Estimated Effect on Employment Rate of Improvements in Time to Export and Time to Import (%)*

	Lower Bound	Upper Bound
<b>F O R E X P O R T S</b>		
4 hours	0.09%	0.11%
6 hours	0.13%	0.17%
8 hours	0.17%	0.23%
10 hours	0.21%	0.29%
12 hours	0.26%	0.34%
<b>F O R I M P O R T S</b>		
4 hours	0.17%	0.20%
6 hours	0.25%	0.30%
8 hours	0.34%	0.40%
10 hours	0.42%	0.50%
12 hours	0.50%	0.60%

*Note: Employment here refers only to the employment of unskilled workers in the formal sector.*

Using estimated time savings of 10 hours for imports and 6.5 hours for exports, we estimate positive impacts on GDP in a range from \$60.8 million to \$73.1 million per year, and from \$52.4 million to \$60.4 million per year, respectively. In the same way, the estimated improvements in employment are in a range from 0.42 percent to 0.50 percent per year for 10 hours savings in import time and in a range from 0.14 percent to 0.19 percent per year for 6.5 hours of savings in export time.

# 6. Conclusions

## Economic Benefit-Cost Analysis

The results of the EBCA of the NAFITH-TCS and the FTZ-TCS show that, in both cases, total economic benefits exceed total economic costs for the proposed valuation scenario.

The results of our conservative analysis indicate that the NAFITH-TCS and the FTZ-TCS are worthy of public sector investment.

The present value of the NAFITH-TCS's net economic benefits is estimated to fall in a range of \$180 million to \$400 million in a valuation horizon from 2006 to 2015. The benefit-cost ratio exceeds 1, and the estimated economic rate of return is estimated to fall in a range of 100 percent to 250 percent, which greatly exceeds the estimated public sector's discount rate, reinforcing the positive economic benefit-cost results.

The present value of the FTZ-TCS's net economic benefits is estimated to fall in a range of \$4 million to \$6 million in a valuation horizon from 2011 to 2020. The benefit-cost ratio exceeds 1, and the estimated economic rate of return is estimated to fall in a range of 45 percent to 64 percent, which exceeds the estimated public sector's discount rate.

## Economic Impact Analysis

Using estimated time savings of 10 hours for imports and 6.5 hours for exports, we estimate positive impacts on GDP in a range from \$60.8 million to \$73.1 million per year, and from \$52.4 million to \$60.4 million per year, respectively. In the same way, the estimated improvements in employment are in a range from 0.42 percent to 0.50 percent per year for 10 hours savings in import time and in a range from 0.14 percent to 0.19 percent per year for 6.5 hours of savings in export time.

## Other Considerations

Finally, our study concludes that the truck control systems—NAFITH-TCS and FTZ-TCS—and the TCIMS give Jordan a competitive advantage in attracting foreign investment and

promoting economic growth. The project provides the Aqaba-Amman corridor and the Syria-Jordan FTZ with the efficiency and reliability needed to remain internationally competitive.

The majority of trucking companies and drivers agree that the TCS increases their efficiency and the efficiency of the port terminals as well. Trucking costs to and from inland points have dropped significantly. The TCS has increased the efficiency and security of port infrastructure and trucking operations while minimizing the impact of truck traffic on residential, tourist, and commercial areas of Aqaba.

Most stakeholders interviewed agree that the TCS concept should be expanded to the entire Jordanian territory, and that the system should be operated by a private entity like Nafith.

## **Stakeholders' Testimonies**

*"The TCS concept should be expanded to the entire Jordanian territory, and that the system should be operated by a private entity like Nafith".*

*"The TCS in Aqaba has increased truck drivers efficiency and the efficiency of the port terminals".*

*"The TCS has increased the efficiency and security of port infrastructure and trucking operations while minimizing the impact of truck traffic on residential, tourist, and commercial areas of Aqaba".*

*"The NAFITH-TCS has contributed to reduce traffic accidents in the Aqaba Zone. Before Nafith, truck drivers speeded to gain a better position in the waiting queue".*

*"We feel very comfortable with Nafith....."*

*"Nafith: big solution".*

*"The Nafith system still has a lot of capacity to grow without investment"*

*"Nafith has improved the trade competitiveness of Jordan. From random to a well organized efficient system."*

*"Nafith, a very Successful Tool".*

*"Nafith has eliminated corruption".*

*"Nafith has benefited all the transportation chain".*

**Appendix A. Summary of  
Interviews with Stakeholders**

Interview 1 Amman  
December 6, 2010  
Ministry of Transport  
Road Freight Directorate  
Doc. Abdullah Shawareh  
Eng Zuhair F. Hattar

