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List of abbreviations

ADC	Aqaba Development Corporation
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
AGC	European Agreement on Main International Railway Lines
AGTC	European Agreement on Important International Combined Transport Lines and Related Installations
AIG	Airport International Group
AMIA	Amman Marka International Airport
ARC	Aqaba Railway Corporation
ASEZ	Aqaba Special Economic Zone
ASEZA	Aqaba Special Economic Zone Authority
BRT	Bus Rapid Transit
CARC	Civil Aviation Regulatory Commission
CBA	Cost-Benefit Analysis
CNG	Compressed natural gas
CO_2	Carbon dioxide
DPL	Development Policy Loan
ETM	Electronic Ticket Machine
EU	European Union
EUR	Euro
GAM	Greater Amman Municipality
GCC	Gulf Cooperation Council
HGV	Heavy Good Vehicles
HMPS	Highway Master Plan Study
ICAO	International Civil Aviation Organization
IMF	International Monetary Fund
IT	Information technology
JAC	Jordan Airports Company
JBRIMP	Jordan Bus Restructuring Interim Master Plan
JD	Jordanian Dinar
JHR	Jordan Hejaz Railway

JHRC	Jordan Hejaz Railway Corporation
JMA	Jordan Maritime Authority
JNTS	Jordan National Transport Strategy
KHBT	King Hussein Bin Talal
KHIA	King Hussein International Airport
KPI	Key Performance Indicator
KSA	Kingdom of Saudi Arabia
LGV	Light Good Vehicles
LNG	Liquid Natural Gas
LPG	Liquid Petroleum Gas
LTRC	Land Transport Regularity Commission
MCA	Multi-Criteria Analysis
MENA	Middle East and North Africa
MoPIC	Ministry of Planning and International Cooperation
MoP-WH	Ministry of Public Works and Housing
MoT	Ministry of Transport
NOx	Nitrogen oxide
pax	passengers
PM	Particulate Matter
PPP	Private-public-partnership
PT	Public Transport
QAIA	Queen Alia International Airport
RORO	Roll-on/roll-off
RS	Reference Scenario
SBA	Stand-By Arrangement
TTF	Trade and Transport Facilitation
UAE	United Arab Emirates
USD/ US$	United States Dollar
VOC	Volatile Organic Compounds
WHO	World Health Organisation

Executive summary

Transport is a vital sector for the Jordanian economy and an important component of daily life of Jordanians. In the past decade, the country has heavily invested in expanding the road sector, which constitutes the backbone of the national transport system, improving urban transport, enhancing the logistic industry and the international connections.
In parallel, the transport sector has seen a gradual process of liberalisation, opening the market to private operators and private investors. To face these new tasks the institutional set up has been and is still being gradually transformed.

Transport demand, both passengers and freight is growing rapidly, due to a growing population and the economic development within the country and in the region. This growth is concentrated on parts of the transport networks, nearby the main urban areas and along the key corridors. As a consequence, parts of the networks are under pressure, and performances are below the needs. Without interventions, as shown by the forecast model, things will worsen and at the end of the next decade, the system will not be able to perform as needed to support Jordanian economy and daily life of citizens.
Unreliability and delays are going to increase, thus causing cost to people and business activities and at the end negatively affecting the economic performance of the Country. At the same time, the international financial crisis imposes serious constraints, at least on the short/medium terms, on financing and asks for a careful selection of investments in order to maximise the positive impacts and increase the efficiency of the entire transport system.

To keep path with the growing demand, the change patterns of national and international trade and the economic development, the government of the transport sector should give priority to actions in the more critical parts of the networks. These are network links and nodes with high demand and traffic flows reaching or exceeding capacity, as failures in these critical components can negatively influence a smooth economic and social growth. Consequently, the focus has to be on reduction of bottlenecks, increase of reliability, reduction of negative impacts (congestion, emissions, accidents, energy consumption).

The Long Term National Transport Strategy comes in the middle of this process and it is thus an opportunity to consolidate the results already achieved and to foster the process of modernisation of the transport system in order to fully support the economic development of the country. The proposed Strategy is a careful combination of policy measures designed to tackle these challenges, and is the final step of a long process of assessment, comparison and consultation with all the most important stakeholders.

The challenges that the transport sector has to face in the next years demand for a multimodal approach, within which each mode contributes to the achievement of the final goal of having a transport system that supports the economy and the people of Jordan. Multimodality requires a coordination between different modes, and cooperation between

different transport authorities. And this is exactly what the Strategy should do, build a consistent framework where all transport modes are interconnected and contribute as much as possible to a seamless transport system. However, it requires also a sophisticated mix of investment and policy measures, where policy measures should contribute to improve the performance of existing facilities and services and optimise the use of the future ones, to reduce social and environmental costs of transport, to reduce nonphysical barriers and to minimise financial needs in order to meet budget constraints.
Finally, the Strategy has to be flexible, in order to be able to cope with a difficult regional context.

The main philosophy beyond the Strategy is to let each mode play his role in the system in order to satisfy the transport demand within a framework of social, economic, financial and environmental sustainability.

This requires a different approach, moving from one that simply provides the infrastructure to satisfy the demand towards a more sophisticated one that tries to manage passengers and freight demand, and to match supply with demand. This new approach has to take the challenges into consideration that the transport system has to face: reduce pressure on the road sector by introducing new modes of transport for freight (e.g. railways and pipeline), and by revitalising public transport. This approach will be supported by a modernised port of Aqaba, a specialisation of the airport system and important policy measures.

The connection between Aqaba, the Amman area and later the border to Syria is the back bone of a railway system designed to intercept part of the long distance freight demand that otherwise would be using the roads. Moving freight from road to railway is not an easy task. It requires focussing on the full multimodal chain. Therefore, it demands a well-integrated system of interconnection between the port, the main logistic centers and the borders. Integration cannot be only physical but requires also smooth procedures, for instance at border crossings in strict connection with the Trade and Transport Facilitation Strategy. The new railway network, as part of the newly proposed multimodal Red Sea - Black Sea “landbridge” transport corridor, denotes a clear commitment of integrating Jordan within the region not only by road transport, but also by railway connections.

Policy measures are also required to increase the attractiveness of the railway in comparison with the road. The proposal, to introduce a pricing policy for road users, initially only for trucks but on the long term also for cars is a leverage not only to increase funding capacity for the road sector, and potentially become attractive for private investors, but also to push part of the demand toward the rail mode by making the road transport on highways more expensive. It is not only road pricing that can help the railway to reach a level of patronage over freight traffic that justifies the huge investment. As said before, a good connection at the Aqaba port, with dedicated transhipment terminals designed to reduce time and risk of damaging is a prerequisite for an efficient railway. The same is true for the dry ports, whose completion should be strictly coordinated with the development of the rail network.

A system in which the railway can play an important role is also a system where the truck industry satisfies some standard requirements. This can be achieved through a set of policies that help improving the truck fleet, by purchasing the older trucks and re-export or scrap and by imposing registration fees that are increasing according to the age of the vehicles.

The railway project, together with the pipeline, will free capacity on the road by reducing the number of long distance trucks and thus contribute to reduce the needs to invest in the road sector in line with the founding pillar of the Strategy to complete the existing network and to make the best use of the existing facilities. Higher importance is given to maintenance and safety-enhancing measures of the existing network, rather than investments in new roads or major improvements. The latter have been carefully selected and phased according to model results, to focus the investments only where they are really needed. This approach is also motivated by the need of optimising the available financial resources and the decision of developing a competitive and more environmental sustainable alternative to private transport.

Enhancing the use of public transport by improving the quality of the services provided is another main building block of the multimodal strategy. Public transport cannot only be a residual mode for those people that have no access to the private car. Additionally, it has to be able to attract new passengers because the services provided are of high quality and can compete with private cars. It is not an easy challenge to move from the existing supply toward a cost effective and high quality service. In fact, this requires a progressive introduction of a new way of operating PT services (network and time tables) where bus services are operated according to a time table and with intermediate stops, a new bus network, which should include also BRT where the demand is sufficiently high, and a renewed bus fleet.

Even a cost effective and efficient bus service might not be able to fully cover its operating costs. There will be routes or services that will require subsidies. A road pricing policy also for cars could be a way not only of optimising the use of the existing roads, and of minimising the expensive construction of more road capacity, but also of generating the necessary resources that can dedicated to an improved public transport service.

International gateways are of paramount importance for keeping Jordan at the core of the regional corridors: the Aqaba port, the airports and their access routes together with the border crossing facilities. There are significant benefits from investments in ports and airports, taking also into account that part of these investment will be private. The success of the newly proposed multimodal Red Sea - Black Sea “landbridge” transport corridor heavily relies on the improvement of the international gateways, and as far as road is concerned on the renewal of the truck fleet, on the completion of a network of service areas for trucks at the main borders together with improvement in border crossing procedures.

International gateways are not only gateways for freight. Airports and to a minor extent also the port of Aqaba are the gates for international passenger flows, in particular tourist flows. The strategy for the aviation sector is related first of all to the development and specialisation of Jordan airports. Recent investments into Queen Alia International Airport can be capitalised by the full exploitation of existing capacity. Amman Marka airport (AMIA) can be opened to commercial flights, VIP and executive flights, as well as low cost and charter flights.. Aqaba King Hussein airport (KHIA) has a function of point-topoint airport with a strong specialisation for touristic flights, satisfying the transport demand related to ASEZ. Jordan airports will be relevant hubs in the transport system where long distance (both passenger and cargo) flows should be seamlessly connected to the national and local PT and logistic networks.

The proposed mix of policies and investment is complemented by two main set of policies: the first one related to safety and the second one to the environment.

Transport safety is a critical issue in Jordan. Although the Jordan National Transport Strategy encompasses all transport modes, it can be easily asserted that significant improvements in Jordan's transport-related safety challenges are to be achieved mainly in the road sector. Several priority areas have been identified as posing particular concern and deserving special attention in the design of the measures: young drivers, impaired driving, speeding, vulnerable road users, motorcyclists and road infrastructures. The proposed relevant measures considered cover three fields of action: road users' behaviour, vehicles characteristics and infrastructure characteristics.
The reduction of the externalities of the transport sector related to the environment (pollutant emissions, greenhouse gases, fuel consumption) is at the core of the proposed Strategy and is pursued through three main set of actions that cross all transport modes: First, a strong commitment to improve the attractiveness of / provide real alternatives to pure road, private transport, both for passengers and freight. This is the case for the new national railway network and for the improved PT supply, that both aim at significantly modifying, in the medium to long term, the modal split towards mode environmental friendly transport modes.

Second, a number of measures to renovate the private (cars, trucks) and public (buses) fleets, through financial, regulatory and enforcement incentives and disincentives. Lowering the average age of the circulating vehicles, means relying upon state-of-the-art technologies with better performances and fuel efficiency. An improved efficiency of the logistic and passengers transport chains has to be reached by promoting intermodality, interchanges, dry ports, as well as consolidating the truck and PT operators.

Finally, the successful delivery of a transport system capable of supporting the development of the Jordan economy whilst ensuring that transport plays its role in meeting social needs and environmental challenges relies on the strong ownership that has been built along the process of design and assessment of the Strategy.

Introduction

The Jordan Ministry of Transport has awarded the project of developing the Jordan Long Term National Transport Strategy to a Consortium of International Consultants, formed by the companies PTV Transport Consult GmbH and TRT Trasporti e Territorio srl.

The overall objective of the project is the development of the National Transport Strategy and of an Action Plan for its implementation. The approach of developing this strategy and the action plan was to review and update existing policy documents and strategies, to thoroughly analyse the current conditions of the transport system, to develop tools for analysis and forecast of conditions until 2030 (development of a National Transport Model), to develop tools for appraisal of investments and assessment of impacts of measures and strategies, to identify measures and to combine them into several alternative options, applying the transport model and the assessment tools to compare the options, to identify the most favourable option and to finally design the National Strategy based on these findings and an intensive consultation process with all relevant stakeholders in the Hashemite Kingdom of Jordan.

This report is one of the final outcomes of the project. It first briefly describes the challenges that Jordan's transport system is facing (section 2), and it provides an overview of the approach and the tools used to develop the National Transport Strategy (section 3). After summarising the process of drafting and selecting the final strategy (section 4), the document then focusses on the resulting National Transport Strategy (section 5) and the Action Plan to implement it (Section 6). Further details on the approach, the data, the tools and the findings are included in respective annexes to this report.

The purpose of this report is to give an overview of the approach and the resulting strategy, not to illustrate all steps in detail. This is why, necessary inputs to the strategy, like the assessment of the whole sector are not described here but in the more detailed project deliverables. All these formed an important input for development of the National Transport Strategy.

1 The challenges of the Jordan transport system

Transport is a vital sector for the Jordanian economy and an important component for the daily life of Jordanians. Transport is a necessary prerequisite to provide mobility, access and consequently maintain current economic processes and welfare, but also the basis for future economic growth of the Kingdom and for growth of quality of life for its inhabitants. Consequently, the country has heavily invested in the transport sector over the past decade, in particular by:

- expanding the road sector, which constitutes the backbone of the national transport system,
- improving urban transport, and
- enhancing the logistic industry.

At the same time, the country has started a process of liberalisation of the sector with the purpose of opening the market and increasing the role of the private operators in the provision of transport. To support these changes the institutional set-up has been gradually transformed.

The Long Term National Transport Strategy comes in the middle of this development process. It is, therefore, a key opportunity to consolidate the results already achieved, while fostering at the same time the process of modernisation of the transport system so to fully support the economic development of the country.

Today, The Jordanian economy and the Jordanian population is dependent on the car for personal mobility and on road transport for freight. For passenger transport, the car is the predominant mode, though in many governorates only a minority of the population owning a car. Alternatives to the car are underdeveloped and difficult to use, public transport and non-motorised transport.

The provided capacity of the road networks is generally sufficient to accommodate current passenger transport demand; only very few real bottlenecks exist today. However, traffic operation is not optimal. The behaviour of car drivers reduces the provided capacities. Traffic authorities, traffic police do not work in favour of a more efficient use of the capacities. Apart from speed limits on interurban roads, traffic police in Jordan does not enforce rules and regulations that would help making best use of provided capacities, i.e. trying to avoid illegal behaviour, like parking at illegal locations, parking in second row, using more than one lane and not sticking to lanes, giving priority at junctions, roundabouts, pedestrian crossings etc.

This is a behavioural issue and a matter of attitudes, starting with politicians and decision-makers, with infrastructure planners and authorities looking after the transport operation, traffic police and finally the population as a whole. Transport behaviour has evolved, it is learned by the users and if not corrected, it develops in a way that leads to unsafe and inefficient operation as is the case in Jordan today.

This means, although capacity provided should be sufficient, already today, the road user is faced with forced traffic flow and congestion particularly in and around urban areas at certain peak times of the day or the week. These conditions will worsen over time as transport demand is forecasted to increase.

For freight transport, the transport of goods, domestic transport in Jordan is strongly depending on road transport, as alternatives barely exist. The country disposes of a historical railway line in narrow gauge, originally part of the Hejaz railway built by the Ottoman Empire in the beginning of the twentieth century with the help of German engineers and the political and financial support by the German Empire. The remainders of this historical railway are barely used for passenger transport. However, the southern section of the line, extended by a few newer railway links connects the port of Aqaba to the phosphate mines in the South. Consequently, phosphate is transported by rail between the mines and the port of Aqaba.

Apart from this limited railway connection, no other transport system exists for domestic freight transport other than the roads. This has serious impacts on the social, man-made and natural environment in Jordan. Nevertheless, currently road freight transport does not suffer from any limitations or restrictions. It appears that the provided capacities of the road network are sufficient to accommodate current freight transport demand. No specific bottlenecks have been identified yet.

However, this will change in future if nothing happens. First of all, the existing infrastructure needs more maintenance as particularly trucks and heavy good vehicles (HGV) put an extra pressure on road surfaces, resulting in a deterioration that has reached unacceptable or even dangerous conditions on some links, like potholes etc. this situation will be aggravated with increasing freight transport over time. Therefore, an intensified maintenance programme will be necessary to keep the freight transport flows on the roads moving.

Furthermore, alternatives should be developed for the domestic transport of goods in Jordan, in order to reduce the negative impacts of freight transport, be it the pipeline connecting the Zarqa refinery with Iraq, be it the National Rail Master Plan allowing to shift freight transport from road transport to rail transport.

Regional transport, mainly the transport of goods through from neighbouring countries to Jordan, out of Jordan or through Jordan, is currently concentrated on road transport. The major regional traffic flows affecting Jordan pass through the port of Aqaba (around 70%).

The infrastructure is generally sufficient; however, maintenance is lacking behind. The major capacity bottlenecks for regional traffic are the borders, the port of Aqaba and the land borders to neighbouring countries. Measures are necessary to increase capacity at borders, reduce waiting times and improve the quality and comfort for drivers, passengers and vehicles.

The latter is also relevant at major regional links throughout the kingdom, i.e. the provision of stations for long-distance freight transport, for refilling and maintenance of vehicles, for resting and other needs of drivers and passengers (restaurants, bathrooms, showers etc.).

1.1 The role of the transport sector in Jordan

Transport is a very important component of the economy in Jordan. On one hand, it is a sector of the economy itself providing workplaces, incomes and welfare. More importantly, it is a prerequisite for economic development. It provides access and mobility; it allows import and export of goods and transporting goods domestically.

Transport serves the national economy essentially along the North-South corridor linking Aqaba and Amman and also plays an important role on a regional level to transport goods and passengers to and from the neighbouring countries

Transport in Jordan has a National and a Regional dimension.

At the national dimension, transport is dominated by the car for passenger transport and by trucks (heavy and light good vehicles) for freight. At domestic level, air and maritime transport only have a marginal role: there are only a limited number of domestic flights between Amman (Queen Alia International Airport) and Aqaba (King Hussein International Airport); and obviously there are no domestic maritime services in Jordan.

Currently, the rail system is composed of infrastructure and services of the Jordan Hejaz Railway (JHR) and the Aqaba Railway Corporation (ARC). Nowadays, due to the more than 100 years old infrastructure, the historical Hejaz railway mainly provides touristic services with vintage trains from Amman to Wadi Rum.

A few attempts to offer scheduled passenger services over the past years, e.g. Amman – Damascus, Amman – Zarqa with Shuttle connection from the city centres to the respective railway stations were given up due to lack of demand or for political reasons (conflict in Syria).

As a result of this, JHR currently does not have any transport function apart from touristic services. JRC currently provides services between the phosphate mines and the port of Aqaba. ARC transports only one commodity of freight and uses the own, purpose-built infrastructure with the backbone link of Hejaz Railway.

Looking at the regional dimension, it is important to note that Jordan lies in the cross-road of relevant regional and international transport flows between north and south (EU and Turkey – KSA and the Gulf) as well as east and west (North Africa, Egypt – Iraq, Iran, Asia). On one hand, the regional development of transport demand, the related transport flows between neighbouring countries and Jordan, but also between neighbouring countries and other neighbouring countries potentially crossing Jordan (transit transport) has an important influence on Jordan and its transport system.

This international transport demand contributes to the transport flows on Jordan's transport networks, to congestions, to negative impacts etc. and consequently has to be taken into account when developing the networks for the future. On the other hand, the development of Jordan's transport system clearly also influences the regional transport flows. If the networks in Jordan that can be used for transit flows are improved, e.g. higher capacity, better comfort, lower slopes, lower travel times, less time lost at borders and lower costs, then the "Jordan route" will attract more transport flows, with benefits for the transport industry, trade and the economy in general.

These additional international flows through Jordan can be flows attracted to Jordan from other routes, e.g. land routes (through Iraq-Syria) or sea routes (through Red sea, Suez canal, Mediterranean sea), or this can be additional flows, i.e. induced transport, increased economic activity in the region, increased exchange of goods in the region due to the improved infrastructure in Jordan. Clearly, an improved infrastructure in Jordan can contribute to a positive economic development of the whole region.

1.2 The transport industry in Jordan

Generally, the transport industry is a heterogeneous structure of all those institutions, authorities, companies, operators, providers of services, vehicles and material that have an influence on the transport system in a country, develop the transport system, contribute to transport operation and regulate it. It is an industry, as all these components employ people, produce revenues and are interlinked in multiple ways with all other social and economic processes of the country.

Moreover, the transport industry represents one of the more significant competitive factors of a country; the level of the transport services influences the performances of the economic system within a defined area or country. Therefore, the transport industry analysis cannot be limited to its internal dynamics (i.e. the ones amongst the subjects belonging to the sector) but must be extended also to the perceptions and expectations of the main users of its services, to better understand if the services provided are in line with the requirements of the economic system.

The basic structure of transport industry in Jordan is comparable to the one of other developed countries. There are public and private entities active in the industry. The transport industry is composed by the following sectors, corresponding to the main transport modes:

- Road transport
- Rail transport
- Civil aviation
- Maritime transport

Within each transport mode or sector of the industry, the following categories are distinguished:

- Authorities planning and managing the infrastructure, the services, maintenance etc.
- Regulatory authorities or bodies
- Infrastructure development companies
- Infrastructure maintenance and operation bodies (public entities and private companies)
- Private passenger transport operators (applicable only to road transport)
- Public passenger transport operators (applicable to road, rail, maritime and air transport)
- Freight transport operators (forwarders, carriers, hauliers, trucking companies)
- Service providers (where applicable)
- Representatives of the economic system

The following table gives an overview of the constituent bodies of the transport industry identified in Jordan in the different sectors of the industry:

Table 1: Identified constituent bodies of the transport industry in Jordan

Transport Mode	Category	Entity / component of the Industry
Road transport	Planning authority, Infrastructure development,Infrastructure maintenance and operation	Ministry of Public Works and Housing
		Greater Amman Municipality (GAM)
	Regulatory authority	LTRC – Public Transport Directorate
		LTRC – Freight Transport Directorate
	Private passenger transport operators (Private vehicles)	Royal Automobile Club of Jordan
		Drivers and Vehicles Licensing Department
	Public passenger transport operators	JETT buses (private operator)
		AUTOBUS (private operator)
		General Union of Jordanian Bus owners (Association)
		Greater Amman Municipality (GAM)
	Freight transport operators	Syndicate of Jordanian Trucks Owners (Association)
		Forwarders Association Owners Syndicate
Rail transport	Planning authority	Ministry of Transport
	Regulatory authority	LTRC - Railways Transport Directorate
	Infrastructure development	Ministry of Transport
	Infrastructure maintenance and operation	Jordan Hejaz Railway and Aqaba Railway corporation
	Public passenger transport operators	Jordan Hejaz Railway
	Freight transport operators	Aqaba Railway Corporation

Transport Mode	Category	Entity / component of the Industry
Civil aviation	Planning authority	Ministry of Transport
	Regulatory authority	Civil Aviation Regulatory Commission
	Infrastructure development	Ministry of Transport – Project Management Unit QAIA
		Airport International Group
	Infrastructure maintenance and operation	Jordan Airports' Company
		Aqaba Airports' Company
		Airport International Group
	Public passenger transport operators, Freight transport operators	Royal Jordanian Airlines
		Royal Jordanian Airlines
	Service provider	Jordan Meteorological Department
Maritime transport	Planning authority	Ministry of Transport
		Aqaba Special Economic Zone Authority
	Regulatory authority	Jordan Maritime Authority
	Infrastructure development	Aqaba Development Corporation
	Infrastructure maintenance and operation	Aqaba Ports Corporation
		Aqaba Container Terminal
	Public passenger transport operators, Freight transport operators	Jordan Shipping Association
		Contractors Association
	Service provider	Jordan Meteorological Department
		Jordan Investment Board
		Arab Bridge Maritime
All modes	Infrastructure development companies	Contractors Association
	Service provider	Jordan Investment Board
	Economic System	Development Zones Commission

The institutional set-up in Jordan's transport sector is quite complex. Each mode is managed and operated by a number of institutions and constituent bodies. Particularly, for most modes there are different institutions responsible for

- Planning of infrastructure, infrastructure development, maintenance and operation
- Regulatory functions of the sector
- Operators of vehicles and providers of services

At strategic national level, different ministries are responsible for some of the sectors, modes or part of the infrastructure.
For example

- The Ministry of Transport (MoT) is responsible for Rail Transport, Civil Aviation and Maritime Transport
- The Ministry of Public Works and Housing (MoPWH) is responsible for road transport, however not for public transport operation and freight transport

Other Ministries involved in the process are the

- The Ministry of Planning and International Cooperation (MoPIC)
- The Ministry of Energy
- The Ministry of Trade and Industry
- The Ministry of Interior

Additionally, different regulatory commissions are responsible for implementation of strategies and policies and for operation of the respective systems

- The Land Transport Regulatory Commission LTRC is responsible for Public Transport on Roads and for Freight Transport on Roads
- The Civil Aviation Regulatory Commission is responsible for execution of policies prepared by the Ministry and for regulation of the civil aviation sector including commercial air transport policy
- Jordan Maritime Authority is responsible for regulation, supervision and development of the maritime sector, enhancement of private sector's role, encouragement of competition and environment protection and maritime safety standards
- Aqaba Special Economic Zone Authority (ASEZA) is responsible for the development and qualification of the Zone, in order to attract investment and create an advanced investment environment

The first issues is the **interaction and coordination between the Ministerial Level and the respective regulatory or implementationary level.**

Generally, it is the respective Ministry, particularly the Ministry of Transport, which is responsible for setting the general policy for the respective sector, set up plans, devise plans, identify and manage sites for transport. Furthermore, the respective Ministry is responsible for procuring financial resources and allocating these resources, coordinating with competent authorities and for taking action to prevent accidents. Whereas, the described regulatory commissions and special authorities are responsible for the implementation of these policies and plans. The commissions are responsible to regulate the operation in their respective sector or, in the case of ASEZA, in their respective area.