1. The New Transport Law, enacted in 2006, opened the local freight transport market to competition, eliminated subsidies, and enforced registration of service providers (trucking companies).
2. The regulatory formwork in Jordan switched from fixed rates in 2003 to a non tariff regulated environment.
3. Pre Nafith Conditions:
  - No chance to choose service provider, queuing system.
  - Fixed tariffs.
  - Random Queuing.
  - 2 shifts morning and evening.
  - The Port announces 300 loads and the queue dispatcher send 300 trucks at the same time.
  - Frequently no match of truck with cargo having frequently safety issues.
  - No established companies promoted stole goods.
  - Strikes, no reliability, no certainty on time, corruption on the queue.
  - No commitment to deliver on time (problem with perishables).
  - No incentives to modernize the fleet or to expedite service.
4. Nafith Benefits:
  - Restrictions to enter Aqaba.
  - Coordination among users, service providers, and authorities.
  - Incentives to eliminate old trucks.
  - Organized system.
  - Reduced Accidents and Pollution.
  - 9 categories of freight and trucks.
  - Transparency and accountability.
5. Overcapacity: Increase of number of trucks (no elimination of old trucks), decrease in cargo volume.
6. Operating costs higher than prices.
7. Time pre Nafith: 2 day turnaround in and out of the ports. 4 trips per month. Now 8 trips per month.
8. Aqaba has a market share of 80% of Jordan trade.
9. In SJFTZ the owner of the TCS is the government.
10. Expected new projects in the region: Rail linking neighboring countries and inland port in Amman.
11. Operations committee: authorities, Nafith, Users, Customs.
12. MoT is looking for licensed individuals (individual truckers) not just companies.
13. Expand the regulation and the TCS to the entire country.

Interview 2 Amman  
December 6, 2010  
Truckers Drivers Association  
Mr. Mohammad Dawood

1. Pre Nafith Conditions:
  - Trucks spent 3-4 day in the queue (Parking waiting zone).
  - Unified queue for all trucks.
  - Morning and evening shifts: released 300 trucks into the port at the same time.
  - No coordination between truck and terminal activities.
  - 10 days per cycle (3 trips per month).
  - No waiting to unload. But congestion also affected access to loaded trucks.
2. Nafith Benefits:
  - Nafith TCS is a very useful and practical solution to an old problem.
  - 60% save in time.
  - Congestion and uncertainty has been eliminated.
  - 6 day per cycle (5 trips per month).
  - Truck access to terminals only when freight and capacity are available.
  - 2 – 3% fuel savings with Nafith.
3. “We feel very comfortable with Nafith but the Government and the New Law are promoting too much competition in Jordan”.
4. Operating margins for truckers and trucking companies are too low or even negative.
  - Round trip fuel cost 200-250 JD.
  - 5-6-years used truck cost about USD\$60,000 and has a useful life of additional 5-6 years.
  - Container 270 JD revenue per box, 200JD fuel cost, 30JD cost of driver.
  - Petroleum (30 tons) revenue 330 JD, Driver 40 JD.
  - Petroleum (40 tons) revenue 460 JD, Driver 40 JD.
5. Aqaba represents 85% of all Jordan foreign trade.
6. Freight transport market in Jordan is expected to have no growth in next 2-5 years.
7. Petroleum and grains government auctions (big companies) define the market conditions in Jordan.

Interview 3 Amman  
December 6, 2010  
Transport Company

1. Before liberalization:
  - 50-year old Government Company was in charge of organizing transport in Jordan.
  - Single queue for all trucks.
  - No coordination between truck and terminal activities.
  - 4-day turnaround time.
  - Only 3 trucking companies.
2. Nafith Benefits:
  - Limited corruption.
  - Better coordination.
  - Now they can give better service to their clients.
  - Alleviated congestion in the port.
  - 18-24 hour turnaround.
3. New Law too much competition in Jordan:200 trucking companies.
4. Operating margins for trucking companies are very low.
5. Freight transport market in Jordan is expected to have no little growth in next 2-5 years.
6. The petroleum and grains government auctions define the transport market conditions in Jordan. No company can do this by its own. They bid and then subcontract other companies.
7. Round Trip Aqaba-Amman operating cost 240-260 JD: Driver, Diesel, Nafith, port/weight station, insurance, and truck depreciation.
8. Unbalanced trade flows. Imports 90% and exports 10%.
9. SJFTZ problems:
  - No yard.
  - Open 7:00 am to 3:00 pm.
  - Only control over the Jordan side.
  - Only one gate.
  - Nafith does not control the door.
10. Trade in Jordan is going to have a very slow growth trend due to recuperation of the Iraq transport sector.

Interview 4 Amman  
December 7, 2010  
Syria-Jordan Free Trade Zone  
Mr. Khaled Rahahleh

1. The SJFTZ-TCS started operations in March 2010.
2. The system is operated by the MoT.
3. Only 5 companies are allowed into the FTZ.
4. Before fixed price, now open market subject to demand/supply.
5. The System needs to get rid of old trucks to avoid over demand.
6. Before the TCS:
  - Some truckers get permit to access and end up with other customer (investors).
  - The conditions of the load and destination were not known.
  - Trucks waiting outside the FTZ were obstructing the access, narrow Gate and 5 KM of narrow road.
7. Now there is no queue and each trucker knows before entering the FTZ his client, type of cargo, and final destination.
8. The Jordanian Import Market: JSFTZ 35%, Aqaba 30% and the rest Saudi Arabia and Iraq.
9. The Jordanian Export Market: JSFTZ cars coming from Aqaba, Aqaba 50% and the rest Saudi Arabia and Iraq.
10. The SJFTZ-TCS average turnaround time (in and out) has improved about 4-6 hours.
11. A marshaling yard is required, companies have no yard.
12. Users lease land inside and own their warehouse.
13. The FTZ is at 50% capacity.
14. Syria works with a National System to organize trade; where all truckers are registered.
15. Destination of Imports of the FTZ: 70% Amman, 10% Zarga, and 20% Iraq