However, the responsibilities are not always clearly defined. There are overlaps in responsibilities. At both levels, Ministerial and Regulatory, the institutions have similar structures, with similar departments and functions, and therefore these departments deal with similar issues. Consequently, in many cases, it is not clear, which level is ultimately responsible, the Ministerial level or the regulatory level; the coordination between ministry and regulating authority is not clarified. This leads to duplication of effort and in some cases even to contradictory output, i.e. contradictory rules and regulations.

The second issue is the coordination at Ministerial Level, i.e. between the different Ministries.

Generally, the MoT is responsible for all modes other than road, for transport policies, pricing, regulations etc. However, there is also the MoPWH. Roads are a public asset. Therefore, the MoPWH looks after the development and maintenance of the road networks, caters for their construction and maintenance. In Jordan, it is quite obvious that the road sector has a prominent role; road transport is by far the most important mode and the road infrastructure plays a crucial role. Hence, the responsibility for the infrastructure development of the most important mode lies with the MoPWH; the MoT focusses on the other modes, aviation, maritime, rail and public transport, but is still responsible to design an overall policy for the transport sector, including road infrastructure development.

This results in shared responsibilities at the highest governmental level for the most relevant parts of the transport sector.

This complex institutional structure and situation with distributed responsibilities for the most relevant mode results in the necessity of a strong cooperation and coordination between the ministries, exchange and sharing of data and information, more than in other countries with complete or at least modal responsibilities.

Current Institutional Structure: Complex institutional structure in Jordan at National level

▪ Ministry of Transport	Overall policy setting, monitoring implementation, international, national, regional coordination
▪ Ministry of Public Works and Housing	planning, development and maintenance of the road network
▪ Ministry of Interior	road safety, accidents
▪ Different regulatory commissions and special authorities	regulation of the sector
	implementation of policies and plans
▪ ASEZA	administrating the Aqaba Special Economic Zone, overseeing its affairs, preparing the necessary plans and programmes;

As per the Aqaba Special Economic Zone Law no. 32, ASEZA takes over more or less all governmental roles in its dedicated area. As the ASEZA area is a crucial part of the country, including its main entry point for goods and partly for passengers, the port of Aqaba, ASEZA plays a core role.

Furthermore, as the transport sector is an integral part of the economy and particularly the port of Aqaba, freight transport passing through the port, the connection of the port with the rest of the Kingdom is of the utmost importance for the economic development of the Kingdom, not to say its survival. There is a strong need for coordination and cooperation between ASEZA and the national authorities. This coordination and cooperation is necessary at the Ministerial Level but also at the level of regulators and implementers.

Generally, the complex institutional structure of responsible authorities and regulatory bodies requires

- An efficient cooperation between authorities and regulatory bodies
- Installation of High joint committees with a strong role of coordination and cooperation at highest managerial level (some high joint committees are in place; but their role should be strengthened)
- Clear and efficient institutional set-up
- Clearly defined responsibilities
- Monitoring of the coordination and cooperation at highest level
- And finally all actors to cooperate and coordinate their activities, e.g. exchange of data and information

This is the minimum requirement. Otherwise, the institutional structure has to be streamlined and optimised, reducing the number of authorities but attributing them clear responsibilities.

1.3 Funding

A relevant issue for the development of Jordan's transport system are the financial resources, the funding for investment of new infrastructure or expansion of infrastructure, for the maintenance and renewal of existing infrastructure, for the operation of transport services both for passenger and for freight transport. Today, the scarcity of financial resources can be noted in the maintenance levels of the infrastructure assets but also in the lack of subsidies for example for public transport.

The situation with scarcity of financial resources was aggravated as a result of the economic crisis affecting Western World countries and as a consequence, a reduction of international development programmes and donor projects benefiting the Hashemite Kingdom of Jordan.

In the past, Jordan has benefited from the support of neighbouring countries, namely the Kingdom of Saudi-Arabia and the Gulf States. Currently, the donor support is mainly related to:

- On 3 August 2012, the IMF Board approved a USD 2 billion, 36-month Stand-By Arrangement (SBA) for Jordan. The negotiations were completed very quickly, allowing a first disbursement in the fourth quarter of 2012
- Regarding other official lenders, the World Bank made available USD 250 M in the form of a Development Policy Loan (DPL2) in early 2012, to strengthen transparency and accountability, budget and debt management, efficiency of public spending and services, and private sector development. A second DPL (DPL3) for the amount of USD 100 M is under discussion
- France has extended a low-interest, medium-term budget support loan to Jordan worth USD 192 M, with the first payment already made in the fourth quarter of 2012 and the second payment in the first half of 2013. Official financing in the form of budget support loans has been also made available from Japan, with USD 175 M to be disbursed over 2012-14
- Concerning official assistance in the form of grants, a USD 5 billion grant package, to be disbursed over 5 years starting in 2012, was approved by the GCC in 2011 (equally distributed among Saudi Arabia, Kuwait, UAE, and Qatar and linked to development projects)[1]

[1] Out of the entire grants of USD 5 billion from the GCC countries, 24% should have to be directed towards local development, 18% towards roads development, 14% for the energy sector, 12% for the health sector and 10% for the water sector. Kuwait, Saudi Arabia and the UAE already disbursed US$ 250 M each in 2012, while the UAE decided in January 2013 to advance the disbursement of the remainder of its pledge (US$ 1 billion) by making a deposit in the Jordanian Central Bank. However, the disbursement to the budget will take place only gradually over the period 2013-16, linked to the actual implementation of investment projects in the above-mentioned areas.

- US grant disbursements to the budget over the period 2012-15 are estimated at nearly USD 900 M with a third of it already disbursed in 2012
- The EU has made available EUR 293 M in grants for the period 2011-13 under its regular cooperation, in support of Jordan's political and economic reform agenda. In addition, EUR 70 M has been allocated to Jordan in 2012 under the SPRING programme, and EUR 10 M from Humanitarian Aid to support Syrian refugees

However, these external sources are not a safe bank. As the economic crisis has shown, funds can diminish or disappear at times.

Consequently, there is the need to develop a common agreement on the objectives for infrastructure investment in Jordan to make best use of the scarce resources, to develop the infrastructure and the services in a way to benefit the majority of the population and to promote economic growth and development. This in turn will result in increased availability of own resources to develop the transport sector.

Furthermore, there is the need to identify additional sources for funding of the transport sector, including the involvement of the private sector. Private-public-partnership (PPP) can help to get funds for infrastructure development earlier. In theory, this could result in boosting the economy and therefore increasing the public funds. However, private resources invested in PPP projects always need an appropriate return-on-investment, which can be assured either by the public sector or by transport users.

Therefore, Public Private Partnership (PPP) has its advantages, mainly of making funds available earlier; and PPP has its areas of application. However, potential areas or project for a PPP certainly have to be investigated and designed carefully in order to really attract private investment.

1.4 Regional political context

The Hashemite Kingdom of Jordan is politically stable. Nevertheless, the area surrounding Jordan currently is not.

Most importantly, the Civil war in Syria that started in 2011 has serious impacts on the region. Economic, social and human capitals have been destroyed within the country of Syria, with unbearable losses for the current and future generations; the exchange of goods between Syria and its neighbouring countries is difficult and limited to the absolute minimum. Transit flows through Syria are dangerous and are therefore currently reduced to a minimum, e.g. transit from Jordan to Turkey across Syria. A similar temporary change can be observed for passenger transport. Currently, there is no regular commuting of employees or students across the border. Personal exchange, personal visits etc. are reduced to a

minimum. Parts of the Syrian population has become refugees, fleeing from Syria to neighbouring countries including Jordan. Most of these refugees in Jordan currently stay in refugee camps and do not regularly return to Syria.

Furthermore, the tensions between Israel and Palestine lead to reduced traffic flows between Jordan and these two countries.

The conditions in Iraq can still be valued as dangerous, or at least as unstable. Therefore, also flows across the Jordan-Iraqi border are still not at normal levels.

All these conditions in the region, in neighbouring countries, between neighbouring countries and between the neighbouring countries and Jordan affect the exchange of goods in the region, freight flows between the countries in the region, transit flows, but also the passenger flows.

Currently, due to the Syrian crisis, the borders between Jordan and Syria are closed or at least, no or very little transit traffic takes place through Syria. This has serious influences on trade and transport in Jordan. Traffic flows for import and export are now more than before oriented towards the port of Aqaba. This has impacts on the Jordan economy.

The situation will of course change again, when Syria finds back to peace, first of all, allowing transit flows across its territory again, and second, resulting in an increase in trade, exchange of goods with Jordan and other countries. Similarly, trade and transport with and through other neighbouring countries will change, should the political conditions change.

This shows, Jordan is a haven of stability in an unfortunately unstable region at the moment. Jordan can hardly influence political conditions in neighbouring countries, despite them having a considerable impact on Jordan's economy, trade and transport, but can only live with the changes taking place.
Consequently, Jordan has to be flexible, has to be able to react to the changing conditions at its borders and has to provide alternatives for import and export, for the social and economic welfare of the Kingdom and its residents.

1.5 The environment

Motorised road transport is the most important transport mode in Jordan. This holds both for passenger transport and for freight transport.

The car is the most important mode of transport for passenger trips in Jordan, despite in many governorates only a minority owning an own car or having access to a car (at national level car availability of less than 150 vehicles per 1,000 inhabitants, against 285 for Amman

Governorate). Real alternatives do not exist or are uncomfortable, time consuming and unreliable. Public transport could be an option but the market in Jordan does not deliver services that provide access to all areas and allow regular travellers to rely on public transport (see respective section in this report below, and report on "Assessment of Infrastructure System"). As a consequence, more and more Jordanian households decide to acquire a car or additional cars, as soon as this becomes affordable to them.

In fact, the car ownership rate increased by 6.7% on average between 1990 and 2007, contributing to more and more passenger trips by motorised vehicles, more pollutants emitted, more greenhouse gases and more noise.

Similarly in freight transport: alternatives to transporting goods by road vehicles (Heavy or
light duty vehicle, HGV, LGV) do barely exist. There are railway links in the South of the Country between the phosphate mines Al Hassa and Al A'byad and Aqaba port, transporting phosphate by rail. In future, there will potentially be a railway line between the mine of Al Sheediyah and Wadi Ytum junction, connecting also this mine to the railway network in order to secure phosphate transport for the future national railway network. This network extension to the mine of Al Sheediyah lately is called the "Mini Project" as a first start for the National Railway Project, a door opener so to say.

For all other commodities and origin-destinations of domestic freight transport, no real alternatives exist. Therefore, the Jordan freight industry heavily depends on road transport, on trucks.

Both, passenger transport by car and freight transport by truck have serious environmental impacts, including the emission of pollutants, of green-house gases and of noise.

Following the increase of car and truck trips, air quality is already deteriorating in Jordan, particularly in urban areas (see Assessment of Transport Infrastructure report).

Other environmental impacts of car and truck transport in Jordan putting costs on other users, on the economic processes, on the natural, man-made or social environment can be classified into the three categories listed below. The costs resulting from these impacts on other individuals or other processes are usually called externalities or external costs.

External costs include:

a. External costs to other road users; like increased travel times for other car and truck drivers due to dense traffic conditions or congestion; higher fuel costs as a result of forced traffic flow; but also external costs to other road users, like pedestrians, including the risk of getting involved in an accident (transport safety).
b. External costs to the rest of the population, social communities, barrier effect of infrastructure, community severance, visual intrusion, limitations to certain population groups to participate in social life, social welfare etc.
c. External costs to the environment, like energy consumption, consumption of nonrenewable resources, emission of pollutants, greenhouse gases and noise.

1.6 Transport safety

Transport safety or Road safety (as road transport is the predominant mode of transport in Jordan) is a serious issue as the lack of safety and the resulting high number of road accidents cause direct costs to the people involved. But more than that, fatalities and serious casualties result in pain and a loss of quality of life for the involved and in grief for families and friends that can hardly be measured in economic terms.

The developed countries in Western Europe, North America, and Australia have been facing the issue of road safety, high and increasing number of accidents, fatalities, serious casualties for many decades now. In most of these countries, safety has become a major issue for the national strategies and policies. Countries have invested in improvements of infrastructure and vehicles, provision of safe facilities for all road users, particularly for the most vulnerable road users, pedestrians and cyclist, but most importantly, in these countries the focus was on behaviour. Driving behaviour, respect of other road users, awareness for safety and the lack thereof have been developed over many years, using awareness campaigns, training, stricter laws and regulations, stronger enforcement of these laws and regulations. The result in most of these countries has been a continuous decrease of accidents and of seriousness of accidents, of road deaths and of injuries, despite an increasing number of vehicles and vehicle kilometres travelled.

Nowadays, road safety is particularly an issue in countries with rapidly growing motorisation, where large parts of the population were not used to motorised traffic, but where an increasing number particularly of young drivers gets access to the car. This is also the case for Jordan. Motorisation rates are still comparatively low but rising rapidly. This confronts an increasing part of the population with motorised traffic, without fully understanding and accepting the risks attached to it. Particularly young and unexperienced drivers over-estimate their abilities, do not take laws and regulations seriously and produce accidents that unfortunately do not only harm themselves but other road users as well.

The following table shows the current situation in Jordan (fatalities from road accidents) in comparison to the World average and to a selection of other developed countries and countries in the region (Source: World Health Organisation WHO, “Global status report on road safety 2013").

The countries/ regions in the table are ordered according to number of fatalities per 100,000 inhabitants per year.

Table 2: Road fatalities per 100,000 persons (2011) in Jordan and selected world's countries

Country/ Region	Road fatalities per 100,000 inhabitants per year	Road fatalities per 100,000 motor vehicles per year
United Kingdom	3.7	6.5
Germany	4.7	7.6
Israel	4.7	14.3
Australia	6.1	8.5
Canada	6.8	10.7
Italy	7.2	8.3
New Zealand	9.1	12.3
United States	11.4	13.7
United Arab Emirates	12.7	42.3
Egypt	13.2	183.3
Qatar	14.0	32.7
World average	18.0	93.3
Jordan	22.9	131.5
Syrian Arab Rep.	22.9	225.5
Saudi-Arabia	24.8	103.0

The table contains only a selection of countries. However, it shows that road traffic safety is comparatively low in Jordan. It is below World Average and below the situation in most other developed countries with respect to "Road fatalities per 100,000 inhabitants per year". In addition, it is far below average and the situation in most developed countries relating to "Road fatalities per 100,000 motor vehicles per year".
Even other countries in the region, like Qatar and UAE that were facing a very low road traffic safety situation have considerably improved over the last years.

In fact, in Jordan in 2007, traffic accidents were recognised the second leading cause of death. As a consequence, in 2008 a road safety programme was implemented including policy measures like:

- An intensification of enforcement
- Traffic law with stiff penalty levels

Nevertheless, road safety is still an important issue in Jordan. Further strategies, policies and measures are necessary to improve the situation.
A proposal for the development of an integrated transport safety programme will be presented as one of the deliverables of the project.

2 Transport supply and demand

2.1 The transport supply

Currently, the transport system of the Hashemite Kingdom of Jordan is mainly focussed on the road network. This is certainly the case for all domestic transport, both for passengers and for freight. No other transport network exists inside Jordan other than roads. Passengers move either by car or by road based public transport. The provision of public transport in Jordan is based on bus services only, both for connections within metropolitan and urban areas as well as for connections between cities across the Kingdom.

Regional transport, i.e. the exchange of goods and the travel of passengers between Jordan and neighbouring countries, as well as the transport between neighbouring countries crossing Jordan, is also focussed on road transport, as far as the Jordan territory is concerned. Entry and exit points to the country are the port of Aqaba for the major part of freight, the land-side border crossings to the Kingdom of Saudi-Arabia, Iraq, Syria, Palestine and Israel, and the airports. The port of Aqaba, the border crossing points and the airports within Jordan are all well-connected to the National road system. And most of these entry/ exit points are only connected to roads. The only exemption is the port of Aqaba with a narrow gauge railway connection to the phosphate mines in the Southern part of the Kingdom, operated by the Aqaba Railway Corporation, and the border to Syria, connected by the ancient narrow gauge Hejaz Railway to Amman and further south. However, no scheduled services operate on the railway connection to Syria.

International transport, i.e. long distance transport to and from Jordan, is managed mainly by the major airport of the Kingdom, the Queen Alia International Airport south of Amman concerning passengers and parcel and by the port of Aqaba.

In the Jordan National Transport Strategy project (JNTS), first, the existing transport supply was analysed, to support this analysis, the current supply in form of networks, links, nodes, entries and exits to the country, port and airports, public transport services, interconnection points, terminals and transhipment points were represented in a National Transport Model. The existing transport supply was represented in a so-called base year model. The base year was set to the year 2010, as this is the last year before the political crisis in Syria where consistent data on traffic flows exists.

The model was used for the analysis of current conditions, the identification of shortcomings and bottlenecks, but also for the naming of problems, particularly related to the dominance of road transport for both passengers and freight.

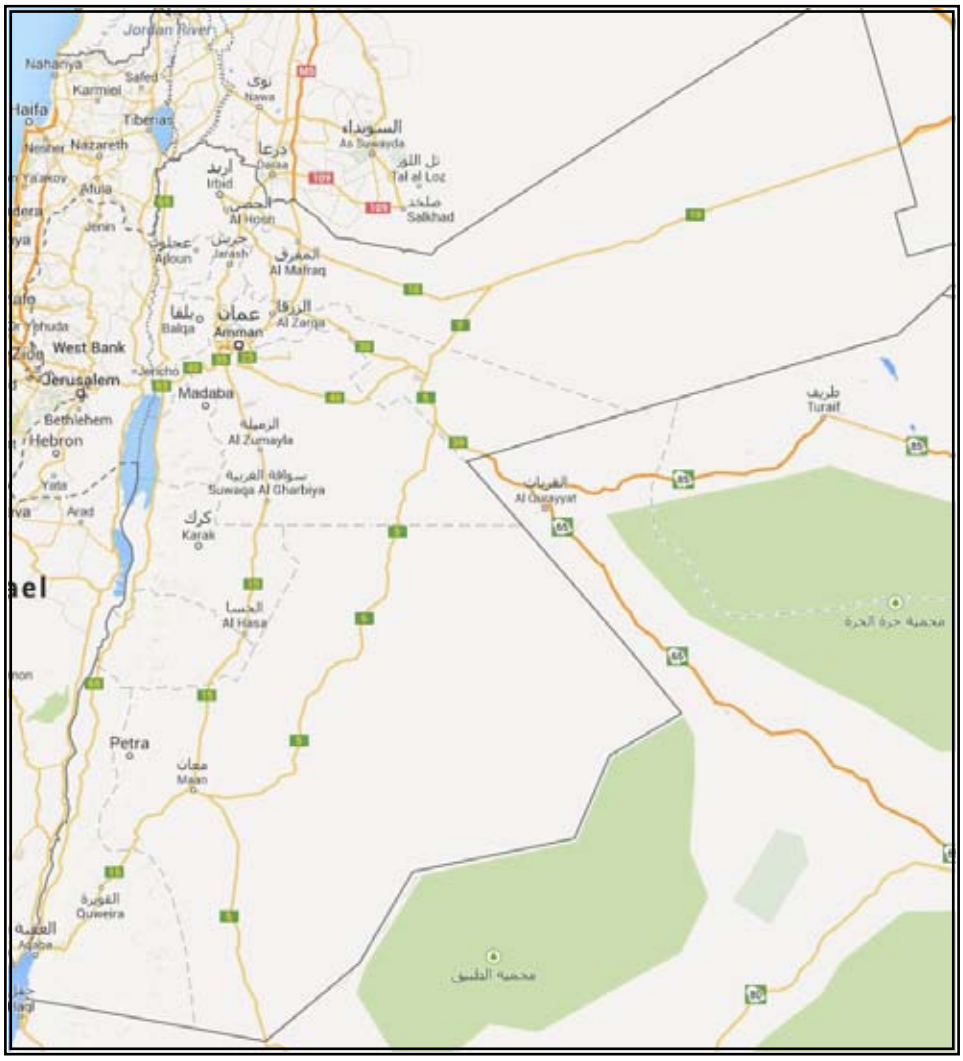
Already existing plans, master plans, studies for the development of transport infrastructure were included in the analysis and formed the basis for the development of forecasts of the future conditions of the transport networks in and around Jordan. Three time horizons were represented as forecast models in the National Transport Model, the years 2018, 2024 and 2030. Plans by Ministries, municipalities, service providers and operators were taken into account to develop models of the future road network, a National railway network, an improved public transport network including Bus Rapid Transit Schemes (BRT), improvements to the port of Aqaba and to the airports.

The findings of these analyses, model developments and assessments were presented to the Ministry of Transport and all Major Stakeholders in Jordan, and were intensively discussed within the sector. This formed the basis for the development of solutions for the future transport system of Jordan: the National Transport Strategy.

Road Network

Currently Jordan's main transport infrastructure consists of a 7,900 km-long road network, with some 3,400 km classified as main roads.

Figure 1: Current Jordan road network



In the south, the 300 km stretch of the motorway 15 ('Desert Highway') connects (coming from the Saudi Arabia border crossing Ad Durra and the port) Aqaba via Ma'an with Amman. Especially for freight transport, this 4-lane motorway is the backbone of the south Jordan road network.

Running in parallel to the Jordan – Israeli border, road 65 stretches from Aqaba to the northern end of the Dead Sea. In the southern part this road is serving as a connection between Aqaba and some industrial facilities mainly producing and processing potash. The northern stretch of road 65 and later motorway 40 connects the Dead Sea region with the Amman agglomeration, this stretch of road 65 is closed for Heavy Goods Vehicles (HGV).

North of the junction with motorway 40, road 65 serves as the major backbone for the cities and villages in the Jordan valley, which plays the major role in Jordan's agricultural industry. In the northern Jordan valley, road 65 is connected to the Sheikh Hussein Bridge border crossing to Israel.

Between motorway 15 and road 65, the ancient Kings Highway, now road 35, forks just south of Ma'an from motorway 15, stretches to the touristic place Petra and connects further north to the cities of Shobak. Tafiela, Karak, Madaba back to motorway 15.

From the junction of motorway 15 with road 35 south of Amman, the main highway to the North becomes now motorway number 15. It traverses the western suburbs of Amman and stretches via Jarash to the city of Irbid in the North.

South-east of Irbid, motorway 35 connects to road / motorway 25, coming from the city of Zarqa and continuing to Ramtha and the border to Syria.

About 20 km further to the west, the northern stretch of motorway 15 connects the Jaber border crossing point with Syria to the city of Mafraq and continues further south to the Zarqa / Amman agglomeration.

In the North, motorway / road number 10 stretches from the west (junction with road 65 near the Israeli border) via the city of Irbid to road / motorway 25 with a junction south of Ramtha, continues to highway 15 near Mafraq and further to the Iraqi border crossing point Alkaramah.

Near As Safawi a junction connects road 10 with road number 5, which is stretching south via Azraq and Al Jafr to motorway 15 near the city of Ma'an and further to the border crossing point to Saudi Arabia near Mudawwara. The road is here one of the backbones for freight transport between the port of Aqaba and Iraq.

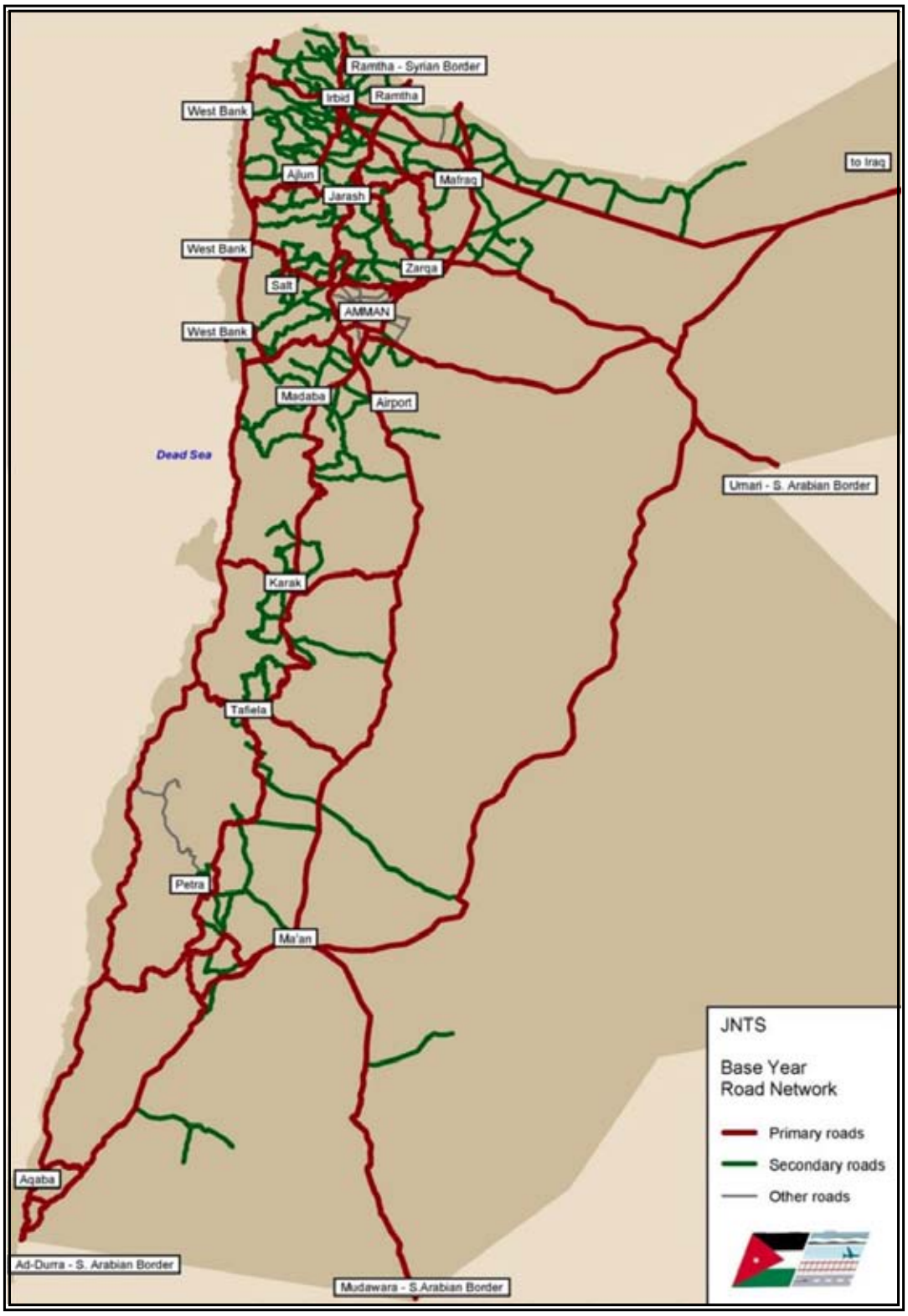
Near Azraq road 30 intersects road 5, coming from the north-west of Zarqa (where it is connected to road 25 and motorway 155) heading to the south-east to the border crossing point Al Omari (Saudi Arabia). Road 30 is an important connection especially for freight transport between the northern parts of Amman / Zarqa agglomeration and the north-eastern border crossings to Iraq and Saudi Arabia.

Another connection, road 40 from Sahab and the southern parts of Amman to the roads 30 and 5 /10 provides an important axis from the Amman agglomeration to the northeastern borders to Iraq and Saudi Arabia.

While most of the classified motorway, primary and secondary road network is in reasonably good condition and provides road capacities that mostly meet the demand in terms of traffic flows, the road network within the Amman / Zarqa agglomeration poses a major obstacle especially for regional relations and for the freight transport. This holds mainly for the relation from south / south-west Amman (intersections motorway 15 (35) / road 35 and motorway 35 / road 40) to the north-east of Zarqa which partly cuts through downtown Amman and the southern suburbs of Zarqa. Similarly, in the north the eastwest connections between Zarqa / Russeifa and the north-western parts of Amman (e.g. Jordan University in Jbaiha) and further to motorway 15 / Balqa poses a high impedance to local and regional traffic.

The following figure shows the road network of Jordan as it is implement in the JNTS Transport Model for the base year.

Figure 2: Jordan road network, base year (2010)



Public Transport Network

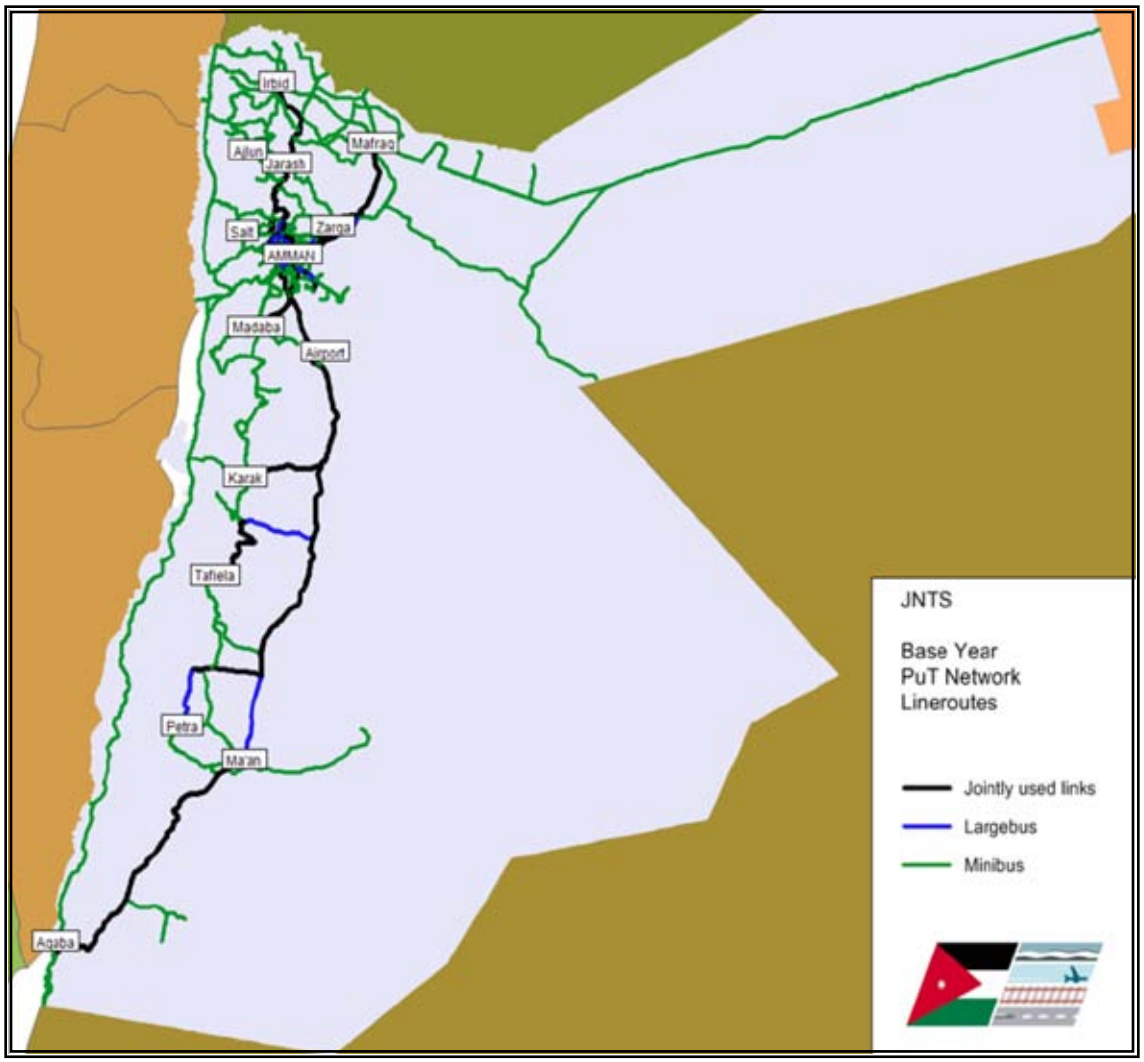
A network of mainly unscheduled bus services of different types (regular city buses, intercity buses, local mini buses, service taxis) provides public transport services in the Hashemite Kingdom of Jordan.

Apart from some bus terminals in major cities, no clearly defined system of terminals, transfer stations, stations and stops is in place.

Bus services in Jordan usually operate from start location to end location with just few stops to provide opportunity for passengers to alight the vehicles. Since buses normally start their journey only once they are full, it is not common to pick passengers along the route. Hence, passengers have to travel to the start terminals to catch a ride. In bigger cities this first leg of the journey is carried out by mini buses, taxi or service (route) taxis.

Currently, no integrated fare structure is implemented. Passengers pay for each part of their journey, whenever they board a bus.
The following figure shows the public transport network of Jordan as it is implemented in the JNTS Transport Model for the base year.

Figure 3: Jordan bus network, base year 2010



Railway Network

A 294 km-long narrow gauge railway line, managed by the Aqaba Railway Corporation (ARC) transports phosphate and other mining products from the mines to the port of Aqaba. Other rail sections (~210 km) managed by the Jordan Hejaz Railway Corporation (JHRC) are not in operation with scheduled services for the time being. Due to the more than 100 years old infrastructure, the historical Hejaz railway mainly provides touristic services with vintage trains from Amman to Wadi Rum. A few attempts to offer scheduled passenger services over the past years, e.g. Amman – Damascus, Amman – Zarqa with shuttle connections from the city centres to the respective railway stations were given up due to the lack of demand or for political reasons (conflict in Syria).

Airports

Three international airports operate in Jordan: Queen Alia International Airport in Amman, King Hussein International Airport in Aqaba, and Amman Civil Airport in Amman (Marka). Currently, the latter two only have a marginal role. In future, this might change, as Marka airport will be allowed to operate scheduled flights as soon as annual passenger numbers exceed 8 M pax at Queen Alia International Airport. Currently, there are only a limited number of domestic flights between Amman (Queen Alia International Airport) and Aqaba airport. With about 75,000 planes arriving and departing per year on the three airports, international flights play the major role in Jordan.

Port

The only sea port is located south of Aqaba on the Red Sea. Main destination for passenger transport through the port of Aqaba is Egypt. The so called Arab Bridge Maritime operates scheduled ferry connections several times per day, partly for passenger cars plus passengers, partly for trucks.

Besides passenger transport, the port of Aqaba is developing three port units; main port, middle port and southern / industrial port with increasing capacities for handling goods, mainly imports and exports to and from Jordan. Major import quantities handled in the port of Aqaba comprise cereals, crude oil, and consumer goods; exports are dominated by phosphate, potash, and fertilizers.

2.2 The transport demand

Transport demand consists of the passengers using the transport system for their trips and of freight being transported between origins and destinations. Current demand can be measured, counted, surveyed, passengers can be interviewed. However, even the most complex empirical analysis of transport demand consisting of a variety of such surveys will only provide a snapshot of the total demand, will only be able to grasp passenger and freight flows on limited time intervals and a limited part of the networks. In any case, empirical surveys can only focus on current demand with counts and revealed preference surveys. Stated preference surveys give a limited insight into potential demand changes, asking respondents how they would modify their behaviour should conditions be changed, i.e. additional infrastructure or services, modified prices.

In order to be able to get an idea of the complete demand, the total number of passenger trips and freight transported, it is necessary to represent demand and supply in a transport demand model, distinguishing between current demand in a so-called base year model and future demand in forecast models. Empirical studies, surveys and counts form the basis for calibration and validation of the models.

The national transport model developed within the JNTS project for the Hashemite Kingdom of Jordan is described in other parts of this and other reports.

The following section provides an overview of the basic figures on the current and on forecasted future transport demand in Jordan, including:

- Total number of domestic passenger trips
- Modal split for passengers
- International and regional transport: border crossing flows and airport volumes
- Regional and domestic freight transport

2.2.1 Current Transport Demand

Total number of domestic trips

The major factors influencing the total number of trips that are carried out are:

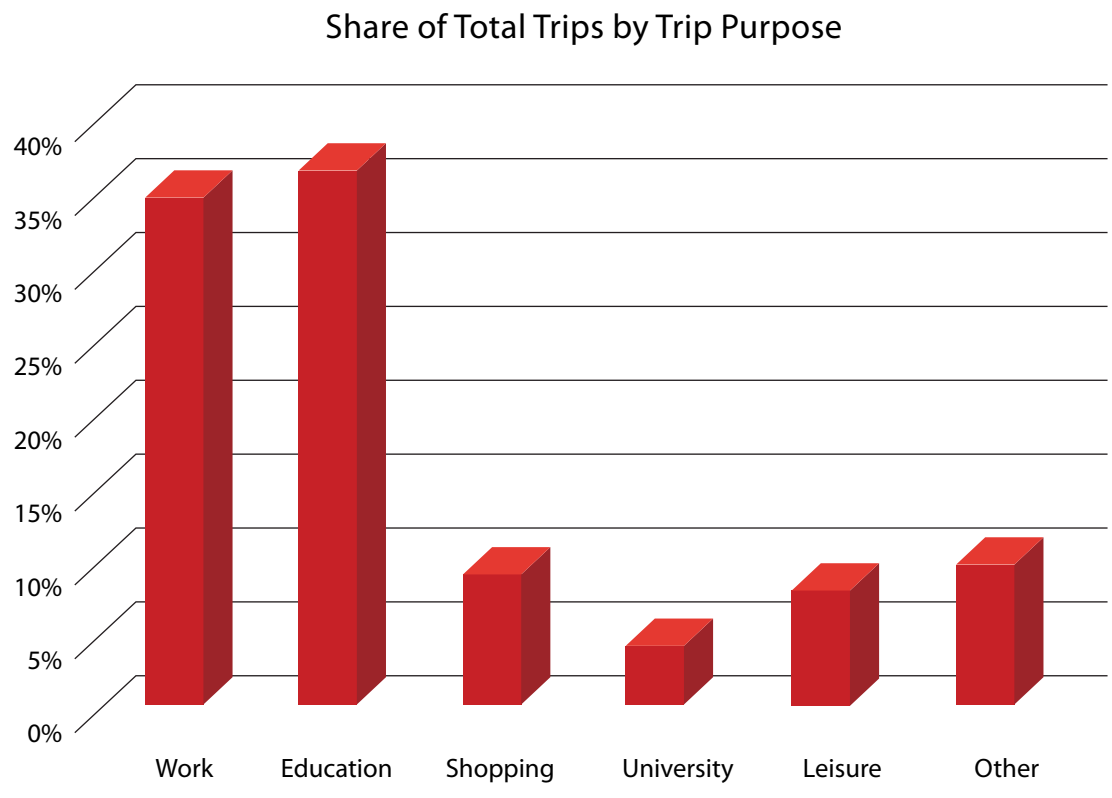
- Total population of Jordan
- Geographical distribution of the population within Jordan (modelled traffic zones)
- Distinction of population into different population groups with a more or less homogenous travel behaviour (e.g. employees with and without car, students, pupils etc.)
- Travel behaviour of these population groups, i.e. number of trips per day, modal choices

The first 3 are retrieved from statistical data, the latter are derived from behavioural surveys, e.g. household surveys.

Based on this input data, the total number of trips for the base year 2010 has been calculated with the JNTS Transport model, resulting in about 9.1 million person trips per average working day.

The following chart shows a differentiation of the person trips by trip purpose.
Clearly, the trips from and to the work as well as the school trips are the dominating trip purposes.

Figure 4: Share of total trips by purpose



Modal Split

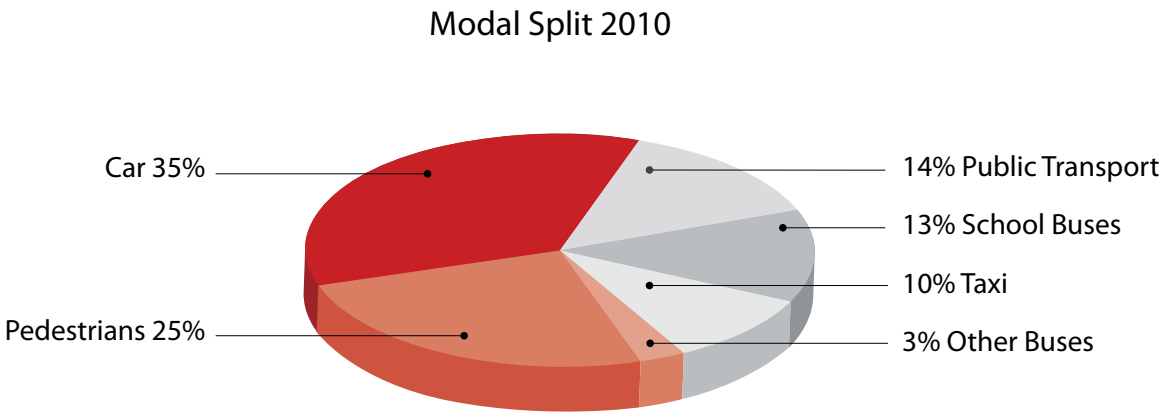
Regarding the modal split (i.e. the choice between different transport modes), the main influencing factors are:

- Motorisation rate
- Trip purpose / population group
- Transport supply (as described above)
- Transport costs and the personal value of time

Based on this input data, the modal split as shown in the following chart has been calculated with the JNTS Transport Model and validated against observed data derived from household surveys.

This shows that in 2010 the most important mode with the highest share of trips can is the private car, whereas public transport has a rather low share.

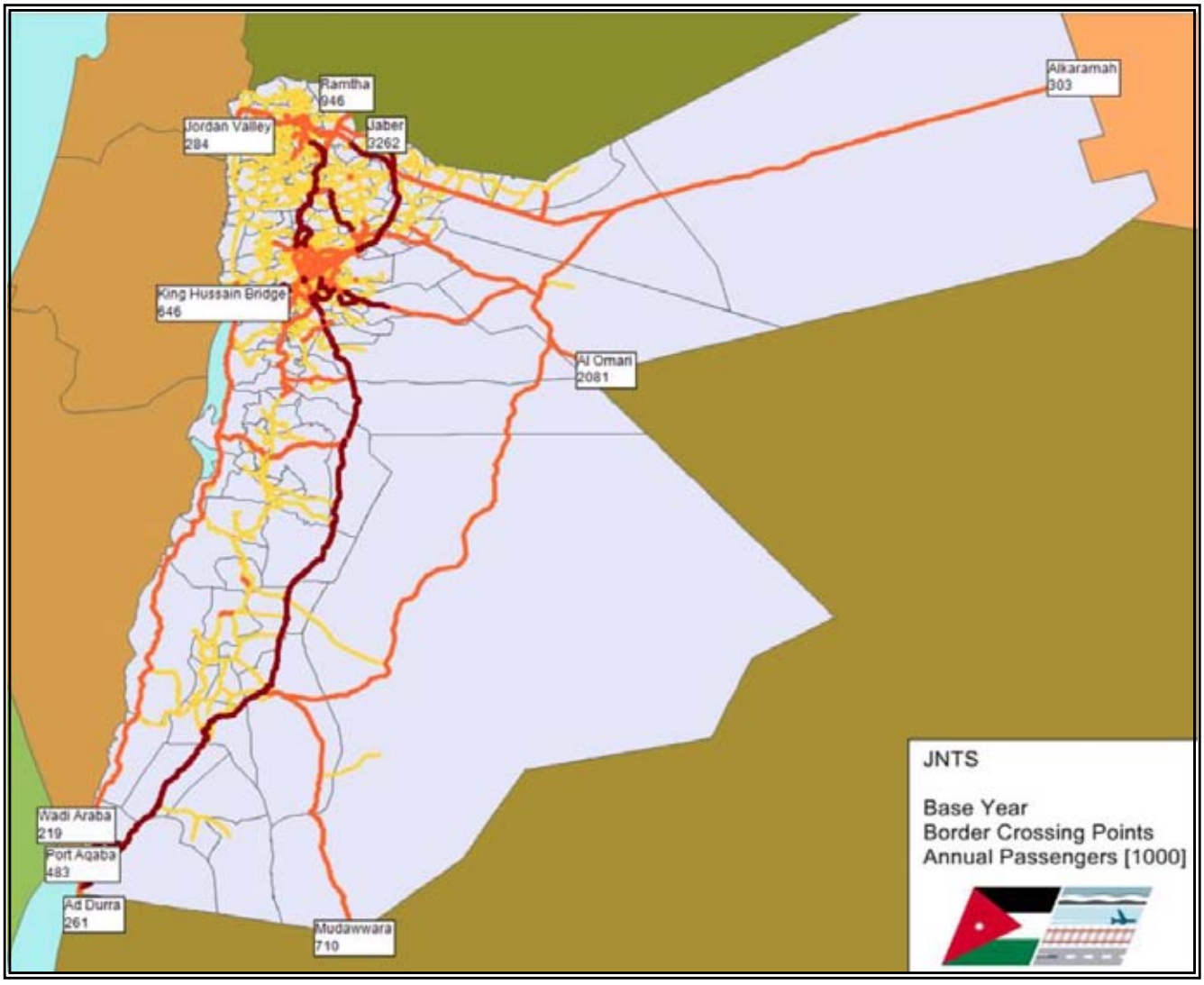
Figure 5: Modal Split – base year 2010



Border Crossing Flows

Regarding international flows, there is a total sum of 9.2 million arrivals per year via the land border crossings and port of Aqaba. The following figure shows, how these arrivals are distributed over the specific border crossing points.

Figure 6: Border crossing flows 2010 (arrivals per year)



Airport Volumes

The table below presents the passenger number of arrivals and departures per year at the three Jordan airports. It underlines the importance of QAIA as the major Jordan airport.

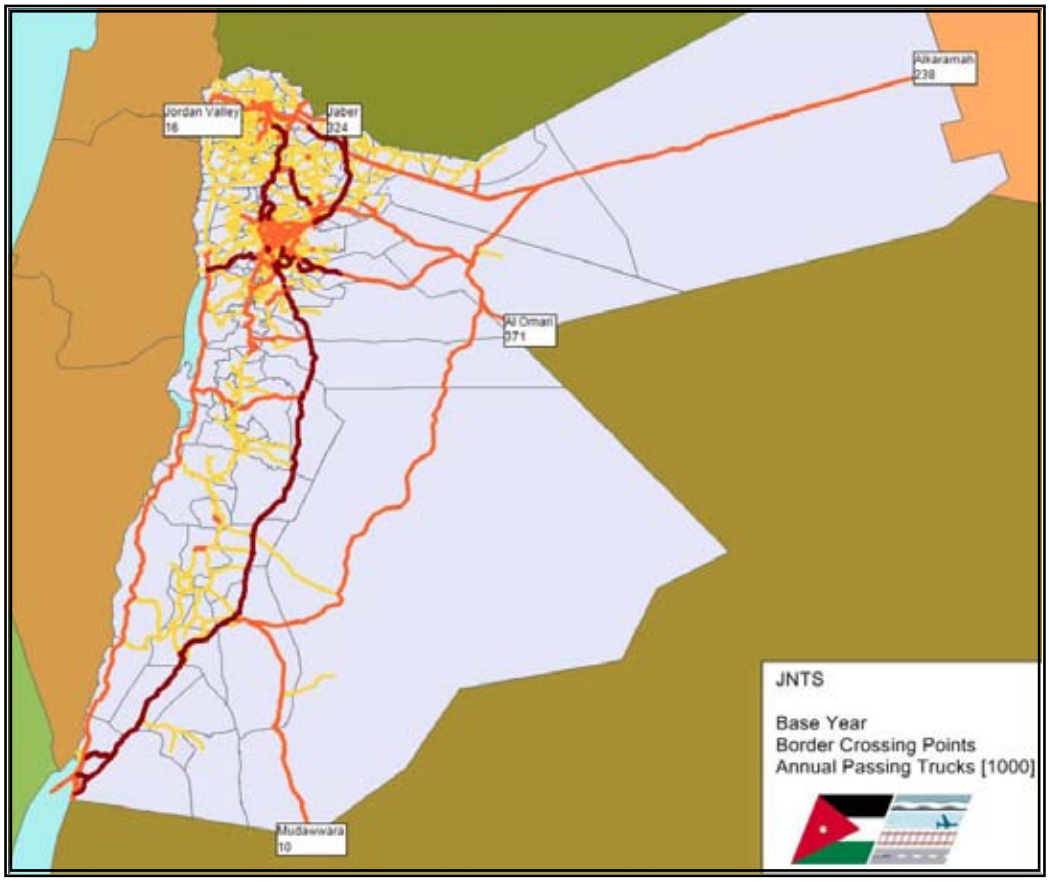
Table 3: Annual airport passengers in 2010

Airport	Base Year Annual Passengers w/o Transfers (Thousand)	
	Arriving	Departing
Queen Alia International Airport	2.066	2.089
Marka International Airport	109	107
King Hussein International Airport Aqaba	104	115

Freight Transport

The (long-distance) freight transport volumes are mainly influenced by the import and export volumes via port of Aqaba and the land border crossings. In 2010, the total import volumes were about 15 million tonnes compared to almost 10 million tonnes that have been exported.
The resulting truck volumes at the land border crossings according to the Jordan Customs Statistics are displayed in the following figure. The Custom Statistics did not include truck volumes at Aqaba.