Interview 5 Port of Aqaba  
December 8, 2010  
Aqaba Special Economic Zone  
Mr Raed Dhiat  
Truck Control System Manager

1. Aqaba is a major contributor to trade in Jordan.
2. Before Nafith:
  - There were two queues one at the entrance of the port and the one at each terminal.
  - Trucks spent weeks waiting for service.
  - Random queuing and loading.
  - 40 Loading points in Aqaba
  - 2500 trucks daily in to the city randomly.
  - The system allowed a lot of corruption (lobbing) to advance in the queue.
  - Congestion and pollution inside the port.
  - Lot of accidents due truck speeding to gain a place in the queue.
  - 100 trucks were rushing to the terminal and just 50 have a loads assigned. The trucks with no load were obstructing the trucks with loads.
  - A vessel with 70 truckloads requested 100 trucks so 30 were with no load obstructing the process.
  - Trucks spent more than 2 days inside the port for loading.
  - 2 shifts per day: 10-11 am and 6-7 pm for clearing loads.
3. MTO liberalized the market to be competitive.
4. Liberalization of transport has improved competitiveness for users; they can choose most convenient transport company.
5. Nafith big solution.
6. Marshaling yard by truck mode (product).
7. Approximate cost of yards 10 million JD.
8. Port terminals have improved in parallel to Nafith.
9. 80% timesaving.
10. Still some inefficiency: Clearance agents operate in a batch system not in continuous way. Frequently shipping agents are not available to process exports. ASEZA needs to establish benchmarks.
11. Capacity is given by the terminals (potential bottlenecks).
12. There are 13,000 trucks in Jordan; regulation is promoting the use of new truck, but old truck still operating.
13. The Nafith system still has a lot of capacity without investment.
14. The situation of the Iraqi economy/transport system (self sustainability) can affect sustainably the future demand in the Aqaba port.
15. Trade in Jordan is going to have a slow growth trend.
16. Strategic projects in the future: Complete the rail network with the neighboring countries, creation of dry ports and multimodal facilities.
17. Changes started 10 years ago have been flourishing in recent years.

Interview 6 Port of Aqaba  
December 8, 2010  
Customs Aqaba Special Economic Zone  
Mr. Mohannad Ma'aitah

1. Nafith Benefits: control/management of traffic, smuggling fight, and follow truck movements.
2. 3000 vehicles per day.
3. 4 main border points: Saudi Arabia, Ferry (Egypt) Israel, and airport.
4. 2 checkpoints for Jordan territory.
5. Their systems are integrated with Nafith system.
6. If the driver does not follow instructions raise a red flag. The permit saves all the information.
7. The customs clearing process finishes before the truck enters the system. Customs has no benefits from Nafith to expedite the customs clearing process, but helps to track the entrance and exit of trucks. The system has information of drives, truck, freight, time, and shipper.
8. The beneficiary is the owner of the cargo and the cargo service provider.
9. Nafith has improved the trade competitiveness of Jordan. From random to a well organized efficient system.
10. Aqaba it the only port entry for containers. All other entry points process containers as general cargo. Cargo is unloaded at the port of entry.
11. Trucks only move for load and unload.
12. Nafith has benefited all the transportation chain.
13. Customs clearing time is about 2-3 hours; it depends on clearing agent, product, origin, and destination. Before customs Health, Q/A are cleared.
14. Red, yellow, green. Less than 30% are red. Green takes 30 minutes.
15. The container terminal customs cleared during November 15, 250 Imports and 6,000 exports.
16. The GPS technology is already operating for transit containers between Saudi Arabia and Syria in high risk good like tobacco and alcohol.

Interview 7 Port of Aqaba  
December 8, 2010  
Clearing Agent Aqaba Special Economic Zone  
Mr Raed Dhiat

1. Before 2 shifts for loading or unloading.
2. Trucks spend 2 and 2.5 day queuing in front of the terminal.
3. Besides these 2 shift in theory trucks were not authorized to get into the port.
4. Grains, sugar, rice are still loaded directly to the truck. They need to wait to the shift.
5. The process started with a manual “unified queue” out of the port that can take from 1 to 7 days. And they send inside the port: General cargo 1 day; direct load 6 hours; and containers 2-3 days.
6. He is expecting a growing market in the long term; however he expects a decrease in the short term because Iraq cargo is decreasing.