Figure 7: Truck volumes at land border crossings – base year 2010

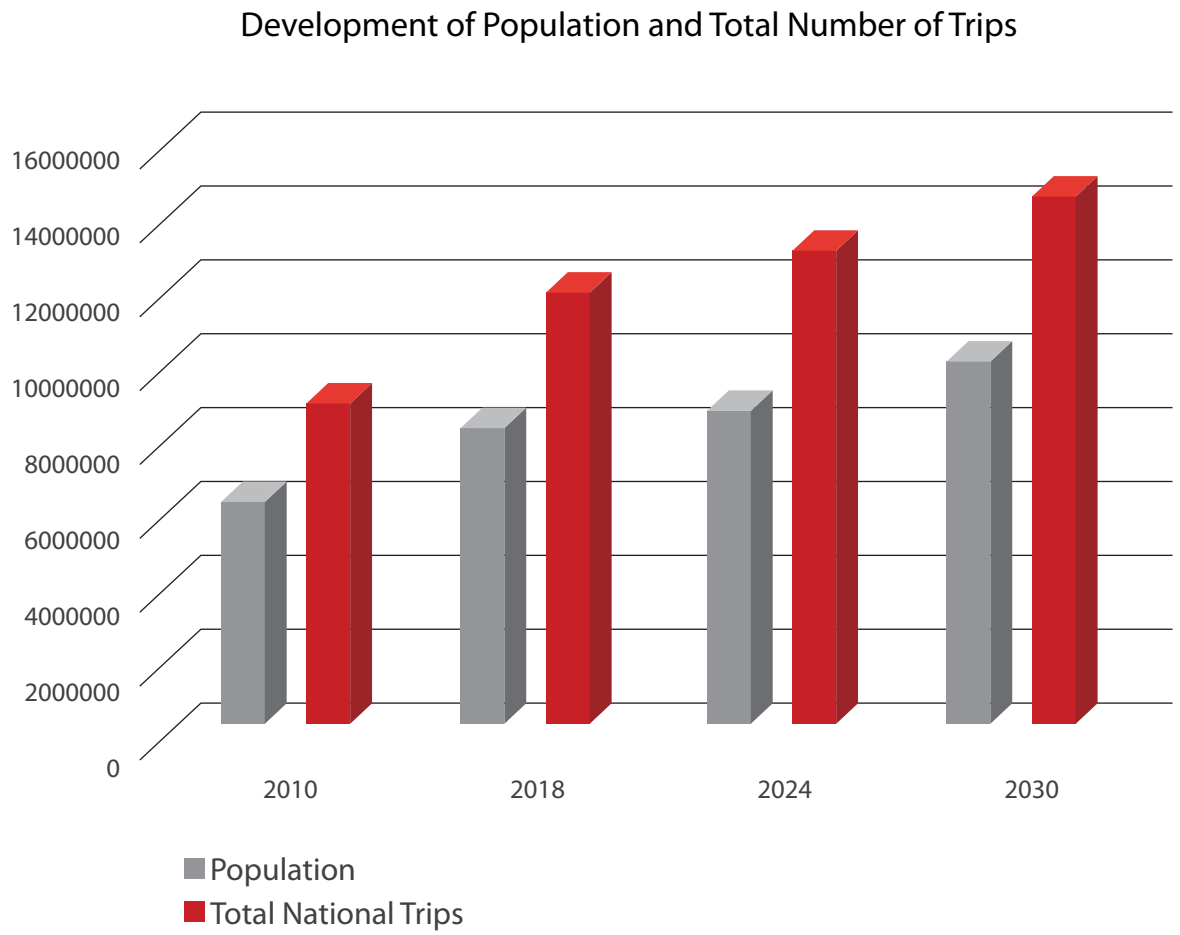


2.2.2 Future Transport Demand

Total number of national trips

The following figure shows the development of total number of domestic trips until the horizon years 2018, 2024, 2030 as they have calculated with the JNTS Transport Model. Since the major input factor for the calculation is population development and population, the increase of trips from 2010 to 2030 is in line with the increase of population. Compared to 2010, the number of trips increases by more than 50 percent until 2030.

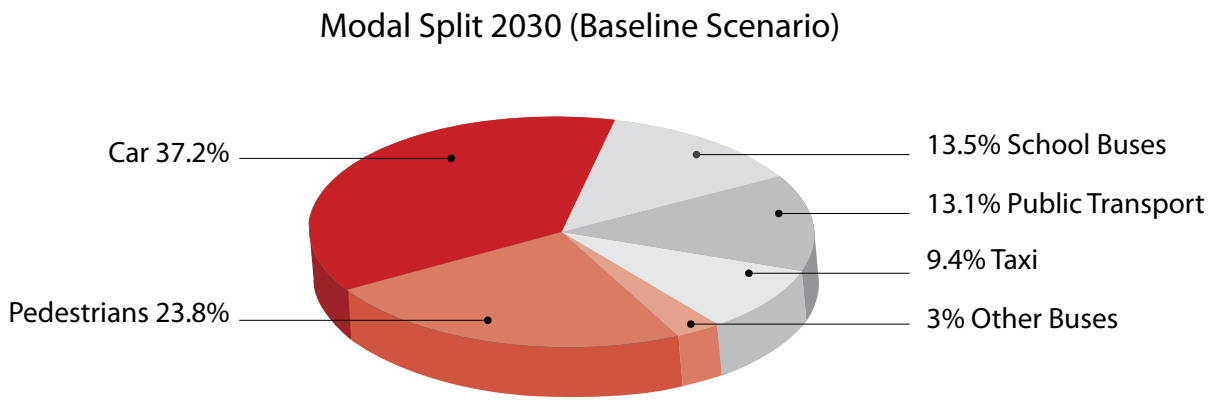
Figure 8: Development of population and number of trips



Modal Split

The following chart presents the modal split that has been calculated for the reference forecast scenario without any strategy, the so-called baseline scenario 2030.

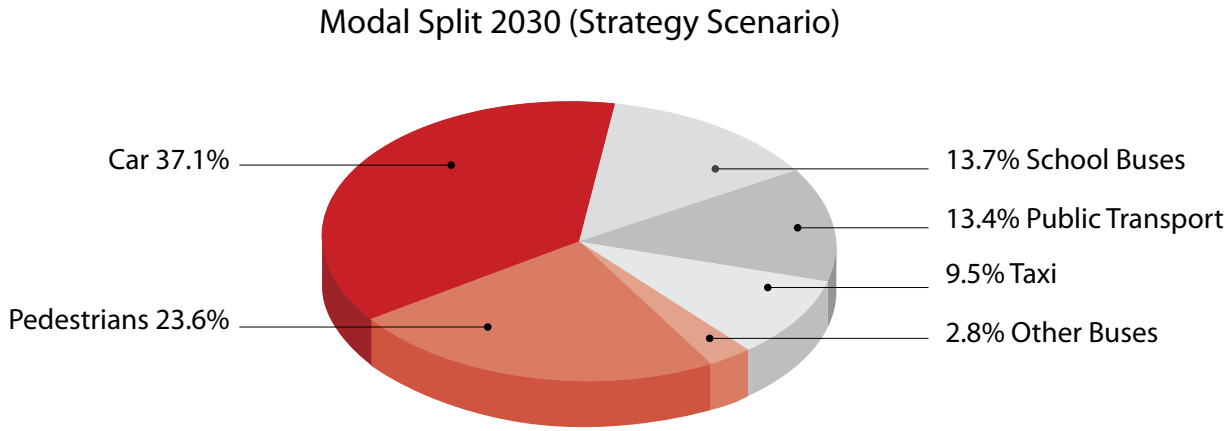
Figure 9: Modal Split – Baseline Scenario 2030



Compared to 2010, an increase of car trips can be observed, whereas the share of Public Transport (PT) decreases, the share for taxi and walking trips decreases slightly. The reason for this development is the development of the main influencing factors, such as motorisation rate and value of time. As presented in Annex 2, both a high increase of the motorisation rate and an increase of the value of time are forecasted for Jordan until 2030. The higher share of persons with car availability and the higher value of time in 2030 lead to a higher share of car trips.

Analysing the 2030 mode share for the strategy scenario, it can be seen that there is a higher share for public transport than in the baseline scenario. Having the same high increase of the motorisation rate and an increase of the value of time as for the baseline scenario, additional measures both for private traffic and public transport are implemented in the strategy scenario.

Figure 10: Modal Split – Strategy Scenario 2030

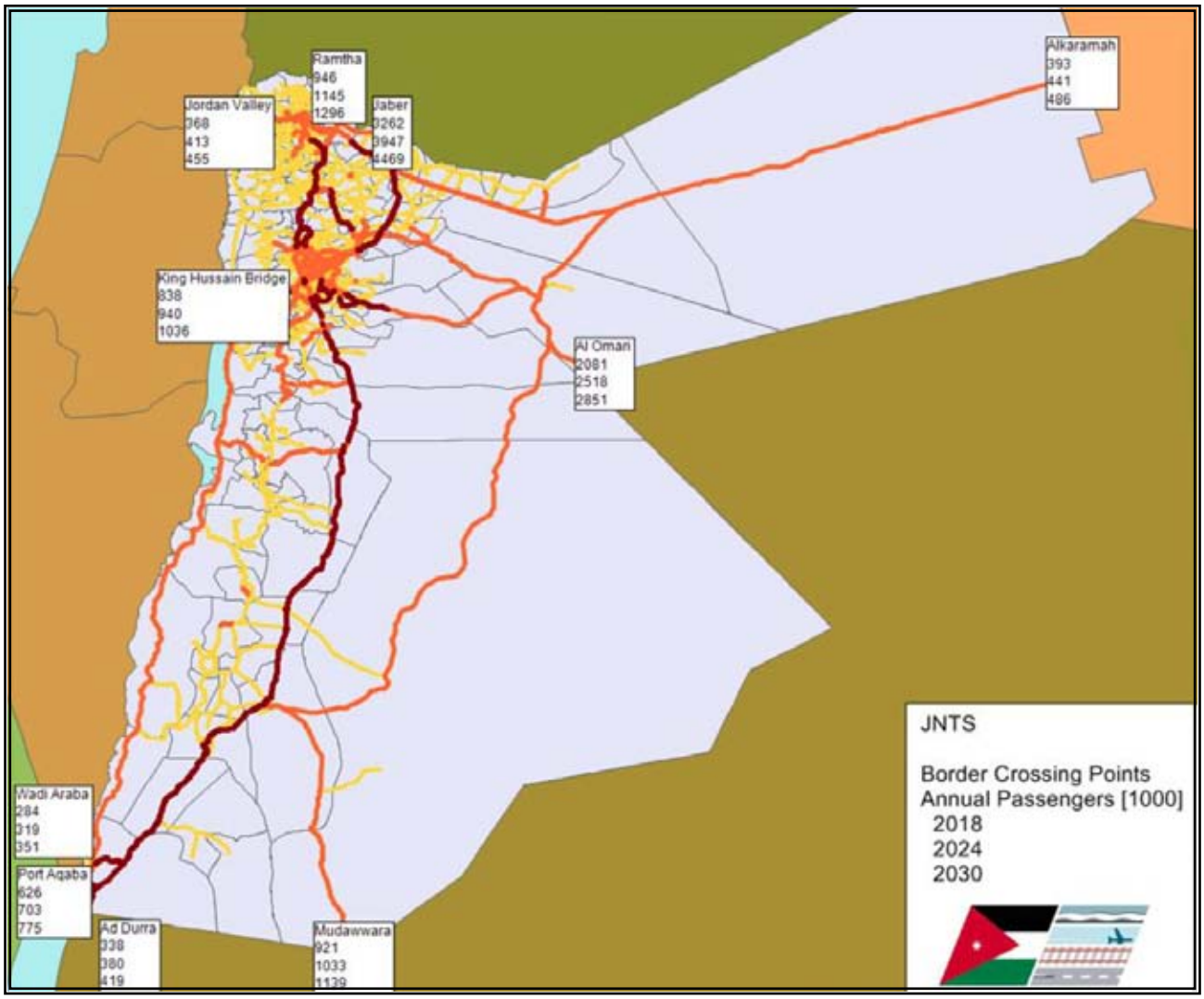


Border Crossing Flows

Regarding international flows, the arrivals per year via the land border crossings and port of Aqaba increase from 9.2 million arrivals in 2010 to 10.1 million in 2018, 11.8 million in 2024 and 13.3 million in 2030.

The following figure shows, how these arrivals are distributed over the specific border crossing points.

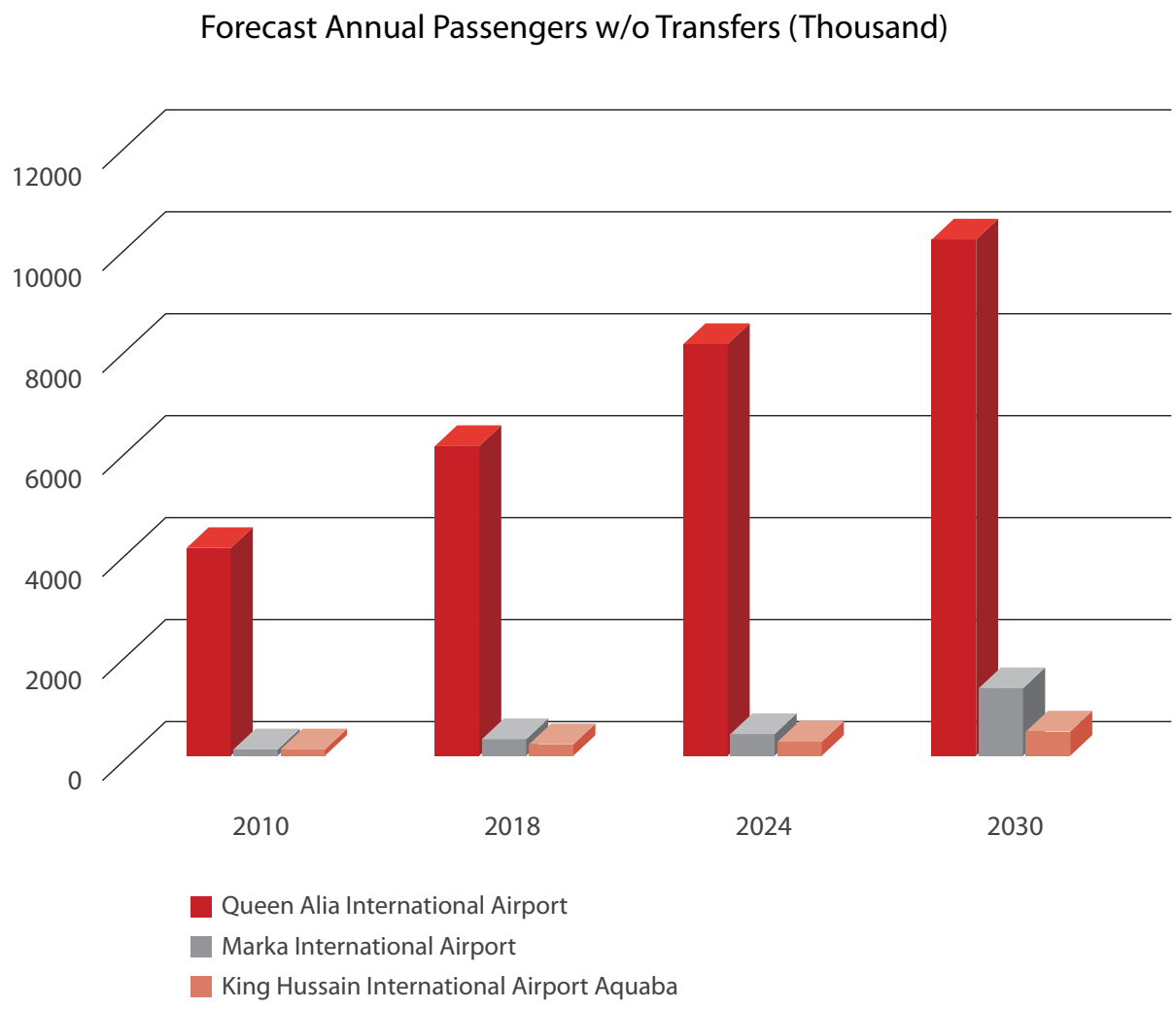
Figure 11: Border crossing flows 2018, 2024, 2030 (arrivals per year)



Airport Volumes

As shown in the following figure, a strong increase of airport passengers entering and leaving Jordan through the airports is forecasted until the horizon years 2018, 2024 and 2030. The increase rates for airport passengers are disproportionally high compared to the increase rates of the general traffic volumes.

Figure 12: Development of annual airport passengers



Freight Transport

The future freight transport is mainly influenced by the import / export growth rates that have been calculated for the horizon years. Having a total import volume in 2010 of 15 million tons, the import volumes almost double by 2030 with 28 million tons. The following table summarises the annual import volumes by commodity group for the base year 2010 and for the three horizon years.

Table 4: Annual import volumes by commodity group

Commodity Group	Annual Import to Jordan (thousand tons)			
	2010	2018	2024	2030
Agriculture	1,578	2,046	2,295	2,530
Food & Beverages	1,128	11,463	1,641	1,809
Wood	462	608	815	1,061
Energy	7,442	9,153	11,412	13,923
Raw Materials	1,071	1,393	1,628	1,875
Metal Products	664	872	1,139	1,453
Construction	557	723	811	894
Fertiliser & Chemical Products	841	1,094	1,448	1,869
Consumer Goods	779	1,026	1,375	1,790
Others	504	664	890	1,159

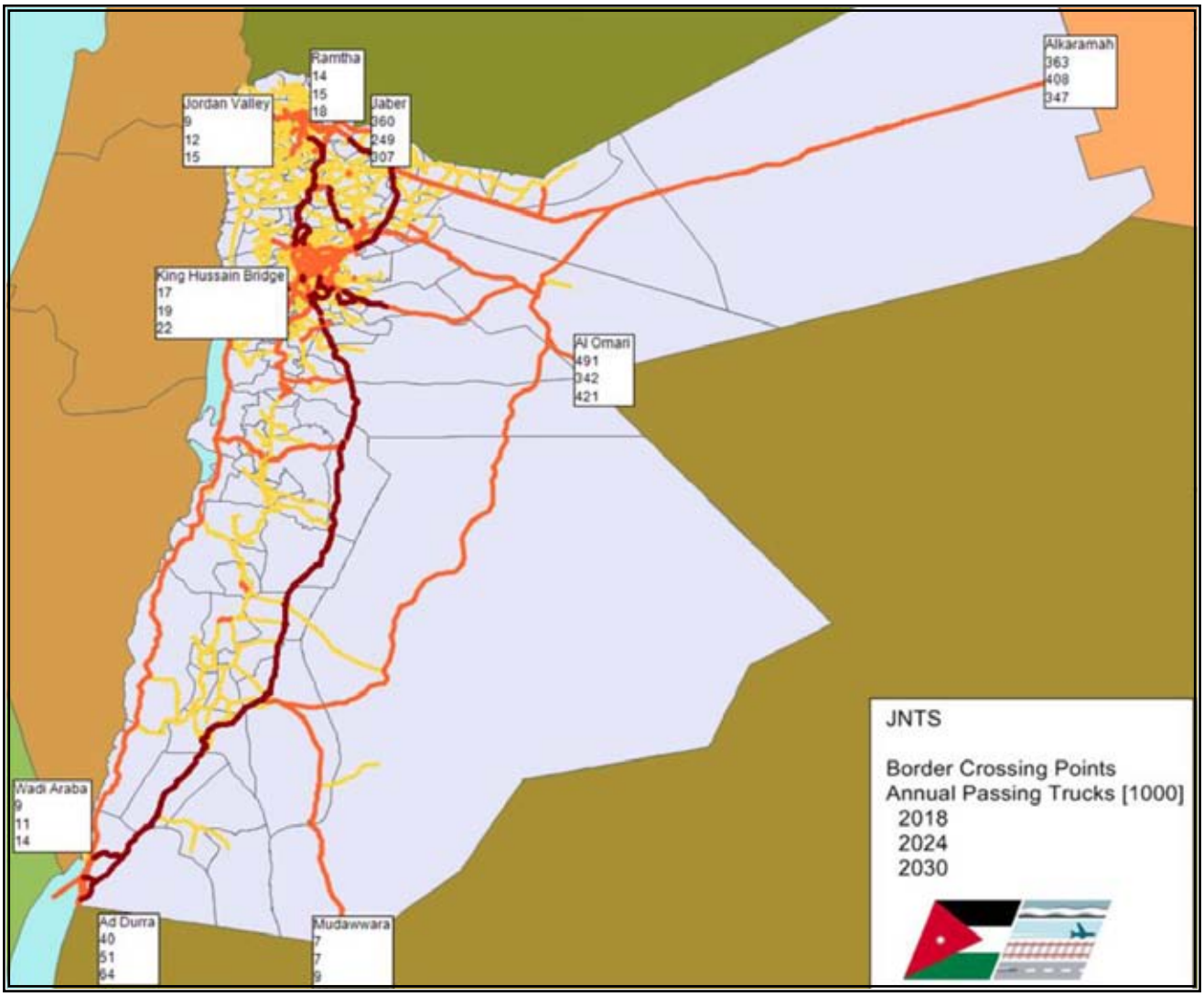
For the export volumes, an increase is forecasted from about 10 million tonnes in 2010 to almost 18 million by 2030. This strong growth is mainly due to the high increase of cement exports that are expected to Syria. The following table summarises the annual export volumes by commodity group for the base year 2010 and the three horizon years.

Table 5: Annual export volumes by commodity group

Commodity Group	Annual Import to Jordan (thousand tons)			
	2010	2018	2024	2030
Agriculture	602	780	876	965
Food & Beverages	507	657	737	813
Wood	152	200	268	348
Energy	2	3	3	4
Raw Materials	5,495	5,975	6,380	6,817
Metal Products	339	446	587	754
Construction	453	588	2,614	4,706
Fertiliser & Chemical Products	1,493	1,763	2,101	2,496
Consumer Goods	296	390	523	680
Others	254	334	445	583

The resulting truck volumes at the land border crossings are displayed in the following figure.

Figure 13: Truck volumes at land border crossings – 2018, 2024, 2030

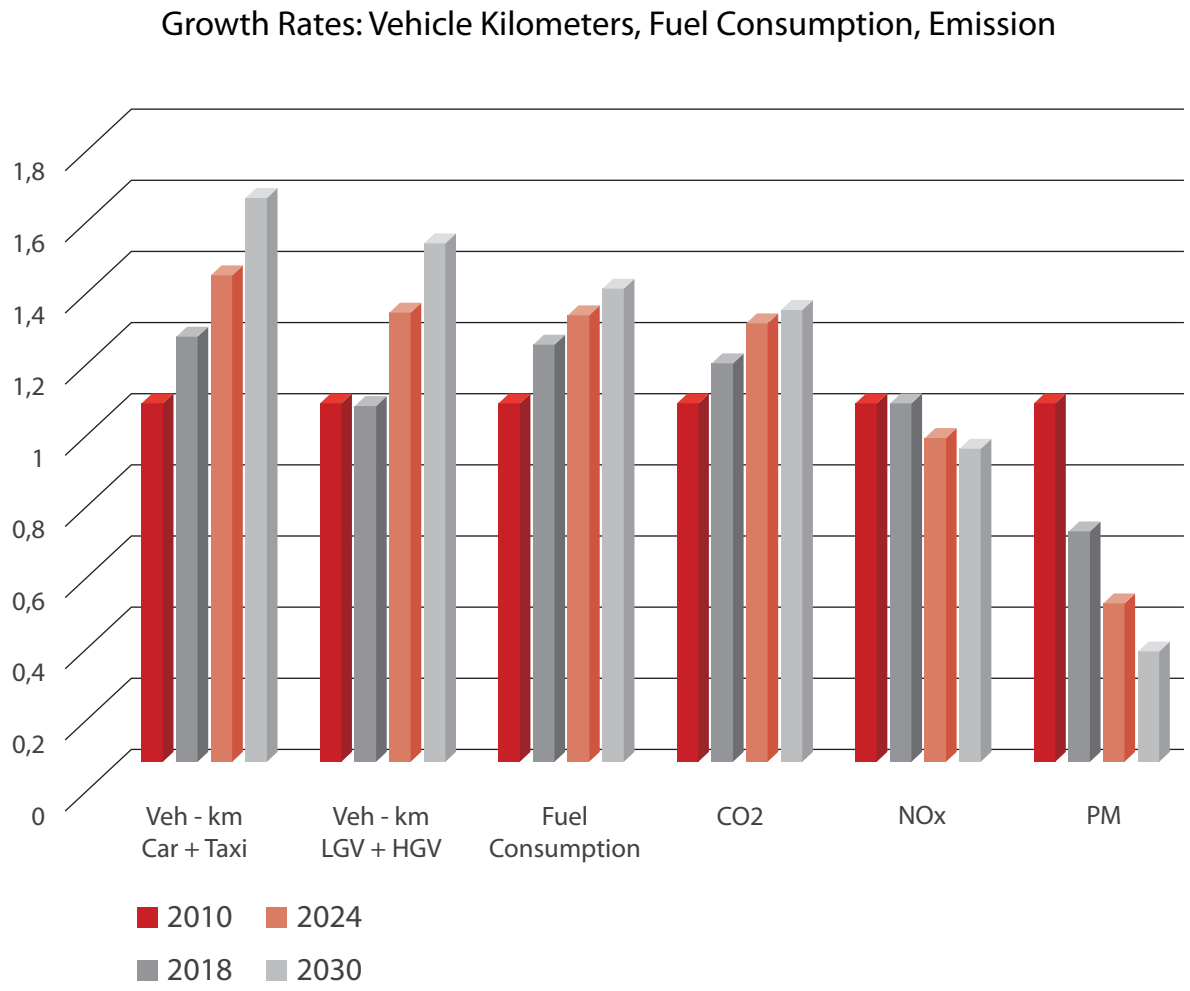


Environmental impacts

Analysing the environmental impacts of the transport sector, a significant improvement can be observed. As shown in the following figure, there is a strong increase of vehicle kilometres compared to the base year. Until 2030, the increase is about 56% for private road traffic and 44% for freight transport. Contrary to this development, the fuel consumption grows only by approximately 30% until 2030, CO2 emissions show an increase by only 26%, while NOx and particle emissions even decrease.

The following figure shows the growth rates of vehicle kilometres and selected environmental indicators until 2018, 2024, 2030. The growth rates are indexes related to the base year 2010.

Figure 14: Growth rates of vehicle kilometres and environmental indicators compared to base year



3 Drafting of the Strategy: main steps

3.1 The options

Based on outcomes of the activities deployed in the previous steps of the project, namely the background analysis, the gathering of existing projects and plans, the consultation with the stakeholders, a number of different transport measures has been identified in order to:

- Meet the objectives in accordance with the policy principles for the Jordan Long-term Transport Strategy (see the JNTS Policy paper)
- Solve or reduce the shortcomings (see the JNTS White paper on industry's views on transport sector's shortcomings)

Five alternative strategic scenarios have been designed as a combination of different sets of integrated hard (investments) and soft (policies) measures and of different phasing of implementation (short term, 2018, medium term, 2024, long term, 2030).
All the five scenarios include policy measures for both passengers and freight. The rationale and the approach behind each scenarios is quite different, even if they share some common measures (that however may differ in terms of phasing) and assumptions.

Two scenarios are based on different assumptions on the level of budget constraints, one with very tight budget constraints, the so called **Low Cost Scenario** (LO) and a second one with no constraints, the **High Investment Scenario** (HI). In the **Integrated Scenario** (IN) the budget constraints are not so tight as in the Low Cost one, but still playing a significant role. **The fourth Regional Scenario** (RE) stresses the regional role of the Jordanian transport sector, while the fifth **Environmental Scenario** (EN) has the protection of the environment at the core of the proposed measures.

Importantly, in coherence with the policy pillars that were set in earlier stages of the project, every scenario strives for fostering trade and integration of Jordan in the region, as well as reducing impacts of the transport sector on the environment. The Regional Scenario and the Environmental, however, give more emphasis to the latter objectives.

Each one of the alternative scenarios builds on and has been compared with the so-called **Reference** (or do-minimum) **Scenario** (RS), which include transport measures that in reason of their advanced level of technical definition, political decision and/or secured funding might be considered as invariant and their implementation might be considered as given. Often those measures and projects are under the responsibility of entities different from the MoT and its direct affiliates (e.g. MoPWH, ASEZA-ADC).

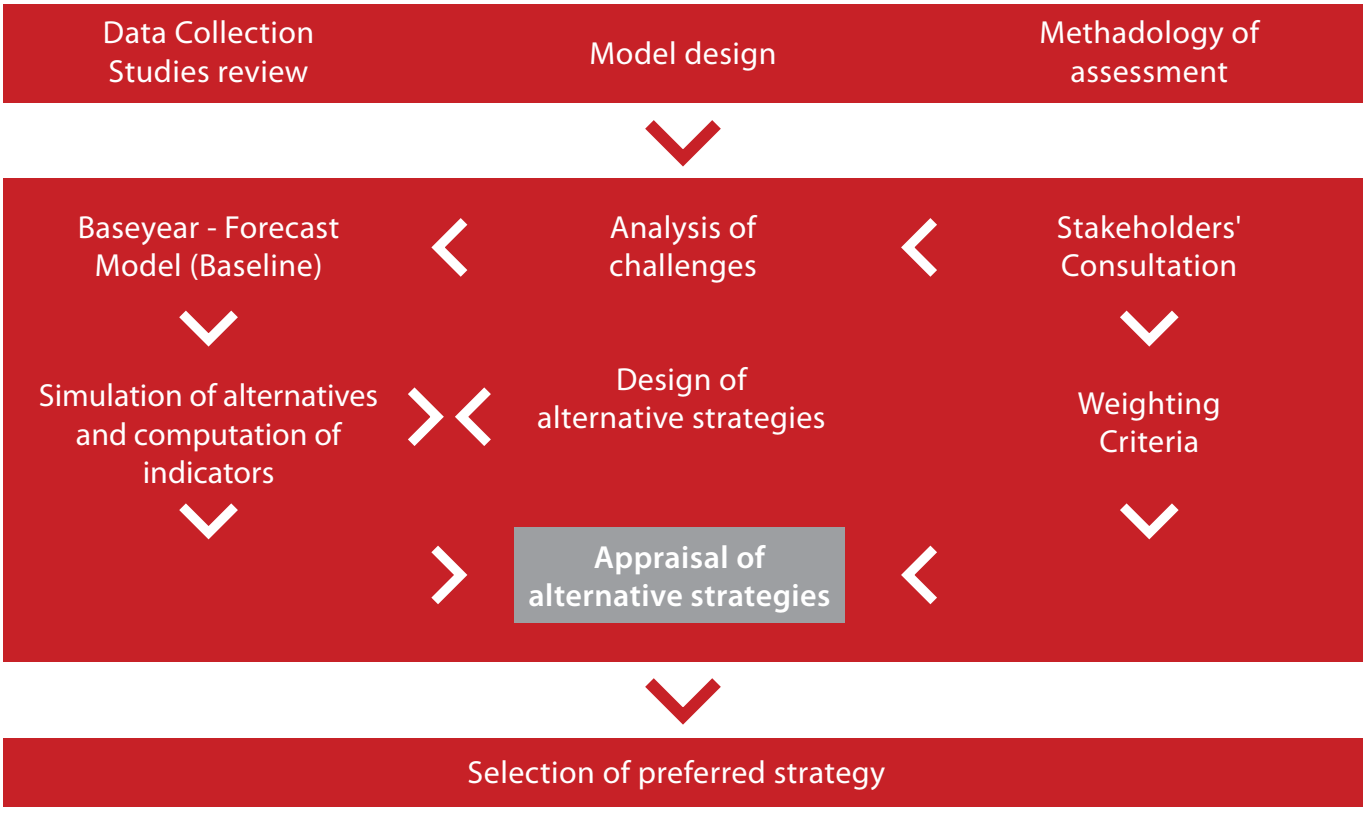
Measures and projects included in each scenario are listed and phased in the tables in **Annex 3.**

3.2 The quantitative approach

To draft the Jordan Long-Term National Transport Strategy, two tools were specifically developed: the transport forecast model and the appraisal and prioritisation methodology. The joint use of the transport model together with the adoption of the prioritisation process have provided quantitative inputs to support decision-making for the selection of the final Strategy.

Specifically, the development of the **transport model** is one of the prerequisites for the development of the National Transport Strategy. The transport model is a tool that is aimed at representing current conditions of the transport system for both, within Jordan (Domestic flows) and between Jordan and other countries (regional level). More importantly, the transport model allows forecasting future conditions without any strategy or measures (baseline scenario) and with the implementation of different strategies and measures in order to evaluate their respective impacts.
This is needed to identify the most useful measures, to combine them into strategies and to compare alternative strategies in order to select the most suitable or the preferred strategy. In this respect, the **appraisal and prioritisation methodology** has been implemented in order to identify the best options to meet the transport sector challenges and the ways to maximise the impacts of public and private investments. What is needed is a systematic approach, which starts by identifying clear objectives, considers all types of intervention, assesses the impacts and prioritizes the options which better impact on the objectives.

Figure 15: Diagram of the approach to select the preferred Strategy



3.2.1 Multi-modal transport model

An integrated multi-modal transport model was developed as a tool for the assessment of the traffic conditions and to identify the impacts of strategies and measures. The transport model is responsive to various kinds of transport planning and transport demand management measures, i.e. measures of infrastructure development, development of transport services, transport demand measures, financial measures like fuel costs, taxes, tolls, public transport fares.

The modelling approach for the Jordan National Transport Strategy Project assumes the following inter-related components:

- **Passenger Demand Model:** to represent travel demand and choices across all modes of transport serving the national and regional study area. This model is developed based on algorithms of socio-economic data, behavioural data of the population and the supply data of the traffic networks and services
- **Freight Model:** freight transport as a whole is a very complex and heterogeneous process. The freight model developed follows a highly disaggregated approach to calculate the freight volumes based on production and consumption of homogenous commodity types.

In order to better examine and reflect transport demand and conditions in Jordan and the region adequately, it was considered best to utilise a traditional four-stage multi-modal transport model, including trip generation, trip distribution, mode choice, and road and public transport network assignment models.

The equations and algorithms used in the modelling process are based on the transportation planning theory practiced worldwide. The parameters used in the equations and algorithms for developing the Jordan transport models are based on a combination of local data, international best practices and the data available from past studies in the Region, adapted to represent local conditions where necessary.

The model results comprise a vast amount of data, detailed matrix based as well as network based information for both, freight demand and passenger demand. For the assessment of the model results and the evaluation of the scenarios, a selection of output data was considered.

Main results of model runs for the five alternative scenarios are reported in **Annex 1.**

3.2.2 Appraisal and prioritisation process

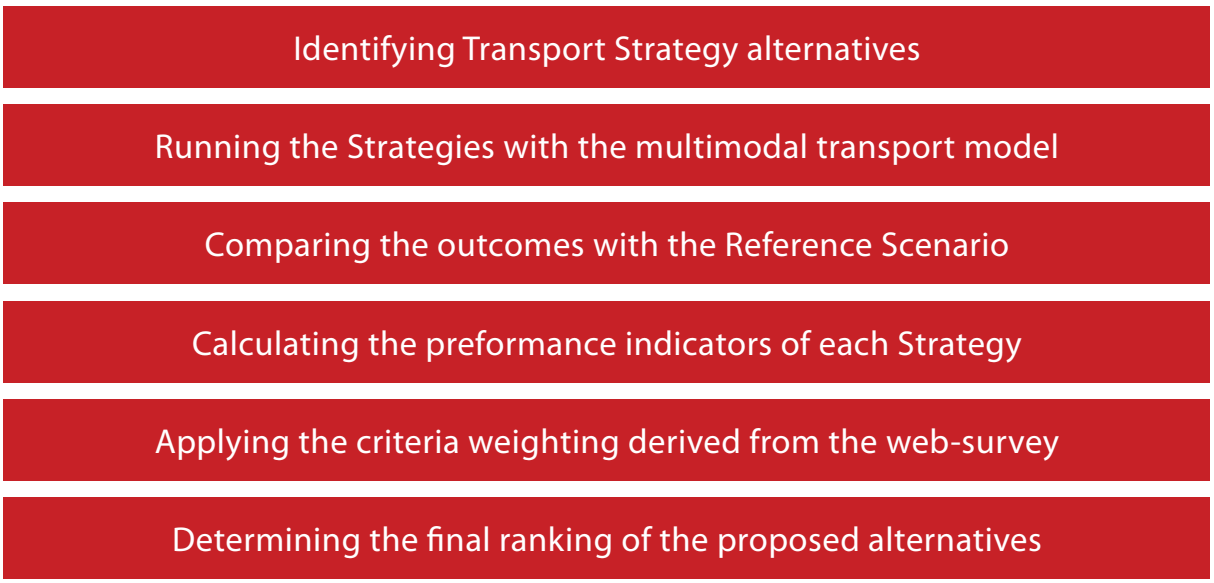
The objective of prioritisation process is to select the most relevant transport strategy. Transport investments and policies should be prioritised according to the degree of contribution to balanced sustainable development of Jordan in terms of their economic, environmental and social impacts. The prioritization methodology is a tool that could be applied also in the future whenever there will be the need for ranking transport strategies, projects or plans. It has therefore been designed as an independent tool.

By incorporating Cost-Benefit Analysis (CBA) results into an Multi-Criteria Analysis (MCA) framework, the approach proposed for the prioritization of Jordan's transport strategies retains the strengths of each appraisal method and provides a procedure for decision makers to create a sound ranking of projects which is consistent between all candidate interventions and has a clear link to policy goals.
The impacts of the five alternative options scenarios have been assessed by comparing the outcomes of the multimodal transport model for each of them with the outcomes of the "do-nothing" reference scenario. Quantitative impacts calculated by the model have been complemented by qualitative impacts evaluated exogenously.
The considered impacts cover the six criteria identified for the assessment:

- Regional
- Technical
- Social
- Policy
- Economic and financial
- Environmental

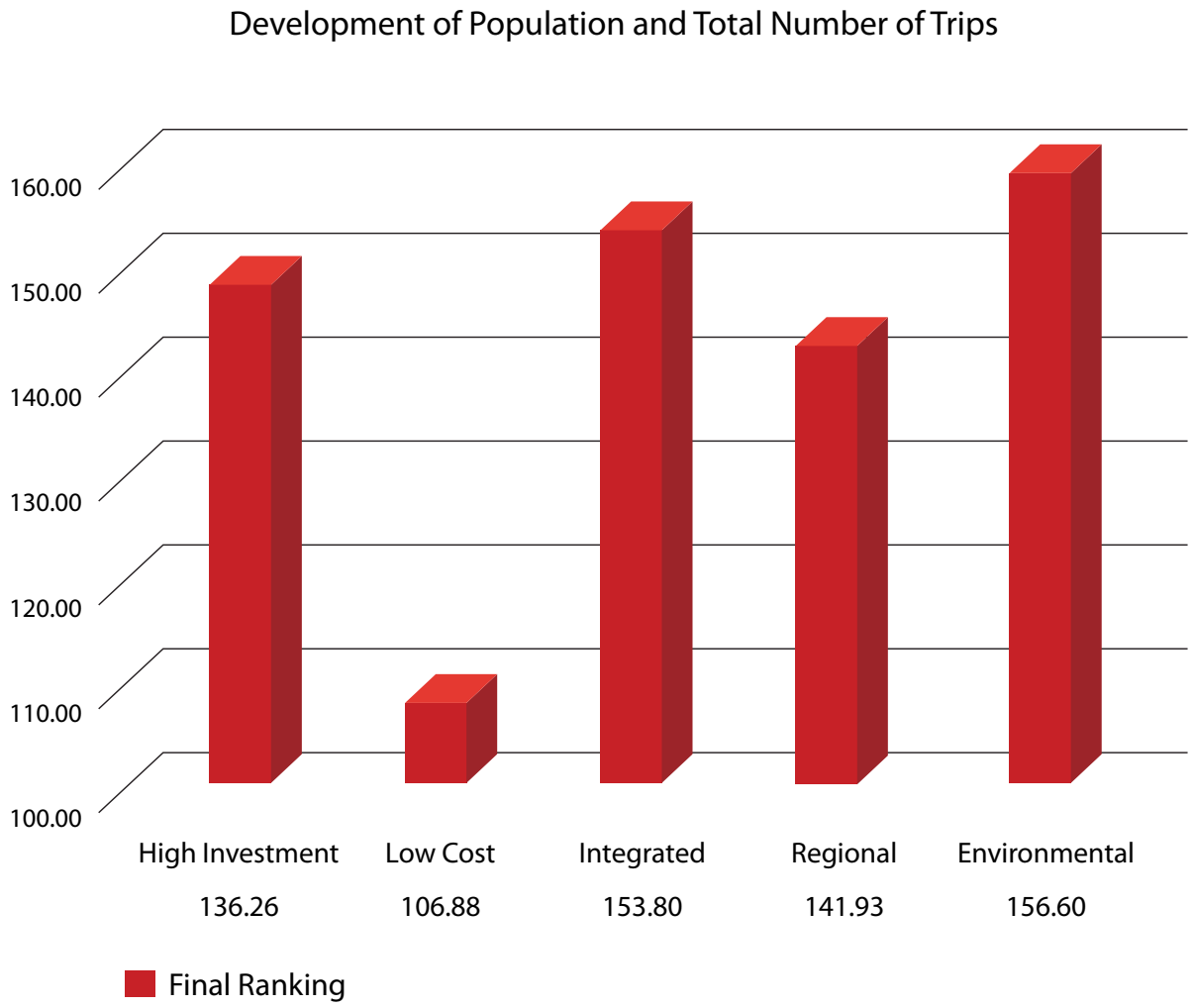
After the identification of different transport strategies, the prioritization process has been developed along the following steps:

Figure 16: Diagram of the prioritisation process



The five alternative scenarios presented above and described in annex have been evaluated by means of the multi-criteria assessment procedure, which has led to the following ranking.

Figure 17: Ranking of alternative scenarios



More details and the final results of the prioritisation process are reported in **Annex 4.**

The Environmental scenario showed the best score, therefore it has been selected as the backbone of the final Strategy. Some minor amendments to this winning solution have been introduced as a result of the interactions and discussions with MoT and its affiliate institutions.

4 The Strategy

4.1 MoT vision, mission and core values

Vision

MoT vision is to have a developed and sustainable transport sector, distinguished for competency, safety and environmental stability, enhancing the socio-economic development and making Jordan a regional hub for transport.

Mission

- Setting and executing policies, aiming at developing and sustaining the transport sector
- Boosting the role of the private sector and motivating this sector on investment, increasing the productivity of the transport sector
- Setting a system of indicators, observing the abidance by safety and security measures and conserving the environment
- Adopting the projects that can make Jordan a contact and communication point inside the region and between the region and the external world

Core values

- Professionalism
  Professionalism is conducting work without errors, abiding by regulations and laws, carrying out work duties on time without delay, continuous improvement, and working with a sense of responsibility towards work
- Collaboration and team spirit work
  Collaboration and team spirit work mean cooperation and team work with all inbound and outbound partners for realizing the Ministry of Transport vision, mission and objectives in addition to the decision-making sharing
- Transparency
  Transparency is the state of being clear and open in the inbound and outbound procedures and information
- Focusing on the service recipient
- Creativity and Innovation
  Providing a suitable work environment that supports creativity and innovation by adopting and rewarding new ideas

4.2 The founding elements

Transport is a vital sector for the Jordanian economy and an important component of daily life of Jordanians. The country has heavily invested in the transport sector in the past decade expanding the road sector which constitutes the backbone of the national transport system, improving urban transport, enhancing the logistic industry. At the same time, the Country has started a process of liberalisation of the sector, opening the market for transport services to private operators and in general increasing the involvement of the private sector. To accompany this changes the institutional set up has been gradually transformed.

Both passengers and freight transport demand is growing rapidly, due to economic growth within the country and the region, and is concentrated on parts of the transport networks, nearby the main urban areas and along the key corridors, and on parts of time of day. As a consequence part of the network is under pressure, and performances are below the needs. Without interventions, as the forecast model has shown, things will worsen and at the end of the next decade part of the system will not perform as needed to support Jordanian economy and daily life of citizens. Unreliability and delays are going to increase, thus causing costs to people and business activities and at the end negatively affecting the economic performance of the Country.

At the same time, the international financial crisis imposes serious constraints, at least on the short/medium terms, on financing and ask for a careful selection of investments in order to maximize the positive impacts and increase the efficiency of the entire transport system.

To keep the pace with the growing demand, the changing patterns of national and international trade and the economic development, the government of the transport sector should prioritize actions in those parts of the transport system and networks, in those nodes that are critical for economic and social growth: reduce bottlenecks, increase reliability, reduce negative impacts (congestion, emission, energy consumption).

The Long Term National Transport Strategy is an opportunity to consolidate the results already achieved and to foster the process of modernization of the transport system in order to fully support the economic development of the country.

The challenges that the transport sector has to face in the next years demand for a multimodal approach, within which each mode contributes to the achievement of the final goal of having a transport system supporting the economy and the people of Jordan. Multimodality requires a coordination between different modes, and cooperation between different transport authorities. And this is what the strategy should do, build a consistent framework where all transport modes are interconnected and contribute as much as possible to a seamless transport system. But it requires also a sophisticated mix of investment and policy measures, where policy measures should contribute to improve the performance

of existing facilities and services and optimize the use of the future ones, to reduce social and environmental costs of transport, reduce non-physical barriers and minimize financial needs in order to meet budget constraints. Finally the strategy has to be flexible, in order to be able to cope with a difficult regional context.

4.2.1 Policy pillars

The pillars on which the Jordan Long Term Transport Strategy is built are based on the following main principles and priorities:

- Complete the existing networks
- Make the best use of the existing facilities
- Pursue a multimodal approach
- Combine infrastructure investments and policies
- Make the best of private participation in the transport sector
- Protect the environment and reduce negative impacts
- Emphasize the regional dimension
- Have citizens at the core of the transport policy

Table 6: The Long Term Transport Strategy policy pillars

Policy pillar	Highlights
Complete the existing networks	▪ Assessing missing links and bottlenecks and prioritising investments are key to maximize the benefits in the short run ▪ Investments in transport infrastructure have allowed the Jordanian network to expand its networks, but supply still appears fragmented ▪ Completing the existing networks and solving major bottlenecks will guide the timing and prioritization of the foreseen interventions
Make the best use of the existing facilities	▪ Improve interconnections, look at the nodes, separate flows, identify small scale interventions ▪ Inefficiencies may be reduced by matching flows and networks, and having networks dedicated to specific flows ▪ Appropriate maintenance (on infrastructure and vehicles) is essential for a safe, reliable and less pollutant transport system
Pursue a multimodal approach	▪ Good interconnections between modes, networks and transport services are key to an efficient and multimodal transport supply, potentially capable to increase public transport ridership ▪ Railway is a major player of, and should rely on, an efficient multimodal transport system. An attractive rail service has the potential to optimise the functioning of the interchange links within the Jordanian territory ▪ Development of the logistic and rail networks should be consistent in time horizon and design

Policy pillar	Highlights
Combine infrastructure investments and policies	▪ Pricing, regulation, safety and security policies are an important component of the transport strategy and need to be harmonized with investments ▪ Compared to investments, policies are easier to implement and less financially demanding ▪ Policies may provide benefits already in the short term but their implementation should be harmonises with that one of the investments ▪ Small scale and better-use policies can offer very good returns in the short term, but should be fitted within a long-term strategy
Make the best of private participation in the transport sector	▪ The private sector can positively contribute to the future of the transport sector by both investing in infrastructure and operating services. ▪ Setting up an appropriate regulatory environment and identifying projects potentially attractive in terms of revenue returns are key to increasing private participation in transport infrastructure.
Protect the environment and reduce negative impacts	▪ Transport activities imply (negative) effects in environmental, economic and social terms ▪ Decarbonising the transport sector requires combined polices aiming at increasing the modal share of low-carbon transport modes, and improving energy efficiency ▪ Promoting innovative technologies is one of the major fields where these combined policies may be applied ▪ Safety is a relevant issue hindering the transport sector and it should be improved with a set of complementary measures based on enforcement, education, vehicle roadworthiness tests and regulation, maintenance of infrastructures
Emphasize the regional dimension	▪ Regional dimension is key, given the strategic role of Jordan as crossroad of major international and regional transport axes ▪ Promoting the regional dimension of the Jordanian transport sector may be leverage to higher trade volumes and increased economic growth ▪ A better domestic transport infrastructure is key to attract and promote a higher share of transit flows
Have citizens at the core of the transport policy	▪ Mobility is a major facilitator of the quality of life and livelihood and directly influences citizens' daily life and activities. ▪ Mobility is fully sustainable when it also addresses the impacts of transport activities in terms of social exclusion-related, economic and social cohesion, and demographic changes. ▪ Providing a greater degree of accessibility to users becomes here crucial to secure access to essential services, particularly when provision of public transport services is poor or inadequate. ▪ Key is promoting a greater inclusion and participation of citizens in the decision making process, where information sharing and dialogue is encouraged.

4.2.2 Key strategies

As far as **freight transport** is concerned, developing a *modern railway network* that is inter-connected and interoperable with neighbouring countries will be the occasion to efficiently connect and integrate existing and future transport hubs and industrial/commercial destination and development zones.

In this respect, key synergic actions are: the reinforcement of the *port of Aqaba* as the main gateway of the Country and beyond (expansion of the container port, relocation and development of major terminals at the south industrial port), the development of *dry ports and logistics centres* (summing up container handling and storage, customs clearance and inspection, stripping and stuffing, bonded storage with warehousing, value added services and commercial offices), *service areas for trucks* at border crossings (with different spaces dedicated both to vehicles and to drivers).

According to the transport model simulations, it is expected that in the long term (2030) the new railways will attract 21.2 million tons of freight per year amounting to 5,100 million ton kilometers on Jordan rail tracks. This will ease road traffic flows by 4,200 ton kilometers.

If accompanied by proper "push and pull" policy measures to *modernise and consolidate the trucking industry* (such as for instance incentives to renewing the fleets, enforcement of regulations and licenses, tolling of highways), and the new railway project but also the achievement of the new oil pipeline from Iraq to Aqaba through Zarqa are strong incitements to do so, the Jordan freight transport sector might reach a real competitive advantage in the region.

Passenger transport requires a strong commitment towards the promotion of alternatives to pure private, road transport. At this regard, the Strategy proposes a set of integrated and complementary measures to increase the quality attractiveness of public transport: the full implementation of *new bus network and services*, setting and enforcing *minimum standards for vehicles* in order to improve safety and quality, *restructuring the sector* and the way PT services are operated and awarded to operators, *upgrading the facilities* (terminal, bus stops, border crossing) while fostering intermodality. Developing and specializing Jordan airports (Amman Queen Alia, Amman Marka, Aqaba King Hussein) is also a key strategy in order to improve the passenger (and freight) connections of Jordan to the Region and beyond. As a result, while in the baseline scenario the share of the demand using public transport is declining through time, in the strategy it shows a moderate increase reaching 13.7% of the total demand compared to 13.1 % in the baseline scenario.

A number of cross cutting issues are addressed by the Strategy as well. A National Transport **Safety** Programme is a fundamental part of it, being aware that significant improvements in Jordan's transport-related safety challenges can be achieved mainly in the road sector. Relevant measures therefore cover three fields of action: road users behaviour, vehicles characteristics and infrastructure characteristics.

Finally, the reduction of impacts of the transport sector related to the environment (pollutant emissions, greenhouse gasses, fuel consumption) is pursued by the Strategy, besides improving the competitiveness of alternatives to pure road, private transport, both for passengers and freight: incentives to renovate public and private fleets, through financial, regulatory and enforcement incentives and disincentives, and improving efficiency of the logistic and passengers transport chains (multimodal centres, facilities).

As a consequence, while the vehicle kilometres in private transport increase by 56% (road freight transport by 44%) in the long term (2030), the fuel consumption only grows by approximately 30%, CO2 emissions show an increase by 26%, and NOx emission even decreases by 14% according to the transport model simulations.

4.2.3 Jordan at the core of regional corridors

The Long-term Transport Strategy confers great importance to the improvement of Jordan's transport system in order to boost goods and passengers exchanges to/from the neighbouring countries and to confirm the key role of Aqaba as one of the main ports for the region.

In fact, the development of Jordan's transport system clearly influences the regional transport flows. If domestic networks that can be used for transit flows are improved, e.g. higher capacity, better comfort, gentler gradients, lower travel times, less time lost at borders and lower costs, then the "Jordan route" will attract more transport flows. Moreover, a better transport infrastructure in Jordan can contribute to the positive economic development of the whole region.

The identification of major international and regional road corridors in the region is pictured in the map below. The so-called Mashreq region being the region of Arabic countries between KSA, Egypt, Turkey and Iran.