Interview 8 Port of Aqaba  
December 8, 2010  
Aqaba Container Terminal  
Mr. Adbee Sartawi

1. Nafith a very Successful Tool.
2. Terminal Capacity 4000 Containers per day, 850,000 per year.
3. Currently Operating 5,000 TEUs per month.
4. 10,000 TEUs peak month.
5. They have by law 9 day free time storage, so in average about 8 day dwelling time; customs take 2-3 days.
6. Before there was no terminal operating system. 20 days dwelling time.
7. Efficiency has improved from 12 TEUs per hour to 32 TEUs per hour.
8. 2009 675,000 TEUs.
9. 2008 15% increase.
10. 2007 42% increase.
11. 2004 132% increase.
12. Master plan to increase static capacity. The bottleneck is customs that requires a lot of yard capacity.
13. ASEZA plans to relocate the phosphate terminal out of the Aqaba Port is going to give some space.
14. The market is growing. Iraq is fundamental, 30% -40% of Jordan trade. A downturn will cause a domino effect.

Interview 9 Aqaba  
December 8, 2010  
Transport Company  
Mr. Mohamed Khalil Al-Majali

1. They were suffering before Nafith:
  - 3-day to get the load.
  - After the manual queue (2 days) it takes 1 day (24 hours) to get the load. Before 10 days per cycle (3 trips per month).
  - Permanent congestion problems in Aqaba and port terminals gates.
  - Long queues and high truck transport costs.
  - Pollution, noise, traffic congestion.
  - No performance measurements.
  - Before Nafith 48-72 hours turnaround, now 12 hours turnarounds.
2. Now only get into Aqaba if they have a load.
3. No waiting to unload.
4. Nafith has eliminated corruption.
5. Good relationship with Nafith.
6. They able to provide better service to their customers.
7. Different cargo categories: grain, general cargo, containers, RoRo, vegetable oil, heavy loads, crude oil.
8. Their garage is in Amman – Maintenance in Rashdiah.
9. 10 trips per month before and now 25 trips per month.
10. Operating costs have decreased but competition has affected operating margins significantly:
  - Fuel per trip 350 liters of diesel. Now up to 5% savings.
  - Driver and other cost 60-75 JD.
  - 25 JD consumables per trip.
  - Trucking companies have no margin at all in container operations.
  - A 5-year old truck costs 35,000-37,000 JD and have 7 year duration. High operating and maintenance cost.
  - A New truck costs 120,000 Euros. Low operating and maintenance cost.

## **Appendix B. Nathan's Traffic Projection**

## Exhibit B-1. Imported-Goods Projection in Aqaba

Goods Imported Via Port of Aqaba	Historical							Estimated	Projected					ACGR
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
General Cargo and Containers														
Cars	227,627	313,902	183,194	152,443	630,770	723,353	728,349	728,349	744,373	760,749	777,485	794,590	812,071	1.8%
Sulphate	378,834	560,084	587,376	669,179	415,588	338,271	486,375	486,375	497,075	508,011	519,187	530,609	542,283	1.8%
Timber	150,018	212,445	242,661	212,911	256,651	185,792	110,542	110,542	116,830	124,522	133,626	141,858	150,315	5.3%
Steel	142,975	196,992	133,967	119,182	162,934	103,116	92,130	92,130	97,371	103,781	111,369	118,230	125,279	5.3%
Frozen	79,825	100,014	129,193	113,138	40,819	56,702	49,443	49,443	50,531	51,642	52,779	53,940	55,126	1.8%
Food	219,748	211,475	156,540	158,070	124,233	142,495	45,383	45,383	46,381	47,402	48,445	49,510	50,600	1.8%
Sugar	160,682	203,953	238,634	153,276	89,713	7,962	25,881	25,881	26,450	27,032	27,627	28,235	28,856	1.8%
Cattle	38,831	45,245	25,326	37,850	31,914	14,215	22,185	22,185	22,673	23,172	23,682	24,203	24,735	1.8%
Construction	3,961	1,650	7,314	1,938	2,418	56,690	20,795	20,795	21,978	23,425	25,138	26,686	28,277	5.3%
Gov	35,595	23,168	14,578	7,211	4,139	3,877	4,600	4,600	4,862	5,182	5,561	5,903	6,255	5.3%
Fertilizers	6,815	5,070	6,739	6,687	880		761	4,492	4,591	4,692	4,795	4,901	5,008	36.9%
Potatoes	1,875	1,653	1,918	617	137	14,366	397	2,995	3,061	3,128	3,197	3,267	3,339	42.6%
Tires	53,719	22,695	22,140	18,704	3,019	321		20,100	20,542	20,994	21,456	21,928	22,410	
Other	1,463,299	183,424	1,642,141	489,222	573,805	480,850	523,643	523,643	535,163	546,937	558,969	571,267	583,835	1.8%
Sub Total	2,963,804	2,081,770	3,391,721	2,140,428	2,337,020	2,128,010	2,110,484	2,136,912	2,191,880	2,250,668	2,313,314	2,375,127	2,438,389	2.4%
Grains and Cereals														
Grains	1,155,016	1,490,797	1,568,826	1,424,268	1,834,716	1,785,608	1,469,799	1,566,438	1,600,900	1,636,120	1,672,114	1,708,901	1,746,497	2.9%
Rice	171,990	102,099	186,803	109,833	58,665	21,756	11,863	96,799	98,929	101,105	103,330	105,603	107,926	44.5%
Sesame Beans	14,893	14,023	19,741	15,055	4,338	3,113	2,081	10,694	10,929	11,169	11,415	11,666	11,923	33.8%
Tea/Coffee	20,866	24,022	23,339	10,263	449	881	1,457	11,866	12,128	12,394	12,667	12,946	13,230	44.4%
Flour	4,461	9,741	2,136	3,616	1,061	49,880	170	10,375	10,604	10,837	11,075	11,319	11,568	102.1%
Others					122,778	97,155	33,177	86,226	88,123	90,062	92,043	94,068	96,138	19.4%
Sub Total	1,367,226	1,640,682	1,800,845	1,563,035	2,022,007	1,958,393	1,518,547	1,782,399	1,821,612	1,861,688	1,902,645	1,944,503	1,987,282	4.6%
Liquid Bulk														
Gas	157,962	179,034	226,479	173,781	233,295	191,310	235,825	241,013	246,315	251,734	257,273	262,933	268,717	2.2%
Ammonia	115,432	229,991	198,238	232,584	227,071	206,279	197,038	201,373	205,803	210,331	214,958	219,687	224,520	2.2%
Min.Oil	17,927	21,161	24,014	12,601	15,254	23,510	26,428	27,009	27,604	28,211	28,832	29,466	30,114	2.2%
Veg. Oil	177,177	293,331	269,632	224,821	78,809	150,524	88,600	90,549	92,541	94,577	96,658	98,784	100,958	2.2%
Others	3,830,741	5,055,129	5,702,549	5,142,520	5,393,964	4,507,051	4,125,474	4,216,234	4,308,992	4,403,789	4,500,673	4,599,688	4,700,881	2.2%
Sub Total	4,299,239	5,778,646	6,420,912	5,786,307	5,948,393	5,078,674	4,673,365	4,776,179	4,881,255	4,988,643	5,098,393	5,210,557	5,325,190	2.2%
Total	8,630,269	9,501,098	11,613,478	9,489,770	10,307,420	9,165,077	8,302,396	8,695,491	8,894,747	9,100,998	9,314,352	9,530,187	9,750,861	2.8%

Source: Nathan estimations.

## Exhibit B-2. Transit Goods Projection in Aqaba

Transit Goods Imported via Aqaba Port	Historical							Estimated	Projected					ACGR
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Saudi Arabia					133,366	138,014	138,701	138,701	141,448	144,249	147,106	150,020	152,991	1.6%
Syria					59,964	47,218	70,530	70,530	76,492	82,958	89,970	97,575	105,823	7.0%
Iraq					144,536	113,603	70,021	70,021	70,021	70,021	70,021	70,021	70,021	0.0%
Kuwait					26,661	19,607	19,756	19,756	19,756	19,756	19,756	19,756	19,756	0.0%
UAE					8,096	6,771	4,699	4,699	4,699	4,699	4,699	4,699	4,699	0.0%
Lebanon					1,745	3,736	2,357	2,357	2,739	3,184	3,700	4,300	4,998	13.3%
Israel							414	414	414	414	414	414	414	0.0%
Yemen					350		345	345	345	345	345	345	345	0.0%
Palestine							40	-	-	-	-	-	-	
Others					11,965	12,731	137,256	137,256	137,256	137,256	137,256	137,256	137,256	0.0%
Total					386,683	341,720	444,079	444,079	453,170	462,882	473,268	484,386	496,303	1.9%

Source: Nathan estimations

## Exhibit B-3. Exported-Goods Projection in Aqaba

Goods Exported Via Port of Aqaba	Historical							Estimated	Projected					ACGR
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Cement	116724													
Phosphate	3,671,570	4,665,955	4,006,311	3,254,305	3,604,329	3,975,840	3,248,075	3,345,517	3,550,582	3,802,484	4,102,066	4,374,393	4,655,413	6.2%
Fertilizers	993,815	1,159,243	1,060,636	1,157,822	1,055,250	968,637	971,713	1,000,864	1,062,213	1,137,573	1,227,198	1,308,669	1,392,740	6.2%
Potash	1,932,030	1,760,970	1,570,580	1,372,415	1,573,560	1,565,329	825,551	850,318	902,438	966,463	1,042,607	1,111,823	1,183,249	6.2%
Other	644,795	315,795	350,701	782,575	934,074	852,373	643,055	662,347	702,945	752,817	812,128	866,044	921,680	6.2%
Re Export	16	1,407	1,246	12,459	11,198	66,114	58,273	60,021	63,700	68,220	73,594	78,480	83,522	6.2%
Other	251,462	5,700	17,124	293,082	186,025	248,050	5,062	5,214	5,533	5,926	6,393	6,817	7,255	6.2%
Trans shipment	3,489	8,799	10,981	118		98		-	-	-	-	-	-	
Containers	589,294	796,072	889,322					-	-	-	-	-	-	
Transit	36,685	56,946	91,439	147,615	130,592	110,743	147,214	151,630	160,925	172,342	185,920	198,263	210,999	6.2%
Sub Total	8,239,880	8,770,887	7,998,340	7,020,391	7,495,028	7,787,184	5,898,943	6,075,911	6,448,337	6,905,824	7,449,906	7,944,488	8,454,859	6.2%
Transit			103,000	148,000	131,000	111,000	147,000	155,719	164,954	174,738	185,101	196,080	207,709	5.9%