Figure 18: Map of international and regional road corridors within the Mashreq region

Source: Regional Cross-Border Trade Facilitation and Infrastructure Study for Mashreq Countries

Priority have been given to the main trade North-South corridor to support the development of a new multimodal Red Sea-Black Sea "land bridge" transport corridor along the route Aqaba - Amman - Syria - Turkey - Samsun (and then to existing sea connections to Russia, Ukraine, Caucasus and Danube river) alternative to the Suez-Mediterranean sea route.

This corridor is also part of the "South Eastern axis", which is one of the five transnational corridors the European Commission foresees to better connect the major axes of the trans - European networks with those of the neighbouring countries. The South Eastern axis is particularly aimed at linking the EU with the Balkans and Turkey and further with the Southern Caucasus and the Caspian Sea. as well as with the Middle East up to Egypt and the Red Sea.

The "land bridge" is of strategic importance to attract transit flows and new businesses in Jordan. In fact:

- It will foster added - value services for vehicles and freight in the Kingdom
- It will have relevant side branches that will feed the main corridor (e.g. in Jordan, towards Iraq and KSA)
- It is designed for freight (mainly) but also passengers
- It will comprise road (initially) and rail (long-term) connections

The Strategy, as it will be shown in the following chapters, comprises infrastructure and regulatory measures aimed at improving connections and trade of Jordan within the region, as well as promoting Jordan as a freight multimodal hub in the region, with a competitive trucking sector.

4.3 The fields of intervention

The Strategy integrates hard (investments) and soft (policies) measures to be progressively implemented in the short (2018), medium (2024) and long term (2030).

There are two main reasons why policies are as much important as infrastructure investments. Firstly, because the positive outcomes of an investment can be neutralized by the lack of appropriate supporting policies. Secondly, because policies can provide benefits in the short term by releasing some of the major problems of the transport sector, while paving the way for fully exploiting the impacts of new or upgraded infrastructures.

Furthermore, a long term strategy should not only plan the transport network for the targeted time horizon, but should also identify the best path. This exercise implies distinguishing between short and long term objectives. Generally, infrastructure investment will start producing benefits some years after they have been completed, and the completion time could be quite long. Meanwhile there is a need to tackle the most urgent problems of Jordanian transport sector. Soft measures can play an important role in this respect.

Detailed measures of the Jordan Long-term Transport Strategy are described in the following sections, according to the (modal) area of intervention:

- Roads
- Railways
- Civil aviation
- Port and Maritime
- Public transport
- Freight transport and logistics

4.3.1 Road

Completing the existing network and making the best use of the existing facilities are the founding pillars shaping the proposed strategies for the road sector.

Higher importance is given to maintenance and safety-enhancing measures of the existing network, rather than investments in new roads or major improvements. The latter have been carefully selected and phased according to model results, to focus the investments only where they are really needed. This approach is also motivated by the need of optimising the available financial resources and the decision of developing a competitive and more environmental sustainable alternative to the road mode (the new Jordan railways, see next section).

Moreover, policy measures to improve road safety and to reduce the impacts on the environment have been considered.
Planned *infrastructure measures* can be classified as follows:

- road maintenance (pavement recovery, bridges)
- road safety measures
- road widenings
- new links

MoPWH is responsible for road infrastructure planning and implementation. Therefore the proposal is based on (a selection of) measures included in the Highway Master Plan Study (HMPS)[2], which have been re-phased according to the JNTS time horizons (2018, 2024, 2030).

A shorter term (to be implemented by 2018), fast tracked **recovery programme** is envisaged to achieve a minimum standard of **pavement** conditions across the main road network (either routine maintenance, periodic maintenance and rehabilitation or pavement reconstruction) and to maintain existing **bridges** (overpasses, underpasses, wadi bridges, box culverts etc.).

The following "priority packages" of measures have been identified by MoPWH in its Highway Master Plan Study:

- Maintenance recovery of Road 15 (Desert Highway), short term priority package 1 (488 km of road network involved):
  - Road 15 from the Syrian border (Jaber) to the Karak-Qatraneh intersection
  - Road 15 from the Karak-Qatraneh intersection to Maan
  - Road 15 from Maan to the Saudi border (Durra), in addition to the Aqaba Back road and the new Aqaba Coastal Road
- Maintenance recovery of other (primary and secondary) main roads, short term priority package 2 (3,995 km of road sections involved)
- Maintenance recovery of tertiary roads, short term priority package 3 (2,512 km of road sections involved)
- Bridge recovery action plan (routine maintenance or immediate action), short term priority package 4 (254 structures to be maintained)

After the recovery program described above (priority packages), **routine maintenance** of the road network and of the main structures is foreseen to keep the road infrastructure at a satisfactory level of performance.

Infrastructural measures aimed at enhancing **road safety** will address: poor alignments (geometric characteristics, wider curves, better grades, redesigning dangerous junctions, providing guard-rails and new Jersey in unsafe median for dual roads), crossing of settlements (e.g., for dual carriageways: insurmountable central barrier, side service roads, pedestrian overpass, vehicle underpass, speed limits reduction; for single carriageways: speed break devices as appropriate, parking lane and lay-bys, sidewalks all along, level pedestrian crossing with adequate protection) and pavement widening.

[2] Highway Master Plan Study, Jordan Ministry of Public Works and Housing (MoPWH), 2011

As for the maintenance recovery program above, packages of measures classified per junctions, U-turns, guard rails, realignments, settlement crossings have been identified by MoPWH in the Highway Master Plan Study:

- Safety measures for Road 15 (Desert Highway), priority package 1:
  - Road 15 from the Syrian border (Jaber) to the Karak-Qatraneh intersection
  - Road 15 from the Karak-Qatraneh intersection to Maan
  - Road 15 from Maan to the Saudi border (Durra), in addition to the Aqaba Back Road and the new Aqaba Coastal Road;
- Safety measures for other (primary and secondary) main roads, priority package 2

Road widening measures are aimed at improving the existing narrow road links and increasing the road capacity of selected links to solve existing or future bottlenecks.

A first set of interventions is related to the homogenising of two lanes roads to a minimum standardised width of 7.3m. Concerned roads have been assessed within the MoPWH HMPS and totals 243km of road network.

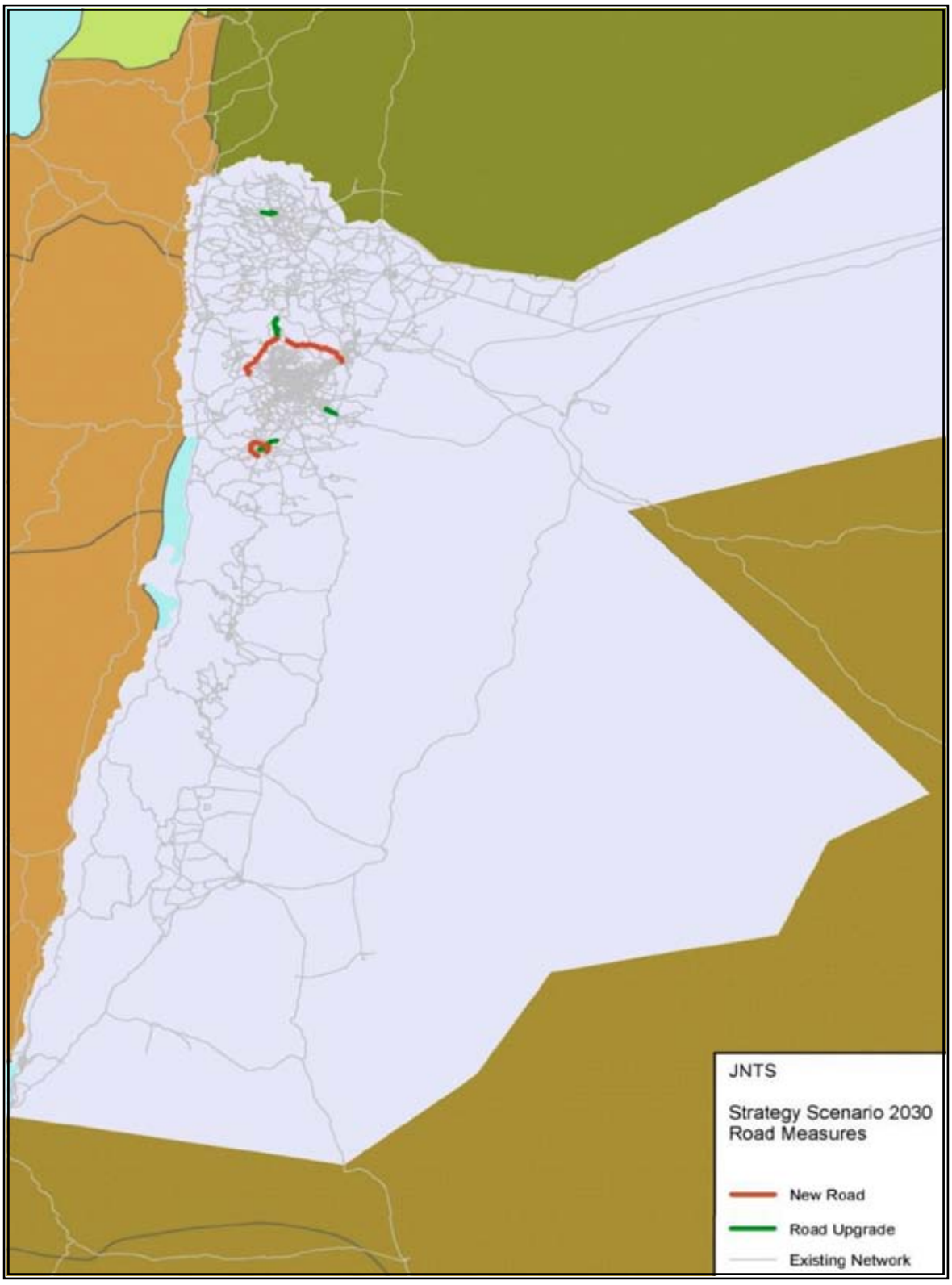
Moreover, major bottlenecks on the main road network have been identified based on the JNTS model results also considering the evolution of the transport demand at the future time horizons. Major criteria for the identification of bottlenecks were the total volumes, volume/capacity ratios, function of roads within the network as well as field experiences of the current local situations. Widenings from four lanes to six lanes are therefore proposed for the following road links (in addition to the measures already included in the Reference Scenario, e.g. the Amman-Zarqa link):

- Irbid - west
- Amman - Jerash
- Amman - Madaba
- Sahab link

As already underlined, there is little need to propose **new links.** The focus is on the main urban areas where congestion occurs or is expected in the approaches or the through roads that create bottlenecks and pollution. A part from roads already included in the Reference Scenario:

- Amman Ring Road - Phase 2 - Sect. 4
- Madaba Ring Road - Phase 1 (East)
- Madaba Ring Road - Phase 2 (West-North)

Figure 19: Road infrastructure measures



Policy measures for the road sector include the following fields of action:

- Road safety
- Incentives to fleet renewal
- Tolled highways

Several priority areas can be identified as posing particular concern and deserving special attention in the design of the **safety measures:** young drivers, impaired driving, speeding, vulnerable road users (pedestrian in particular), motorcyclists and road infrastructures. Relevant measures have been included in the National Transport Safety Programme to cover three fields of action:

- Road users behaviour
- Vehicles characteristics
- Infrastructure characteristics

and are summarised in the table below.

Table 7: Road safety measures

Theme	Measure
National legislation	Seat belts law (all vehicle occupants)
	Promotion of child restraint in cars
	Safety standards for motorcycle helmets
Enforcement	Police enforcement on: use of restraint devices (seat belts), use of helmets, speed, impaired driving, alcohol, driver's license possession
Awareness campaigns and educational programmes	National awareness campaigns for road users (incl. pedestrians)
	School road safety programmes
	Taxi / bus / truck drivers awareness programmes
Training and driving licenses	On-road controls
	Drivers training on work intensity, driving times and rest periods
	Cargo securing (especially transport of dangerous goods)
Vehicle safety	Stricter vehicle checks procedures (for trucks and buses/minibuses)
	Roadside inspections
Road infrastructures	Routine maintenance of the road surface
	Physical measures designed to enhance the safety of the road system

Theme	Measure
Post-crash medical care	Road signs to show the way to the nearest mobile network covered area
	First aid education system (in schools and during training)
Statistics and monitoring	Accident black spots analysis
	National monitoring scheme
Accompanying measures	Establishing and strengthening of a lead agency
	Design transport around walking, cycling and public transport
	Allow only safe vehicles on the roads

Incentives to fleet renewal are introduced with the purpose of renovating the circulating vehicles (both passenger cars and freight trucks) and reducing their average age (therefore their roadworthiness and their emissions). That would have positive safety (i.e. roadworthiness) and environmental (i.e. reduction of pollutant emissions and greenhouse gases) impacts. Incentives can be developed in terms of financial contributions for the purchase of new vehicles, or taxes/duties reductions.

In the medium term (2024), as soon as the new freight railway backbone will be operational (see the following section), it is proposed to introduce tolls on highways, as a first step limited to freight traffic. This would have two main benefits. The first one, to rebalance operating costs between different transport modes and make alternatives to pure road traffic more competitive. The second one, to collect revenues to be made available for the improvement of the transport sector. A decision about the allocation of the revenues from tolls should be taken. Possible options are: management and maintenance of the road network, funding of alternative modes to road transport (PT services, railways) etc.

In the long term (2030), as a second implementation stage, the tolling system will be extended also to passenger vehicles.

Main highways (Roads 5, 10, 15, 30 and 40), net of urban ring roads which should be exempted not to worsen traffic conditions in urban areas, will be interested by this measure (see map below). Technological and operational options (e.g. limited number of barriers vs tolling gates at all the exits, free flow solutions vs traditional tolling gates), as well as fare schemes should be assessed in a specific feasibility study before the scheme implementation.
Adequate compensating measures on alternative, non-tolled routes, such as limitations to heavy goods vehicles, road checks etc. should be evaluated as well to avoid possible undesirable diversions.

Figure 20: Proposed tolled highways

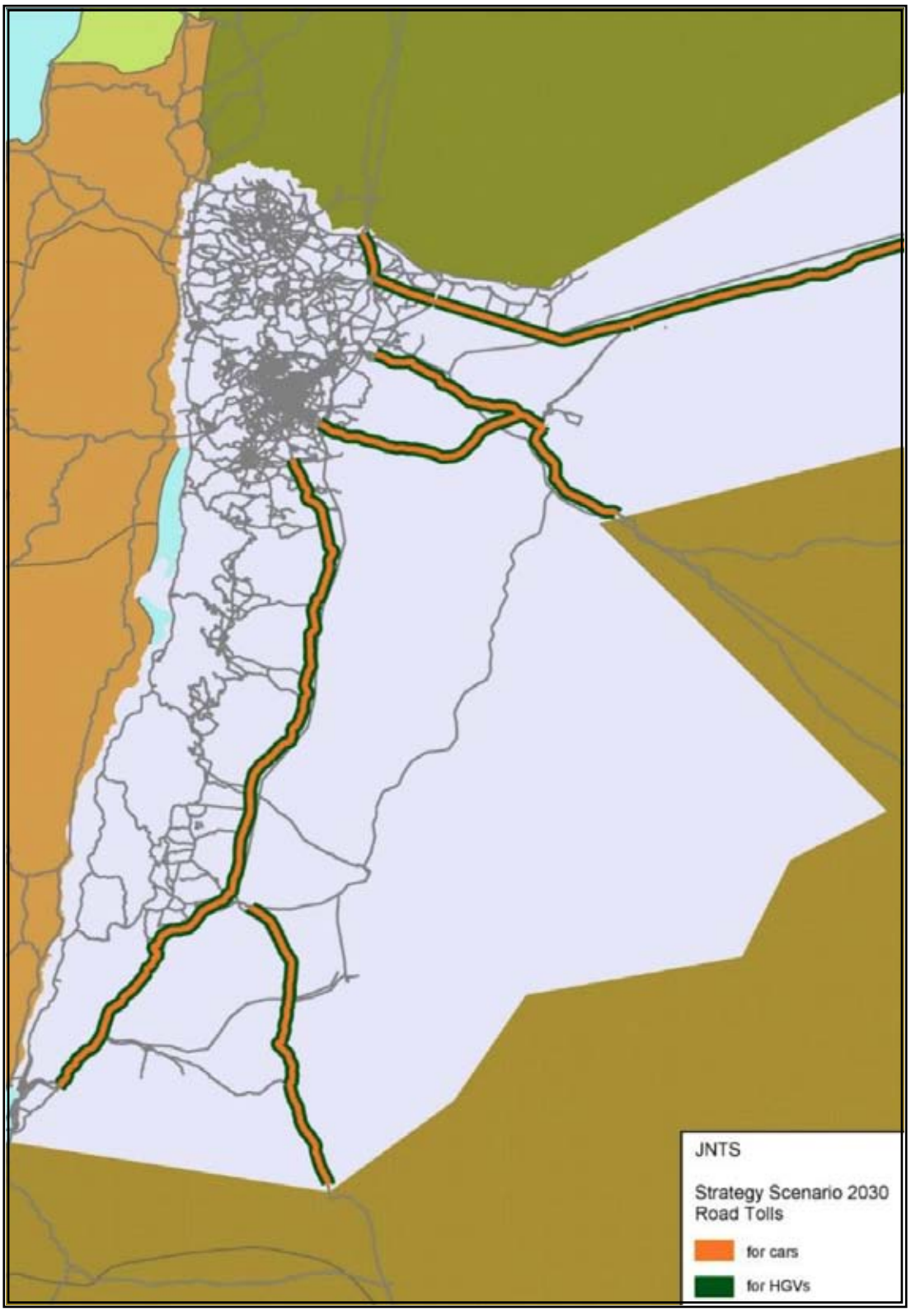


Table 8: Road measures: list and time horizons

RD	Strategy						
Roads	Infrastructures/Services			REF	2018	2024	2030
1	Road maintainence: recovery programme to achieve a minimum standard of pavement conditions across the main road network and to maintain existing bridges	1.1	Maintenance recovery of Road 15 (Desert Highway), as included in the HMPS short term priority package 1		✓		
		1.2	Maintenance recovery of other main roads, as included in the HMPS short term priority package 2		✓		
		1.3	Maintenance recovery of tertiary roads, as included in the HMPS short term priority package 3		✓		
		1.4	Bridge recovery action plan (routine maintenance or immediate action), as included in the HMPS short term priority package 4		✓		
		1.5	Maintenance of road network after priority packages			✓	✓
		1.6	Maintenance of main structures after priority packages			✓	✓
2	Road safety measures, aimed at enhancing road safety by addressing poor alignments, crossing of settlements and pavement widening	2.1	Safety measures for Road 15 (Desert Highway), as included in the HMPS short term priority package 1		✓		
		2.2	Safety measures for other main roads, as included in the HMPS short term priority package 2		✓		
3	Road widenings: improvement of existing narrow road links and increasing of road capacity of selected links to solve existing or future bottlenecks	3.1	Widening of narrow roads to a minimum section of 7.3m		✓	✓	✓
		3.2	Widening to 6 lanes (selected and phased according to model results)			✓	✓
4	New links	4.1	Tafelah Ring Road, Amman Ring Road - Phase 1; Amman to Airport Road; Al-Mafraq - Irbid; Irbid Ring Road - Phase 1; Al-Hashimeyah - Bal'ma; Parallel Road to Al Dura Check Point; Madaba Road - Jalul Airport), Salt By-pass - Phase 2	2018			
		4.2	Amman Ring Road - Phase 2- Sect.4				✓
		4.3	Madaba Ring Road - Phase 1 (East)		✓		
		4.4	Madaba Ring Road - Phase 2 (West-North)			✓	

RD	Strategy						
Roads	Policies/Regulations			REF	2018	2024	2030
1	Road measures included in the JNTS National Transport Safety Programme	1.1	National legislation		✓		
		1.2	Control and enforcement (compliance with road traffic rules)		✓		
		1.3	Awareness campaigns and educational programmes		✓		
		1.4	Training and driving licenses (also for professional drivers)			✓	
		1.5	Vehicles safety		✓		
		1.6	Post-crash medical care			✓	
		1.7	Statistics and monitoring		✓		
		1.8	Accompanying measures		✓		
2	Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts				✓	✓	✓
3	Tolled highways for trucks					✓	
4	Tolled highways for all traffic						✓

4.3.2 Railways

The creation of a new railway network in Jordan is of strategic importance for the development of the transport sector and the consolidation of role of the country in the Region. Indeed a new, state-of-the-art railway system in the Country, if connecting major origins and destinations of freight commodities, could capture a significant share of medium to long haul freight traffic, easing road traffic on major highways, in a synergic way with the oil pipeline from Iraq to Aqaba.

The **Jordan National Railway Project** aims at developing a modern and reliable freight railway network linking the nation's key cities (i.e. Amman, Mafraq, Zarqa), the country's gateway port (the Port of Aqaba on the Red Sea) and the largest phosphate mine (Shidiya Mine).

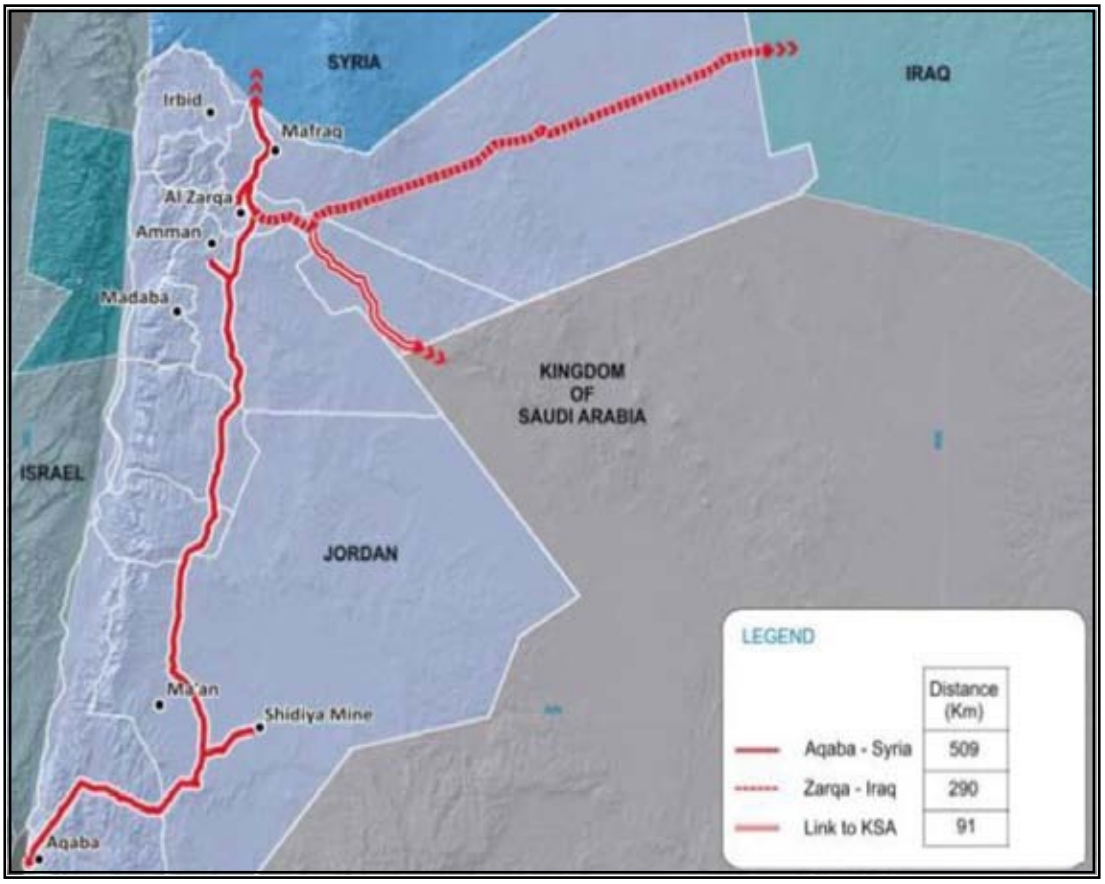
The project itself is organised to integrate the Jordan railway network with the regional, mainly under development, network by establishing effective rail connections with neighbour Countries.