Source: Nathan estimations

**Exhibit B-4. Imported and Exported Goods Projection Summary (Aqaba)**

Summary Concept	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	ACGR
	Historical							Estimated	Projected					
<b>Imports</b>	8,630,269	9,501,098	11,613,478	9,489,770	10,307,420	9,165,077	8,302,396	8,695,491	8,894,747	9,100,998	9,314,352	9,530,187	9,750,861	2.72%
National					9,920,737	8,823,357	7,858,317	8,251,412	8,441,577	8,638,116	8,841,084	9,045,801	9,254,558	2.76%
Transit					386,683	341,720	444,079	444,079	453,170	462,882	473,268	484,386	496,303	1.87%
<b>Exports</b>	8,239,880	8,770,887	7,998,340	7,020,391	7,495,028	7,787,184	5,898,943	6,075,911	6,448,337	6,905,824	7,449,906	7,944,488	8,454,859	6.18%
National					7,364,028	7,676,184	5,751,943	5,920,193	6,283,383	6,731,087	7,264,805	7,748,409	8,247,150	6.19%
Transit					131,000	111,000	147,000	155,719	164,954	174,738	185,101	196,080	207,709	5.93%
<b>TOTAL</b>	<b>16,870,149</b>	<b>18,271,985</b>	<b>19,611,818</b>	<b>16,510,161</b>	<b>17,802,448</b>	<b>16,952,261</b>	<b>14,201,339</b>	<b>14,771,402</b>	<b>15,343,084</b>	<b>16,006,823</b>	<b>16,764,258</b>	<b>17,474,675</b>	<b>18,205,720</b>	<b>4.23%</b>

Source: Nathan estimations.

# **Appendix C. Nathan's Benefit-Cost Calculations**

**Exhibit C-1. Number of Permits and Time Saving Assumptions Summary (NAFITH-TCS)**

Concept	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Historical				Estimated	Projected				
Imports	9,489,770	10,307,420	9,165,077	8,302,396	8,695,491	8,894,747	9,100,998	9,314,352	9,530,187	9,750,861
Exports	7,020,391	7,495,028	7,787,184	5,898,943	6,075,911	6,448,337	6,905,824	7,449,906	7,944,488	8,454,859
Total Tons	16,510,161	17,802,448	16,952,261	14,201,339	14,771,402	15,343,084	16,006,823	16,764,258	17,474,675	18,205,720
Tons/per truck	22	22	22	22	22	22	22	22	22	22
Number of Truck Loads	750,462	809,202	770,557	645,515	671,427	697,413	727,583	762,012	794,303	827,533
Loaded/empty factor	1	0.82	1.05	1.25	1.23	1.25	1.25	1.25	1.25	1.25
Total Number of Permits	736,550	660,376	811,039	804,272	823,994	871,766	909,479	952,515	992,879	1,034,416
Total Number of Permits			811,039	804,272	823,994	855,884	909,479	952,515	992,879	1,034,416
Average Permits per day	2,046	1,834	2,253	2,234	2,289	2,422	2,526	2,646	2,758	2,873
Single Movement Permits	428,906	384,548	472,282	428,466	501,179	536,457	559,664	586,147	610,986	636,547
Double Movement Permits	307,644	275,828	338,757	375,806	322,815	335,309	349,814	366,367	381,893	397,869
Total Number of Permits	736,550	660,376	811,039	804,272	823,994	871,766	909,479	952,515	992,879	1,034,416
Without Project Turnaround Upper (hrs)	36	36	36	36	36	36	36	36	36	36
Without Project Turnaround Lower (hrs)	24	24	24	24	24	24	24	24	24	24
With Project Turnaround (hrs)	19	16	17	16	15	13	12	12	12	12
Time Savings per Permit Upper (hrs)	17	20	19	20	21	23	24	24	24	24
Time Savings per Permit Lower (hrs)	5	8	7	8	9	11	12	12	12	12
Total Savings Upper (hrs)	12,519,219	13,296,777	15,698,505	15,730,844	17,498,193	20,050,621	21,827,485	22,860,351	23,829,103	24,825,981
Total Savings Lower (hrs)	3,680,619	5,372,265	5,966,037	6,079,580	7,610,262	9,589,427	10,913,743	11,430,176	11,914,551	12,412,991

Source: Nathan estimations.

## Exhibit C-2. Economic Benefits Calculation Summary (NAFITH-TCS)

I. Benefits for Users USD	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	NPV
	Historical				Estimated	Projected					
Truck Cost per hour	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
Other Operating Costs per hour	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Driver Cost per Hour	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	
Fuel Savings per Trip	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	
Truck Cost Savings	4,259,976	6,217,900	6,905,135	7,036,551	8,808,174	11,098,874	12,631,647	13,229,370	13,789,990	14,366,887	\$73,351,914
Other Operating Costs Savings	1,703,990	2,487,160	2,762,054	2,814,620	3,523,270	4,439,550	5,052,659	5,291,748	5,515,996	5,746,755	\$29,340,765
Driver Cost Savings	4,459,212	6,508,706	7,228,083	7,365,645	9,220,126	11,617,960	13,222,419	13,848,098	14,434,937	15,038,816	\$76,782,526
Fuel Cost Savings	3,717,368	3,332,918	4,093,314	4,059,161	4,158,699	4,399,804	4,590,138	4,807,341	5,011,062	5,220,697	\$32,848,867
Accidents Reduction	1,823,305	1,823,305	1,823,305	1,925,410	1,971,620	2,068,301	2,185,692	2,323,453	2,446,852	2,572,605	\$15,919,177
	15,963,851	20,369,989	22,811,891	23,201,388	27,681,888	33,624,489	37,682,555	39,500,010	41,198,837	42,945,760	\$228,243,249
<b>II. Benefits for Non-Users</b>											
Elimination of Congestion	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	NPV
	Historical				Estimated	Projected					
Number of Vehicles in Aqaba	6,000	7,034	7,505	7,762	7,933	8,107	8,286	8,468	8,654	8,845	
Average Trips per day	3	3	3	3	3	3	3	3	3	3	
Duration per Trip (hours)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Time Savings	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
Total Savings in Hours	324,000	379,836	405,270	419,148	428,369	437,793	447,425	457,268	467,328	477,609	
Cost of Time	1,308,462	1,533,953	1,636,667	1,692,713	1,729,953	1,768,012	1,806,908	1,846,660	1,887,286	1,928,807	\$12,931,138
Cost of Vehicle	112,500	131,888	140,719	145,538	148,739	152,012	155,356	158,774	162,267	165,837	\$1,111,804
Operating Costs	45,000	52,755	56,288	58,215	59,496	60,805	62,142	63,509	64,907	66,335	\$444,722
Cost of Fuel	272,160	319,062	340,427	352,084	359,830	367,746	375,837	384,105	392,556	401,192	\$2,689,677
Accidents Reduction	168,205	168,205	168,205	177,624	181,887	190,806	201,636	214,345	225,728	237,329	\$1,468,585
	1,906,326	2,205,862	2,342,305	2,426,174	2,479,905	2,539,380	2,601,879	2,667,393	2,732,744	2,799,499	\$18,645,926
<b>Total Economic Benefits</b>	<b>17,870,178</b>	<b>22,575,851</b>	<b>25,154,196</b>	<b>25,627,562</b>	<b>30,161,793</b>	<b>36,163,869</b>	<b>40,284,433</b>	<b>42,167,403</b>	<b>43,931,581</b>	<b>45,745,260</b>	<b>246,889,175</b>

Source: Nathan estimations.

**Exhibit C-3. Economic Costs Calculation Summary (NAFITH-TCS)**

III. Economic Cost for Users	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	NPV
Nafith Fee	Historical				Estimated	Projected					(2006-2015)
Total Permits	736,550	660,376	811,039	804,272	823,994	871,766	909,479	952,515	992,879	1,034,416	
Double Movements	307,644	275,828	338,757	375,806	322,815	335,309	349,814	366,367	381,893	397,869	
Single Movements	428,906	384,548	472,282	428,466	501,179	536,457	559,664	586,147	610,986	636,547	
Cost for Users											
Double Movements	1,615,132	1,448,095	1,778,474	1,972,982	1,694,780	1,760,371	1,836,525	1,923,428	2,004,937	2,088,813	\$13,753,658
Single Movements	750,585	672,960	826,494	749,816	877,063	938,800	979,413	1,025,758	1,069,226	1,113,957	\$6,805,484
<b>Total Economic Costs for Users</b>	<b>2,365,717</b>	<b>2,121,055</b>	<b>2,604,968</b>	<b>2,722,797</b>	<b>2,571,843</b>	<b>2,699,172</b>	<b>2,815,937</b>	<b>2,949,186</b>	<b>3,074,164</b>	<b>3,202,770</b>	<b>\$20,559,143</b>
IV. Economic Cost for Government	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	NPV
Total Investments	Historical				Estimated	Projected					(2006-2015)
Infrastructure and Buildings	-	-	-	-	-	-	-	-	-	-	\$11,920,557
Expansion and Major Rehabilitation	-	-	-	-	-	9,450,000	-	-	-	-	\$6,410,825
Maintenance	630,000	630,000	630,000	630,000	630,000	630,000	630,000	630,000	630,000	630,000	\$4,773,831
Expenses of human resources and operationa	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	2,800,000	\$23,866,039
<b>Total Economic Costs for Government</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>12,880,000</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>3,430,000</b>	<b>\$46,971,252</b>
<b>Total Economic Costs</b>	<b>5,795,717</b>	<b>5,551,055</b>	<b>6,034,968</b>	<b>6,152,797</b>	<b>6,001,843</b>	<b>15,579,172</b>	<b>6,245,937</b>	<b>6,379,186</b>	<b>6,504,164</b>	<b>6,632,770</b>	<b>67,530,395</b>

Source: Nathan estimations.