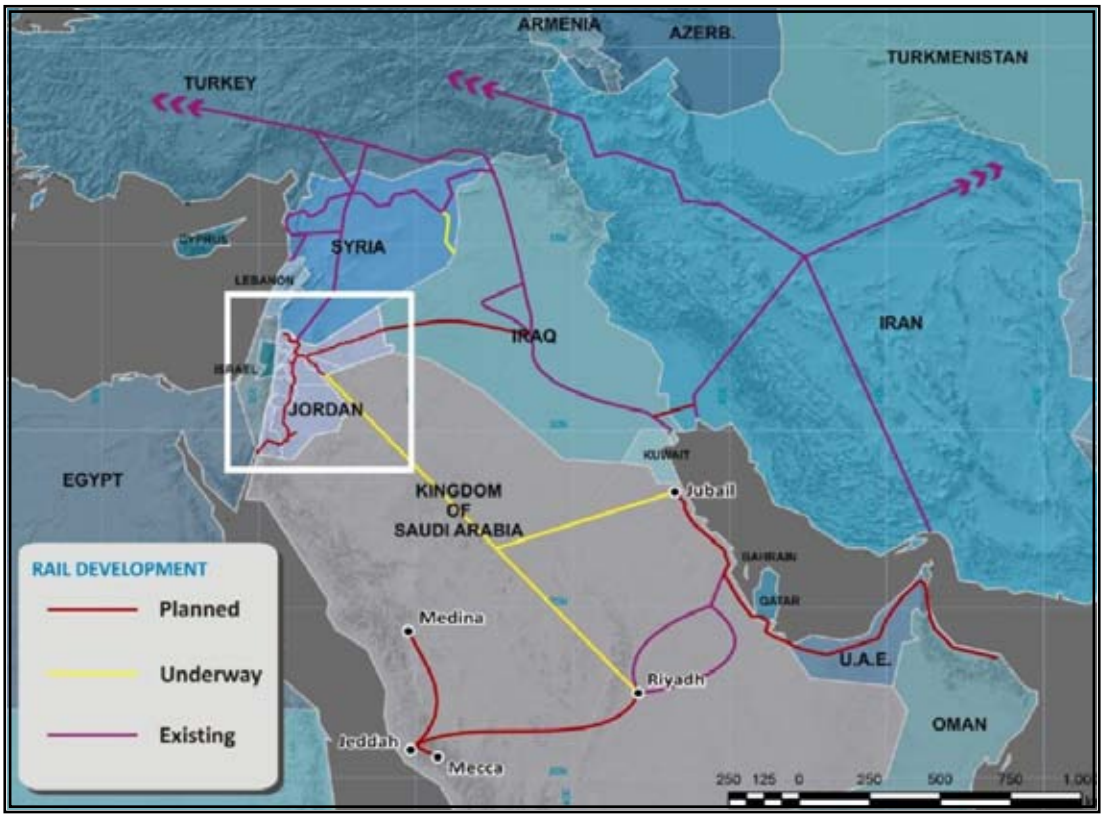
According to the project, the Jordan National Railway should consist of three parts:

- The "North-South Line", from the Syrian border to the Port of Aqaba via Amman (509 km), including rail links to the country's largest phosphate mine (Shidiya Mine) and to the South Terminal of the Port of Aqaba
- The "Zarqa-Iraq Link" from the city of Zarqa to the Iraq border (290 km)
- The "Link to Kingdom of Saudi Arabia" (91 km) that will complete the bridge between Saudi Arabia and Syria and will be an important component of a rail transport corridor between GCC countries and Europe

The new network will be single track, standard gauge, diesel traction, "AGC-AGTC" speed standard (120 km/h for freight traffic and 160 km/h for the passenger traffic), 30 tons maximum axle load, 1,5% maximum vertical gradient and 7,1m maximum vertical clearance, suitable for double-stacking of containers and possible future electrification.

Figure 21: Jordan National Railway project





Source: Ministry of Transport, Jordan National Railway Project brochure, 2011

Priority is given, within the time frame of the Strategy, to the implementation of the **core backbone (the North-South corridor)**, as part of the new multimodal Red Sea - Black Sea "landbridge" transport corridor.

The segment corresponds to the main demand corridor, connecting the port of Aqaba (both the Middle – container- port and the South – industrial one), which is the main origin and/or destination of land freight traffic in the Country, to: the phosphate mines, the great Amman conurbation including Zarqa, the border of Syria. The potentialities of the railways will be opened to commodities (containers, cereals, vehicles, cement, oil products, imports/exports) other than the pure phosphate goods.

The first implementation step (medium term, 2024) includes the route Aqaba-Amman, with the following mainline segments:

- Amman Logistics Center-Ma'an (193 km)
- Sahab link (15km)
- Ma'an-Aqaba South Industrial Area (coastal alignment, 191 km)

In the long term (2030), the new network will be connected to Syria trough Zarqa and Mafraq with the following segments:

- Syrian border-Zarqa Junction (63 km)
- Zarqa J.-Amman Logistics Center (32 km)

The railway will boost and optimise the operation of both the foreseen dry ports/logistic centres located in Amman and in Mafraq (see section 5.2.6 below).

Other links, connecting the core backbone with the other neighbouring countries (Iraq and KSA), might be considered as a further implementation step after 2030:

- Zarqa Junction-Saudi Junction (33 km)
- Saudi Junction-Saudi border (85 km)
- Saudi Junction-Iraqi border (253 km)

The implementation of the new services will require parallel investments in new rolling stock (locos and waggons): 62 locomotives and 1592 wagons in 2024, to reach respectively 80 locomotives and 1995 wagons in 2030 Preparatory and parallel measures to restructure and enhancing the trucking industry, that otherwise might be adversely affected by the new railway, have to be deployed (see also section 5.2.6), particularly as far as consolidating small operators into bigger organisations is concerned.

In the short term (2018), the on-going railway "**Mini Project**" is part of the reference solution, with the objective to increase the rail phosphate transportation capacity from Shidiya mine to the new South Port of Aqaba. It consists of a new (missing) narrow gauge link from Shidiya Mine to existing line and a new rail-truck transhipment at Wadi Ytum station. From Wadi Ytum to the new phosphate terminal at the Aqaba South Port, freight would go by truck along the back road.

As soon as the new railway network will be operational (2024), the link line to Shidiya will be upgraded to standard gauge and fully integrated to the new network, therefore the transhipment in Wadi Ytum won't be necessary any more.

Figure 22: Illustration of the "Mini Project" of National Railway Project

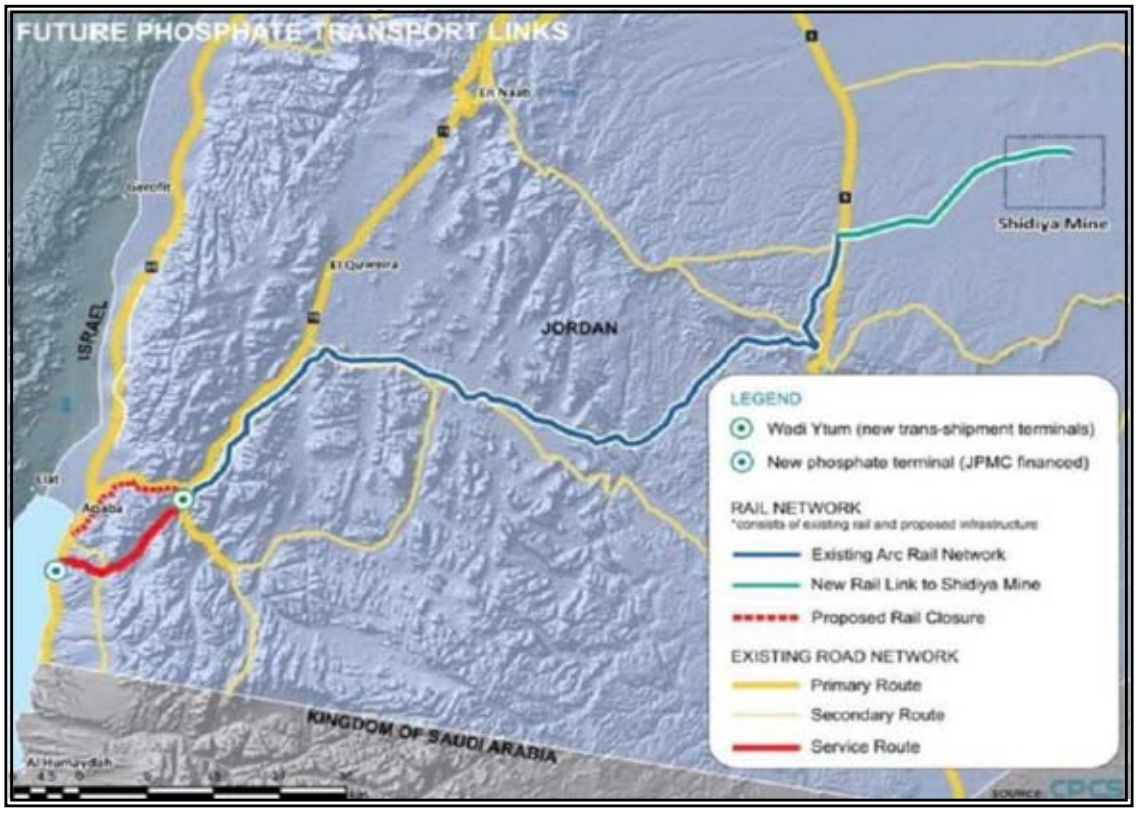


Table 9: Railways measures: list and time horizons

RW	Strategy						
Railways	Infrastructures/Services			REF	2018	2024	2030
1	Optimising and making the best use of the existing facilities (narrow gauge line) in the short / medium term to secure the phosphate traffic	1.1	Mini Project: new narrow gauge link from Shidiya Mine to existing line and a new rail-truck transhipment Wadi Ytum station	2018			
2	New National railway network, core South - North corridor from Aqaba to Syrian border, as part of the Red Sea - Black Sea "landbridge"	2.1	Syrian border-Zarqa Junction				✓
		2.2	Zarqa link				✓
		2.3	Zarqa J.-Amman Logistics Center				✓
		2.4	Amman Logistics Center-Ma'an			✓	
		2.5	Sahab link			✓	
		2.6	Ma'an-Aqaba South Industrial Area (coastal alignment)			✓	
		2.7	Investments in new rolling stock (locos and waggons)			✓	✓

4.3.3 Civil aviation

The strategies for the aviation sector are related first of all to the **development and specialization** of Jordan airports. Recent investments for Queen Alia International Airport can be capitalized by the full exploitation of existing capacity.

Jordan airports will be relevant hubs in the transport system where long distance (both passenger and cargo) flows should be seamlessly connected to the national and local PT (see § 5.2.5) and logistic (see § 5.2.6) networks.

Queen Alia airport (QAIA) will consolidate its function of international hub, for scheduled flights and cargo. Development measures concern:

- The completion of Phase 2 of the project for rehabilitation, expansion and operation of the airport (reference scenario), to accommodate a maximum of 12 million passengers
- The rehabilitation of east road access to the cargo area

After the achievement of 8 million passengers/year at QAIA, which is expected already in the short term (2018), Amman Marka airport (AMIA) can be opened to commercial flights. Vip and executive flights, as well as scheduled low cost and charter flights will be operated at Marka.

Development measures to cope with the expected passengers growth, as defined in JAC Amman Marka International Airport Master Plan (2012), include:

- Widening the runway strip; building new taxiways; expanding the passenger terminal; enhancing the main access road capacity; implementing new public parkings
- Enhancing road and PT connections

The location of airport infrastructures, in a vulnerable and heavily urbanized area, requires to deploy all the possible mitigation measures, monitor impacts and assess the possible displacement of the other functions currently based there (Jordan Air Force, flight training academies). In this latter respect, Mafraq airport could be an option to be considered.

Finally, **Aqaba King Hussein airport** (KHIA) has a function of point to point airport with a strong specialization for touristic flights, satisfying the transport demand related to ASEZ. The development of the passenger terminal, as defined in its Master plan, is part of the reference scenario to be completed in the short term (2018).

The second stronghold of the strategies for the sector, is to continue the road map which has been put in place by CARC to align Jordan with the international and European regulations and to consolidate the aviation industry and market. At this regard, the following policies are planned:

- Increase the bilateral agreements to improve connections and destinations served by the air transport services from Jordan. As of 2012, Jordan already signed 33 treaties with as many Countries for executing the open skies policy on a mutual basis. In the short term, it is foreseen to sign more agreements with targeted Countries

- Development of civil aviation legislations and harmonizing it with the European aviation legislations. Jordan is committed to keep up with the European regulations, that are stricter than the international (ICAO) ones. Also this policy is part of the open skies policy, aimed at opening EU market to Jordan operators and vice versa but also to keep pace with the international best practices

- Going on developing programs to monitor noise levels and aircraft emissions in coordination with airport operators and relevant government organizations and the State's plan of action to reduce greenhouse gas CO2. This is part of the CARC core mission for improving the aviation sector as far as the environmental protection is concerned

- Improving the use of air sectors and its dynamic use (The Flexible airspace). This policy, which has to be coordinated between CARC and the military authorities, is aimed at increasing the number of aircraft crossing Jordan and the related revenues (e.g., opening to routes capacity and frequency of the services for both passengers and cargo services; without restrictions on number of flights, aircrafts and routes)

- Licensing new airline companies based on the market's demands, to meet the market's needs for air transport services (e.g., more opportunity for airline designation, or code sharing). Open to the possibility of foreign investors/shareholders to own, or control of new airlines. Consider also the opportunity of franchising and leasing

Table 10: Civil aviation measures: list and time horizons

CA	Strategy						
Civil Aviation	Infrastructures/Services			REF	2018	2024	2030
1	Development of airports	1.1	Rehabilitation, expansion and operation of Queen Alia International airport - Phase 2	2018			
		1.2	Rehabilitation of east road access at QAIA cargo area		✓		
		1.3	Rehabilitation, expansion and operation of Amman Marka IA: specialized for low cost, charters and executive flights		✓	✓	✓
		1.4	Enhance road and PT connections to AMIA		✓		
		1.5	Passenger terminal development at Aqaba King Hussein International Airport	2018			
Civil Aviation	Policies/Regulations			REF	2018	2024	2030
1	Holding bilateral agreements to liberalize air transport on a reciprocal basis				✓		
2	Development of civil aviation legislations and harmonizing it with the European aviation legislations				✓		
3	Develop programs to monitor noise levels and aircraft emissions in coordination with airport operators and relevant government organizations and the State's plan of action to reduce greenhouse gas CO2				✓		
4	Improving the use of air sectors and its dynamic use (The Flexible airspace)				✓		
5	Licensing new airline companies based on the market's demands				✓		

4.3.4 Port and maritime

Strategies for the port and maritime sector have been developed in continuity with the work undertaken by the ASEZA and Aqaba Development Corporation (ADC). The proposal is therefore based on (a selection of) measures included in the Aqaba Ports Master Plan (Aqaba Development Corporation, 2007) and subsequent updates and modifications, which have been re-phased.

Infrastructure measures (mainly reference scenario's measures) are related to the **development and the reconfiguration of Aqaba Port.** The objectives are to increase capacity to accommodate large vessels, growth in cargo, increase efficiency in operation, allow good quality of services, be competitive at the regional level to attract new cargo.

Key aspects are the disposal of the Main port (to be converted to other urban and touristic developments with only a cruise ship terminal), the relocation of the existing facilities from the Main port to the South (Industrial) port and the development of the Middle Port:

- Relocation of Main Port facilities to South Port
- New cruise ship terminals at Main port
- Further expansion of Container terminal at Middle port
- Development of Mustarak & Mo'ata Berths (bulk commodities) at Middle port
- Upgrade of the existing passenger ferry terminal at Middle port (new halls and security facilities, new logistics facilities and yards)
- Rehabilitation of Oil terminal at South port (to boost handling capacity and enhance safety and environmental protection)
- New miscellaneous liquids, LPG (Liquid Petroleum Gas), LNG (Liquid Natural Gas) terminals at South port
- Rehabilitation of the existing Industrial terminal and building one additional jetty at South port
- New general cargo, Ro-Ro and grain terminals at South Port
- New port area infrastructures at South Port

The Aqaba port is the stronghold of the upgraded national railway, being the main access gate to the Country for freight. Importantly, as soon as the first implementation step of the new railway network (the segment Aqaba port – Amman, see section above) will be operational (2024), **the new phosphate terminal at South port should be seamless connected to the new railway.**

As far as *policies and regulations* are concerned, first of all it is foreseen the improvement of the port operations by means of:

- **Marine services development** (regulate and control the movement of vessels in territorial waters and the organization of wireless communication between them and the beach, tug boats, training, safety and security systems)

- Implementation of a **Port community Information System and Vessel traffic Service,** IT system based on International Standards to integrate trucking companies, depots, rail terminals, administrative and regulatory authorities, shipping lines, RORO operations, marine terminals, customs

On the maritime side, in the short term it is planned the issuing Jordanian Maritime Law regulating the sector and the ratification of international maritime conventions.

More in general, there is the need of reinforce the role of the Jordan maritime industry by means of:

- Encouraging ship registration under Jordanian flag with quality and modern reputable International registry
- Training and education of maritime manpower
- Fostering investments in shipping related industries, shipping repairs etc.

Table 11: Port and maritime measures: list and time horizons

PM	Strategy						
Port and Maritime	Infrastructures/Services			REF	2018	2024	2030
1	Relocation of Main Port facilities to South Port			2018			
2	New cruise ship terminals at Main Port			2018			
3	Expansion Container terminal at Middle port, phase 3			2030			
4	Development of Mustarak & Mo'ata Berths (bulk commodities) at Middle port			2018			
5	Upgrade of the existing passenger ferry terminal at Middle port (new halls and security facilities, new logistics facilities and yards)			2018			
6	Rehabilitation of Oil terminal at South Port (to boost handling capacity and enhance safety and environmental protection)			2018			
7	New miscellaneous liquids, LPG (Liquid Petroleum Gas), LNG (Liquid Natural Gas) terminals at South Port			2018			
8	Rehabilitation of industrial port at South port			2018			
9	New general cargo, Ro-Ro and grain terminals at South Port			2018			
10	New port area infrastructures at South Port			2018			
11	Integration of port and railway project development					✓	
Port and Maritime	Policies/Regulations			REF	2018	2024	2030
1	Holding bilateral agreements to liberalize air transport on a reciprocal basis				✓		
2	Development of civil aviation legislations and harmonizing it with the European aviation legislations					✓	
3	Improving the use of air sectors and its dynamic use (The Flexible airspace)				✓		
4	Licensing new airline companies based on the market's demands				✓		

4.3.5 Public transport

Measures related to the public transport sector are aimed at improving the quality and the attractiveness of PT services. Indeed, within the Strategy high priority is given to the sector with the aim of shifting modal shares from private to collective modes, pursuing a multimodal approach with good interconnections between long and short distance, urban and interurban networks and services. Providing better public transport services translates into a greater degree of accessibility to users, becoming crucial to secure access to essential services.

Major pillars in this respect are:

- The full implementation of new bus network and services
- Setting and enforcing minimum standards for vehicles in order to improve safety and quality
- Restructuring the sector and the way PT services are operated and awarded to operators

A **new bus network** has been proposed by the LTRC Jordan Bus Restructuring Interim Master Plan (JBRIMP), with a hierarchical and integrated structure of services (route numbering):

- Level 1 - Premium Inter City: a series of high quality premium price express services linking the cities of Jordan
- Level 2 - Core National Network; a more extensive network of limited stop services that connect the main cities and towns in Jordan
- Level 3 - Other Inter Governorate Services: the remaining standard regional services operating between the Governorates
- Level 4 - Intra Governorate: those regional services which operate within a single Governorate
- Level 5 - Local services: services operating within an individual municipality (this level is not be part of the National Strategy).

Introducing a **new way of operating PT services** (network and time tables) means that bus services have to be operated: 1) according to a time table and 2) with intermediate stops (with different average distance according to the hierarchical level), not just from two end terminals. At the moment, buses do not operate to a timetable and as such are unreliable and very time consuming for passengers, as vehicles only depart when they are full. This is compounded by the fact that many buses do not stop at designated bus stops (which are, in any case, rarely provided), so passengers must travel to the bus terminal in order to guarantee being able to make a bus journey out of towns and cities.

The Strategy promotes the implementation of the core network (levels 1 and 2) in the short term, while completing the restructuring of the network at governorates level (levels 3 and 4) in the medium term (2024).

The PT network will be complemented by the new **Amman-Zarqa Bus Rapid Transit,** foreseen in the reference scenario for the medium term.

Parallel to the restructuring of the network and services, an upgrade of **facilities for passengers** is needed. Guidelines for bus terminal and bus stops has to be defined (location, layout, facilities and services to passengers, information provision to travellers also by means of ITS, interchanges and intermodality) and main terminals have to be upgraded whenever not compliant with basic standards. A benchmark analysis of existing terminal facilities has already been performed within the JBRIMP and an action plan of proposed improvement is included.

Specific **facilities to accommodate buses and passengers** are planned at main border crossings:

- Jaber (border crossing with Syria)
- Karama (border crossing with Iraq)
- Omari (border crossing with KSA)
- Aqaba (border crossing with KSA)
- Jordan Valley (border crossing with Palestine)

Such service areas are aimed at improving comfort and shortening transit times at border crossings, providing waiting areas, toilets, restaurants, parking areas, customs and check points, information (also touristic) to passengers, etc.

Renewing the fleet of public transport buses (to be coordinated with the progressive implementation of hierarchical network levels) is fundamental to improve quality (comfort and attractiveness), safety while reducing environmental impacts and fuel consumption.

Two are the policies to be considered in this respect:

- To deploy financial contributions for the purchase of new vehicles, or taxes/duties reductions

- To set (and enforce) minimum standards for vehicles: definition of quality standards, technical specifications, maximum age for busses

The revitalisation of public transport requires significant work in terms of new concessions regime, government subsidies, fares regulation, operators' consolidation:

- Consolidating the actual fragmented industry of small operators into bigger organisations, fostering competition and efficiency
- New contracts to move from a system of licenses, or permits, to a service contract, which must include clear obligations of the parties
- Revision of fare system (including. technologies, electronic ticket machines - ETMs)
- Separate services for which fares can be liberalised from regulated services and assess the need to introduce subsidies (to be coordinated with the progressive implementation of hierarchical network levels)

Table 12: Public transport measures: list and time horizons

PT	Strategy						
Public transport	Infrastructures/Services			REF	2018	2024	2030
1	Bus services to be operated according to a timetable and with intermediate stops (with different average distance according to the hierarchical level)				✓	✓	
2	New bus network, as proposed by the LTRC Jordan Bus Restructuring Interim Master Plan (JBRIMP), with a hierarchical and integrated structure of services (route numbering)	2.1	Level 1 – Premium Inter City: a series of high quality premium price express services linking the cities of Jordan		✓		
		2.2	Level 2 – Core National Network; a more extensive network of limited stop services that connect the main cities and towns in Jordan		✓		
		2.3	Level 3 - Other Inter Governorate Services: the remaining standard regional services operating between the Governorates		✓	✓	
		2.4	Level 4 – Intra Governorate: those regional services which operate within a single Governorate		✓	✓	
3	Mass rapid transit in the main (high demand) corridors	3.1	Amman-Zarqa BRT	2024			
4	Upgrade of facilities for passengers. Guidelines for bus terminal and bus stops has to be defined (location, layout, facilities and services to passengers, information provision to travellers also by means of ITS, interchanges and intermodality) and main terminals have to be upgraded whenever not compliant with basic standards				✓	✓	
5	Service areas for buses and passengers at border crossings	5.1	Jaber (border crossing with Syria)			✓	
		5.2	Karama (border crossing with Iraq)		✓		
		5.3	Omari (border crossing with KSA)		✓		
		5.4	Aqaba (border crossing with KSA)			✓	
		5.5	Jordan Valley (border crossing with Palestine)			✓	

PT	Strategy						
Public transport	Policies/Regulations			REF	2018	2024	2030
1	Renewing the fleet of public transport buses (to be coordinated with the progressive implementation of hierarchical network levels)				✓	✓	
2	Minimum standards for vehicles. Definition of quality standards, technical specifications, maximum age for busses, enforcement				✓		
3	Restructuring of the sector/ industry: consolidating small operators into bigger organisations, competition and efficiency				✓		
4	Fares and contracts	5.1	New contracts replacing old licences (never expiring)		✓		
		5.2	Revision of fare system (incl. technologies, ETMs electronic ticket machines)		✓		
		5.3	Separate services for which fares can be liberalised from regulated services and assess the need to introduce subsidies (to be coordinated with the progressive implementation of hierarchical network levels)		✓		

4.3.6 Freight transport and logistics

If Jordan aspires to become a relevant player in the transport supply of the Region, there is the need to invest in an efficient logistic system and in restructuring its trucking industry.

Despite some shortcomings to be overcome (old fleets, excess of supply, small dimension of the truck companies, inefficiencies as low loading factors), the sector has a strong potential to become more competitive if the right policies are put in place.

Restructuring and enhancing the sector is crucial also considering the implementation of the new freight railway network, which is a strong opportunity for the Country but also a project that will put under strain the trucking industry.

In terms of *infrastructures,* **dry ports and logistic centres** have to be developed as hubs for services to drivers and vehicles (maintenance), transhipment (big to small trucks) and freight distribution.

This concept has been developed in the Study for Jordan dry ports/logistic centres (2013) to integrate both typical 'dry port functions' (e.g. container handling and storage, customs clearance and inspection, stripping and stuffing, bonded storage) as well as typical 'logistic center functions' (e.g. warehousing, value added services and commercial offices). Two sites have been identified:

- Amman - Madounah site (124 ha), with the primary focus to function as storage/ distribution center for consumer goods (to be launched in the short term and gradually developed)

- Mafraq - KHBT (170 ha), with primary potential to provide logistic services to facilitate the supply chains of industrial companies that will be located in the King Hussein Bin Talal (KHBT) development zone (in the long term)

Service areas for trucks should provide different spaces dedicated both to vehicles (for the parking, maintenance, repair, etc..) and to drivers (rest, recreation, etc..), while ensuring the safety requirements and safeguard goods and people.

Ideal locations are near borders, dry ports and industrial areas). Beyond the two dry ports/ logistic centres above, the following locations are recommended:

- Jaber (border crossing with Syria)
- Karama (border crossing with Iraq)
- Omari (border crossing with KSA)
- Aqaba (border crossing with KSA)
- Jordan Valley (border crossing with Palestine)

Proposed policies and regulations, on the contrary, are focussed to the improving of the standards of vehicles to reduce safety concerns and emissions of trucks, as well as to facilitate the restructuring of the sector/industry (consolidating small operators into bigger organisations).