**Exhibit C-4. Net Economic Benefits Summary (NAFITH-TCS)**

<b>Total Net Economic Benefits (Costs)</b>	<b>12,074,460</b>	<b>17,024,796</b>	<b>19,119,229</b>	<b>19,474,765</b>	<b>24,159,950</b>	<b>20,584,697</b>	<b>34,038,496</b>	<b>35,788,217</b>	<b>37,427,418</b>	<b>39,112,490</b>	<b>179,358,780</b>
<b>Economic Internal Rate of Return</b>	<b>100.5%</b>										
<b>Benefit/Cost Index</b>	<b>3.7</b>										

Source: Nathan estimations.

## Exhibit C-5. Number of Permits and Time Saving Assumptions Summary (SJFTZ-TCS)

Concept	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Estimated	Projected									
Total Number of Permits	15,862	31,724	46,008	49,633	52,928	56,328	59,848	63,589	67,563	71,786	76,273
Relative Size Compared to Aqaba		3.6%	5.1%	5.2%	5.3%	5.4%	5.6%	5.7%	5.8%	5.9%	6.0%
Average Permits per day	44	88	128	138	147	156	166	177	188	199	212
Single Movement Permits	8,450	24,025	37,976	41,221	44,160	47,193	50,335	53,678	57,234	61,017	65,040
Double Movement Permits	7,412	7,699	8,032	8,412	8,768	9,135	9,513	9,911	10,329	10,769	11,232
Total Number of Permits	15,862	31,724	46,008	49,633	52,928	56,328	59,848	63,589	67,563	71,786	76,273
Without Project Turnaround Upper (hrs)	36	36	36	36	36	36	36	36	36	36	36
Without Project Turnaround Lower (hrs)	34	34	34	34	34	34	34	34	34	34	34
With Project Turnaround (hrs)	30	30	30	30	30	30	30	30	30	30	30
Time Savings per Permit Upper (hrs)	6	6	6	6	6	6	6	6	6	6	6
Time Savings per Permit Lower (hrs)	4	4	4	4	4	4	4	4	4	4	4
Total Savings Upper (hrs)	95,172	190,344	276,048	297,797	317,567	337,968	359,091	381,534	405,380	430,716	457,636
Total Savings Lower (hrs)	63,448	126,896	184,032	198,531	211,711	225,312	239,394	254,356	270,253	287,144	305,091

**Exhibit C-6. Economic Benefits Calculation Summary (SJFTZ-TCS)**

I. Benefits for Users USD	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV	
	Estimated	Projected											(2011-2020)
Truck Cost per hour		1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
Other Operating Costs per hour		40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Driver Cost per Hour		1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	
Fuel Savings per Trip		2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	
Truck Cost Savings	-	146,870	213,000	229,781	245,036	260,778	277,076	294,394	312,793	332,343	353,114		\$1,818,295
Other Operating Costs Savings	-	58,748	85,200	91,913	98,014	104,311	110,831	117,757	125,117	132,937	141,246		\$727,318
Driver Cost Savings	-	153,739	222,962	240,528	256,496	272,974	290,035	308,162	327,422	347,886	369,629		\$1,903,336
Fuel Cost Savings	-	36,597	53,075	57,256	61,057	64,980	69,041	73,356	77,941	82,812	87,988		\$453,078
Accidents Reduction	-	71,748	104,630	113,890	123,857	133,241	142,924	153,050	163,832	175,308	187,518		\$930,765
	-	467,703	678,866	733,369	784,461	836,283	889,907	946,719	1,007,106	1,071,287	1,139,495		\$5,832,792
<b>II. Benefits for Non-Users</b>													
Elimination of Congestion	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV	
	Estimated	Projected											(2011-2020)
Number of Vehicles in the SYFTZ	776	793	811	829	847	865	884	904	924	944	965		
Average Trips per day		3	3	3	3	3	3	3	3	3	3		
Duration per Trip (hours)		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		
Time Savings		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%		
Total Savings in Hours		42,837	43,779	44,742	45,727	46,733	47,761	48,812	49,886	50,983	52,105		
Cost of Time	-	172,995	176,801	180,691	184,666	188,729	192,881	197,124	201,461	205,893	210,423		\$1,336,939
Cost of Vehicle	-	14,874	15,201	15,536	15,877	16,227	16,584	16,948	17,321	17,702	18,092		\$114,948
Operating Costs	-	5,950	6,080	6,214	6,351	6,491	6,633	6,779	6,929	7,081	7,237		\$45,979
Cost of Fuel	-	35,983	36,775	37,584	38,411	39,256	40,119	41,002	41,904	42,826	43,768		\$278,083
Accidents Reduction	-	6,619	9,652	10,507	11,426	12,292	13,185	14,119	15,114	16,173	17,299		\$85,865
	-	236,421	244,510	250,531	256,731	262,993	269,402	275,973	282,728	289,675	296,818		\$1,861,815
<b>Total Economic Benefits</b>	-	<b>704,124</b>	<b>923,376</b>	<b>983,899</b>	<b>1,041,192</b>	<b>1,099,277</b>	<b>1,159,309</b>	<b>1,222,692</b>	<b>1,289,834</b>	<b>1,360,961</b>	<b>1,436,313</b>		<b>7,694,607</b>



# **Appendix D. Photographic Record**

The Pre Nafith Situation



## Current Situation in Aqaba