The following actions are proposed, based on the analysis and outcomes of the Jordan Trucking Sector review (2011):

- Purchase Old Trucks & Re-export or Scrap

  as of 2011, more than 20% of heavy trucks (about 3,300) were more than 20 years old. These trucks should be taken off the road not only for safety and environmental reasons, but also to cope with the excess capacity in the industry. It is recommended to purchase 50% of the oldest trucking fleet (more than 20 years old) in a three-five year action plan before the new railway will be operational

- Impose higher registration fees for old trucks and/or define restrictions on operational age

  externalities of old trucks (higher emission levels) are higher than new trucks and this provides a legitimate reason to charge higher fees to people who register older vehicles. A phasing-in process should foresee, year after year, higher and higher fees per younger and younger trucks . The revenue earned from this policy could be used to off-set the costs of the policy above (buying up old trucks). As an alternative, restrictions on operational age could be implemented

Table 13: Example of phasing-in process: registration fees as % of nominal fees

	Truck age			
	≥25 yrs	≥20	≥15	≥10
Year x	105%			
Year x + 1	110%	105%		
Year x + 2	115%	110%	105%	
Year x + 3	120%	115%	110%	105%
Year x + 4	125%	120%	115%	110%

- Establish Enforcement Unit

  to properly enforce driver licensing, vehicle checks at time of registration, on-road inspection of vehicles, load security, weights and dimensions, etc. Effective enforcement of the regulations would require the services of a specialized enforcement unit considering that newer, more stringent safety regulations that are proposed might be too complex for police officers who have a general training in a broad number of areas

- Develop regulations on emission, trip inspections, maintenance standards, hours of work

  to bring to a higher standard the operational level of the Jordan trucking industry. With proper enforcement (see point above), only the more structured and best performing operators will be able to successfully remain on the market

- Improve motor vehicle inspections

  revising standards, procedures, qualification of inspectors and enforcement of vehicle conditions according to the international best practices

- Implement dangerous goods regulations

  signing and implementing the ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road)

- Permit program for large trucks

  to allow special permit trucks to operate at either weights or lengths (or both) heavier/ longer than those now allowed under the current truck weight and dimension regulations

- Improve Custom Procedures / Bilateral Agreements with neighbouring countries to ease international flows, to be coordinated with the Transport and Trade Facilitation

Table 14: Freight transport and logistics measures: list and time horizons

FL	Strategy						
Freight transport & logistics	Infrastructures/Services			REF	2018	2024	2030
1	Dry ports and logistic centres, to be developed as hubs for services to drivers and vehicles (maintenance), transhipment and freight distribution	1.1	Amman - Madounah site (124 ha), with the primary focus to function as storage/ distribution center for consumer goods (3 phases)		✓	✓	✓
		1.2	Mafraq - KHBT (170 ha), with primary potential to provide logistic services to facilitate the supply chains of industrial companies that will be located in the King Hussein Bin Talal (KHBT) development zone (3 phases)				✓
2	Service areas for trucks (services for drivers and vehicles near borders, dry ports and industrial areas)	2.1	Jaber (border crossing with Syria)			✓	
		2.2	Karama (border crossing with Iraq)		✓		
		2.3	Omari (border crossing with KSA)		✓		
		2.4	Aqaba (border crossing with KSA)		✓		
		2.5	Jordan Valley (border crossing with Palestine)				✓
Freight transport & logistics	Policies/Regulations			REF	2018	2024	2030
1	Purchase Old Trucks & Re-export or Scrap					✓	
2	Impose Higher Registration Fees for Old Trucks and/or define restrictions on operational age				✓		
3	Establish Enforcement Unit				✓		
4	Develop Regulations (Emission, Trip Inspections, Maintenance Standards, Hours of Work)					✓	
5	Improve Motor Vehicle Inspections				✓		
6	Implement Dangerous Goods Regulations				✓		
7	Permit Program for Large Trucks					✓	
8	Improve Custom Procedures / Bilateral Agreements				✓	✓	
9	Restructuring of the sector/ industry: consolidating small operators into bigger organisations				✓	✓	

4.4 Crosscutting issues

The set of integrated investments and policy measures associated to each of the transport modes and sectors address the following crosscutting issues.

Table 15: Summary of cross cutting issues versus field of intervention

Issues	Road		Railways	Port and Maritime		Civil Aviation		Public Transport		Freight and Logistics	
	I	P	I	I	P	I	P	I	P	I	P
Meeting the needs of the different population demand	+	++						+++	+++		
Balanced modal choice and strategies for mitigating social, energy and environmental risks	+	++	+++		+		+	+++	+++	+	+
Mode specific bottlenecks overcoming	+++	+	+++	+		+		+		+	
Improvements of quality attribute of transport, market access and competition issues	+++	++	++	++	+	++	+	+	++	++	+
Improvement of multimodality and Jordan's potentials in regional transport corridors	++		+++	++		+		++		++	+
Border crossings and regional cooperation	+		++	++	+	++	+			+	+++
Tariff setting, pricing, cost recovery, taxation and subsidy strategies		++							+++		+++
Improvement of traffic safety	++	+++	+		+		+		++		+
Energy efficiency / savings coupled with environmental sustainability		++	+++					+++	++	+	+
Key institutional reforms and sector management including operational, regulatory and licensing issues		+++						++	+++		+++
Use of PPP financing		++	++			++		+++		+++	
Better use of existing and planned transport and transport-related infrastructures	+		+++	++		+		++		++	

Relevance scale: low (+) to high (+++); empty cell: not relevant
I = Infrastructures/Services, P = Policies/Regulations

Meeting the needs of the different population demand

The different population groups of the Hashemite Kingdom of Jordan have the need to participate in social processes: being able to go to work, getting to their workplaces and back home; similarly to and from places of education; additionally, social processes consist in shopping for personal needs, meeting friends and family etc. Mobility and transport are the prerequisite for access and participation. It is important to provide access to all groups of the population and to provide it for the different needs.

Different population groups have different behaviour: employees, students, retired people, housewives and housemen. However, the most important difference is whether people do have access to personal motorised mobility or not, i.e. is there a car or more cars available in the household and can this be used? This is the most important issue because Jordan heavily relies on the car as main mode of transport. In Jordan, people without direct access to a car are deprived of many possibilities, e.g. to choose a certain job. To improve the situation for all groups of the population, it is important that other modes of transport are improved, mainly public transport and non-motorised modes.

This is exactly the focus of the National Transport Strategy: a balanced strategy, improving all modes, particularly public transport and non-motorised modes through new infrastructure, re-organisation of the market and the industry. Furthermore, the strategy puts emphasis on a better integration of transport and land use planning, resulting in a better mix of activities and consequently, a reduced need to travel (by motorised modes) or the possibility to travel shorter distances.

To improve the knowledge on mobility and travel behavior, it is also proposed to add a thematic section to the questionnaire of the upcoming National Census. The following questions should be included, with reference to the investigated day, per each person:

- List of performed trips
- Origin and destination of the trips
- Purpose of each trip (at least according to main categories: commuting – i.e. work, school – or other modes – shopping, accompanying people, business etc.)
- Transport mode (of the main leg of the trip and possibly of all the transport chain)
- Starting time of the trip

While designing the questionnaire, it can be decided the level of complexity and detail of the questions. For instance, main attributes of the trip could be asked only for the main/ first (commuting) trip. A more detailed survey and questionnaire could follow the Census on a voluntary basis.

Balanced modal choice and strategies for mitigating social, energy and environmental risks

The National Transport Strategy allows balanced modal choices as its emphasis is on development of other modes than the car and the truck. As a result of the strategy, other modes are improved and become a real alternative, with acceptable travel times, comfort, safety and reliability. Only this guarantees that users, particularly users with access to the car, choose not to use the car but to take other transport modes as well. Choices become possible, on the urban, regional and national level.

As result, modal splits are changed. Lower shares of private motorised trips results in a positive development relating to fuel consumption and environmental impacts, less energy consumption, less consumption of non-renewable resources, less emission of greenhouse gases, pollutants and noise, less accidents and less sever accidents, lower intrusion in social communities and reduced barrier effects by transport infrastructure. Furthermore, this results in higher social participation and better accessibility for all population groups.

Mode specific bottlenecks overcoming

Currently bottlenecks do not really exist in Jordan's transport system. There are only some limitations of capacity at certain times of the day. But, traffic is forecasted to increase, following increase of population, economic growth and increase of wealth of the population, more activities, longer distances travelled etc.

All current and future bottlenecks relate to road transport. The National Transport Strategy focusses on developing the other modes as well. This reduces the pressure on the road network. Furthermore, important components of the strategy are to alleviate the current and future bottlenecks through infrastructure development and better transport management, e.g. additional roads (mainly ring roads), improved junctions, widening of existing roads.

For the other modes, improvements are planned, e.g. expansion of Queen Alia International airport, improvements at the port of Aqaba, development of a National Railway system, improvements of public transport. However, no real bottlenecks will occur here now and in close future.

Improvements of quality attribute of transport, market access and competition issues

There is a significant commitment in the Strategy to make the Jordanian transport industry more competitive and to improve the way infrastructures are managed and services are operated.

In this respect, the improvement of the quality of infrastructures (road maintenance, safety enhancing measures), of PT services (operating the network according to schedules, better busses and better facilities), of the logistic chain (inter-modality, operations at Aqaba port and airports, logistic centres and service areas for trucks) are key. A specific focus is also dedicated to the renewal and improvement of vehicle (car, buses, trucks) fleets, by means of a mix of incentives, standards setting, regulations and enforcement, for the sake of better services, safety, efficiency.

Measures to restructure both the PT and trucking sectors are also included in the Strategy, dealing with contracts, fares, liberalisation, consolidating small operators etc., for a better competition and access to the market. Liberalisation and competition among service providers are also fostered by policy measures for civil aviation (licencing companies, bilateral agreements etc.).

It is recommended to carry out training and capacity building programmes for implementing authorities, recognizing the critical stage of implementing the Strategy. The aim is to build capacities in the transport sector for more efficient service delivery to the people, seeking to support a comprehensive human skills development among concerned authorities and the complementary staff.

Implementing or strengthening the business management training is also key, since it seems that there is an insufficient level of education for transport staff and inadequate trained manpower. Actions to be put in place should include voluntary courses and manuals both for business managers of freight companies and individual operators, as well as incentives for operators to work with legality (i.e. avoiding the use of unlicensed or underage drivers).

Improvement of multimodality and Jordan's potentials in regional transport corridors

The development of other modes than the car for passenger transport and the truck for freight transport as part of the National Transport Strategy has already been described above. This is of course a pre-requisite for the development of multimodality both for passengers and for freight. This is not only the case for the local and domestic market but also for the regional and international markets. Multi-modal transport corridors across Jordan are in the focus of the national transport strategy, e.g. the development of the national railway system with the Aqaba-Amman-Syria connection as its backbone and with further connections to Iraq and KSA.

Focussing on the development of these long-distance corridors across Jordan will attract transport and trade to these corridors, e.g. a Red Sea – Black Sea Land Bridge, connection the Arabian Peninsula and North Africa with Turkey Europe, the Caucasus and Russia. The improvement of road, rail and maritime infrastructure, interchanging facilities between these modes and improvements of organisational and operational issues, as it is proposed by the national transport strategy, will further improve the attractiveness of the Jordanian corridors for international trade and transport.

The challenge will be to respond to the ever changing political and economic conditions in the region. The Long-term National Transport Strategy lays the foundation for a successful future.

Border crossings and regional cooperation

Through developing its domestic transport system, Jordan provides all necessary input for fostering the regional cooperation. Combined with the improvement of operation and management of the border crossings, Jordan will strongly contribute to regional cooperation. The improvement of border crossing procedures and facilities are the aim of the Trade and Transport Facilitation Programme (TTF), whereas the improvement of the transport system itself is the aim of the National Transport Strategy. The cooperation and integration of these two programmes and strategies guarantees that the Hashemite Kingdom of Jordan will turn into becoming the driving force of regional cooperation in the MENA region. By developing the national railway system, Jordan will contribute inregional railway network, stretching from Saudi Arabia and the Gulf States via Syria and Turkey to Europe and Central Asia. Similarly, the upgrading of Jordan's road network, port facilities and airport capacities will contribute to a stronger regional cooperation, exchange of goods, increased trade and travel of passengers across borders.

Tariff setting, pricing, cost recovery, taxation and subsidy strategies

Pricing is fundamental for the efficient operation of all markets, including transport, and these measures represent an important component of the Strategy. Prices that users have to pay will influence how far they travel, how frequent, with which mode of transport, following which routes. Together with taxation and incentives, they can also help to tackle environmental issues and congestion and thus reduce the need for additional infrastructures. But they play also a major role in guaranteeing that infrastructure and services are kept in operation and maintained at standard levels, and can contribute to reduce the financial needs of the entire transport sector. Tariff setting, pricing policies, subsidies, incentives therefore can have very powerful impacts and have been proposed in the Strategy to complement the infrastructure investment and the other policies.

Various pricing and taxation leverages have been taken into consideration and the following ones have been proposed in the Strategy deploying a set of push and pull measures, including:

- Revising the fare system for the Public Transport sector, including. technologies, electronic ticket machines – ETMs and separate services for which fares can be liberalised from those regulated, and for the latter establish subsidies for the routes where revenues cannot cover costs, to be coordinated with the progressive implementation of hierarchical network levels

- Financially incentivising the renewal of private (cars and trucks) and public (buses) vehicle fleets, with the aim of reducing emissions, increasing quality of services for public transport,, increase safety for all type on vehicles

- Restructuring the trucking industry: purchasing old trucks, imposing higher registration fees for older trucks, not only for environmental and safety reasons but also to cope with excess supply that will become even more serious with the openin of the pipeline and the new railway

- Pricing of infrastructures: gradually introducing tolled highways initially for trucks only and at a later stage also for private cars, with the aim to reduce the congestion, push freight transport using the railway, and to a minor extent also passengers toward public transport. It will also support the policies of restructuring the trucking industry, reducing environmental pollution and generate revenues that can be used to cover road maintenance and/or incentives and subsidies

Improvement of traffic safety

Transport safety is a critical issue in Jordan. Although the Jordan National Transport Strategy encompasses all transport modes, it can be easily asserted that significant improvements in Jordan's transport-related safety challenges can be achieved mainly in the road sector.

A number of policies and actions, as well as legislation acts, are in place in Jordan, although a transport safety national strategy is still missing. A separate National Transport Safety Programme, which complements this Strategy document, aims at filling in this gap, suggesting a number of integrated measures to face the major risk factors affecting road safety.

Several priority areas have been identified as posing particular concern and deserving special attention in the design of the measures: young drivers, impaired driving, speeding, vulnerable road users, motorcyclists and road infrastructures.

The relevant measures considered cover three fields of action: road users behaviour, vehicles characteristics and infrastructure characteristics and, in particular, the following topics:

- National legislation
- Enforcement
- Awareness campaigns and educational programmes
- Training and driving licenses (also for professional drivers)
- Vehicles safety
- Road infrastructures
- Post-crash medical care
- Statistics and monitoring

Of course more significant results can be achieved only in a long term perspective, when issues like behavioural changes, improved safety culture, as well as a different modal split more oriented towards intrinsically safer transport modes (e.g. the railways) can be taken into account.

Compared to road transport, impacts on safety of other modes are often negligible in terms of injuries and fatalities, for a number of reasons related to limited transport demand (i.e. risk exposure) e.g. for railways, intrinsically safer modes, strict international regulations and consolidated practices to deal with safety issues (e.g. civil aviation, maritime).

Energy efficiency / savings coupled with environmental sustainability

The reduction of the externalities of the transport sector related to the environment (pollutant emissions, greenhouse gasses, fuel consumption) is pursued by the Strategy through a set of combined actions.

First of all, there is a strong commitment to improve the attractiveness of / provide real alternatives to pure road, private transport, both for passengers and freight. This is the case for instance of the new national railway network or the improved PT supply, that are aimed to significantly modify, in the medium to long term, the modal split towards mode environmental friendly transport modes.

Secondarily, a number of strategy measures are envisaged to renovate the private (cars, trucks) and public (buses) fleets, through financial, regulatory and enforcement incentives and disincentives. Lowering the average age of the circulating vehicles, means relying upon state-of-the-art technologies with better performances and fuel efficiency.

In this respect, also the promotion of alternative fuels and vehicles (such as LPG, CNG, hybrids, electric vehicles) and related support actions (network of fuelling and charging stations etc.) should be taken into consideration. But there is also the need to improve the quality of traditional fuels, since the quality of fuels is a critical component of an effective strategy aimed at protecting the environment. A growing vehicle number and the high emission levels caused by poor quality propellants heavily contribute to serious air pollution and health problems, which are increasingly common in the cities of developing countries. Moreover, fuel quality is essential non only for directly eliminating or reducing pollutants such as lead, but also as a precondition for introducing important technologies for the control of pollution (e.g., the lowering of sulfur content to enable use of diesel particulate filters).

Last but not least, an improved efficiency of the logistic and passengers transport chains is addressed. Promoting intermodality, interchanges, dry ports, as well as consolidating the truck and PT operators are examples of policy measures that go in this direction.

Key institutional reforms and sector management including operational, regulatory and licensing issues

Currently, one of the challenges facing Jordan's transport sector are the complex institutional structure within the transport sector itself and the resulting issues with responsibilities, financing, regulation and operation of the different modal sectors and with licensing of vehicles, services etc. The National Transport Strategy has assessed the sector and identified the challenges for improvement, like:

- Improvement on communication and cooperation at Ministerial Level (Ministry of Transport, Ministry of Public Works and Housing, Ministry of Planning, Ministry of Trade)
- Improvement of coordination between the different levels of each modal sector
- Clear responsibilities for planning, regulating, financing, operating the transport systems in the different modal sectors
- Procedures to institutionalise coordination and regulation across levels and across modal sectors

Several proposals are included in the strategy to improve the institutional setting, to improve the regulatory responsibilities and modal licencing, e.g.

- Licencing of vehicles (cars and trucks) with the purpose of reducing environmental damage (pollutants and noise) and increasing safety and reliability
- Licencing of public transport services with the purpose of improving service quality, reliability, comfort and attractiveness of public transport

Furthermore, there is a need to improve the coordination between transport planning at different levels (national, regional, municipal), between the different transport modes, and between transport and other sectors of the economy, particularly

- Land-use planning
- Planning of the economic development and trade
- Planning for sustainability, i.e. reduction of environmental impacts

This integrated planning is an important contribution to the economic development of the Hashemite Kingdom of Jordan. It will result in:

- Better modal integration, making best use of the capabilities of the different modes of transport, both for passengers and freight, and providing the necessary facilities for changes between modes in order to improve inter-modality
- A better integration of land-use planning with transport planning, a better mix of landuses and consequently activities, resulting in better accessibility of the population to mobility and to all relevant destinations, like job locations, provision and leisure facilities; additionally, a good transport – land-use integration will result in shorter travel distances and less trips by motorised modes, reducing the need to travel but improving the accessibility for the population

- a reduction of negative environmental impacts, like emission of pollutants, greenhouse gases and noise, dependency on the car and the truck, community severance, visual intrusion etc.
- An increase of safety, with less and less heavy accidents
- An increase of personal wealth for the population and an increase of the quality of life in Jordan as a whole

Particular attention should be put on:

- Land-use planning at municipality level, as today, urban development is rarely coordinated with PT network and infrastructures
- Multi-modality and links between urban and interurban PT networks
- Safeguard the capacity of the main roads, particularly those roads related to the access to relevant transport facilities (e.g. dry ports and logistic centres, airports etc.) through appropriate buffer zones.

Use of Public-Private-Partnership (PPP) financing

The possible interest for the private companies/firms to positively invest in infrastructures and operating services has been assessed in the prioritisation procedure to select the final Strategy, where this element was one of the assessment criteria.

Considering that only revenue generating projects are candidates for PPP, the following infrastructures/measures are estimated as attractive for private participation:

- Tolled highways for trucks and/or cars: privates can contribute in the ordinary maintenance of the tolled sections in return for the revenues rising from highway tolls
- Amman Marka development: as for the QAIA, the operation of a big airport for passenger traffic is well seen from specialized private companies
- Public transport: Level 1 – Premium Inter City bus network: the Premium bus network is envisaged to be operated on a commercial basis (revenues from tariffs)
- Amman-Zarqa BRT: privates can contribute in the construction and the operation of the line, collecting revenues from tariffs as well as from land use development
- Amman dry port: this dry port is well positioned to develop as a feasible project, mainly due to its favourable location close to the major consumer market in the greater Amman region

PPP might play also a role for the following projects:

- New railway link from Aqaba Main Port to the South Port and National railway network: privates could contribute the operation of the lines, collecting revenues from tariffs and land use development
- Service areas for passengers and buses and service areas for trucks at border crossings: privates could manage the services in return for the fees and the other revenues deriving from the operation of the terminals

- Mafraq dry port: low starting volumes, as well as an increased risk profile related to the dependency on the future industrial activities generated at the KHBT zone, make this dry port less desirable from the private sector perspective

Better use of existing and planned transport and transport-related infrastructures

Optimising and enhancing existing facilities is one of the pillars at the basis of the Strategy. Having an integrated and multimodal vision, where transport networks and hubs are strictly interconnected since the planning phase, is a way to mutually enhance synergic projects and reduce respective investments costs.

This is the case for instance of the new core railway network, that is supposed to connect the port of Aqaba, dry ports and logistic centres to the main industrial and commercial development areas. Or the integrated hierarchical PT network, complemented by upgraded terminals and service areas for passengers at border crossings.

4.5 Implementation phases

The following sections present the list of strategies to implemented respectively in the short (2018), medium (2024) and long term (2030).
A summary of the estimated total financial resources required by time horizon, sector and overall, is provided in the following table.

Table 16: Summary of required resources (Million JD)

Sector	2018	2024	2030	Total	%
Roads	490,1	322,6	505,3	**1318,0**	**38,7**
Railways	0,0	1181,7	455,8	**1637,5**	**48,0**
Port and Maritime	0,9	0,0	0,0	**0,9**	**0,0**
Civil Aviation	37,2	22,5	22,5	**82,2**	**2,4**
Public Transport	79,8	79,1	0,0	**158,9**	**4,7**
Freight Transport and Logistics	58,5	81,0	71,2	**210,7**	**6,2**
Total	**666,5**	**1686,9**	**1054,8**	**3408,2**	**100,0**
%	**19,6**	**49,5**	**30,9**	**100,0**	

4.5.1 Short term

Table 17: Short term strategies

RD	Strategy				
Roads	Infrastructures/Services			REF	2018
1	Road maintainence: recovery programme to achieve a minimum standard of pavement conditions across the main road network and to maintain existing bridges	1.1	Maintenance recovery of Road 15 (Desert Highway), as included in the HMPS short term priority package 1		✓
		1.2	Maintenance recovery of other main roads, as included in the HMPS short term priority p.2		✓
		1.3	Maintenance recovery of tertiary roads, as included in the HMPS short term priority p.3		✓
		1.4	Bridge recovery action plan (routine maintenance or immediate action), as included in the HMPS short term priority p. 4		✓
2	Road safety measures, aimed at enhancing road safety by addressing poor alignments, crossing of settlements and pavement widening	2.1	Safety measures for Road 15 (Desert Highway), as included in the HMPS short term priority package 1		✓
		2.2	Safety measures for other main roads, as included in the HMPS short term priority package 2		✓
3	Road widenings: improvement of existing narrow road links and increasing of road capacity of selected links to solve existing or future bottlenecks	3.1	Widening of narrow roads to a minimum section of 7.3m		✓
4	New links	4.1	Tafelah Ring Road, Amman Ring Road - Phase 1; Amman to Airport Road; Al-Mafraq - Irbid; Irbid Ring Road - Phase 1; Al-Hashimeyah - Bal'ma; Parallel Road to Al Dura Check Point; Madaba Road - Jalul Airport), Salt By-pass - Phase 2	✓	
		4.2	Madaba Ring Road - Phase 1 (East)		✓

RD	Strategy				
Roads	Policies/Regulations			REF	2018
1	Road measures included in the JNTS National Transport Safety Programme	1.2	National legislation		✓
		1.2	Control and enforcement (compliance with road traffic rules)		✓
		1.3	Awareness campaigns and educational programmes		✓
		1.4	Vehicle safety		✓
		1.5	Statistics and monitoring		✓
		1.6	Accompanying measures		✓
2	Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts				✓

RW	Strategy				
Railways	Infrastructures/Services			REF	2018
1	Optimising and making the best use of the existing facilities (narrow gauge line) in the short/medium term to secure the phosphate traffic	1.2	Mini Project: new narrow gauge link from Shidiya Mine to existing line and a new rail-truck transhipment Wadi Ytum station	✓	

PM	Strategy				
Port and Maritime	Infrastructures/Services			REF	2018
1	Relocation of Main Port facilities to South Port			✓	
2	New cruise ship terminals at Main Port			✓	
3	Development of Mustarak & Mo'ata Berths (bulk commodities) at Middle port			✓	
4	Upgrade of the existing passenger ferry terminal at Middle port (new halls and security facilities, new logistics facilities and yards)			✓	

PM	Strategy				
Port and Maritime	Infrastructures/Services			REF	2018
5	Rehabilitation of Oil terminal at South Port (to boost handling capacity and enhance safety and environmental protection)			✓	✓
6	New miscellaneous liquids, LPG (Liquid Petroleum Gas), LNG (Liquid Natural Gas) terminals at South Port			✓	
7	Rehabilitation of industrial port at South port			✓	
8	New general cargo, Ro-Ro and grain terminals at South Port			✓	
9	New port area infrastructures at South Port			✓	
Port and Maritime	Policies/Regulations			REF	2018
1	Marine services development				✓
2	Issuing Jordanian Maritime Law				✓
3	Ratification of international maritime conventions				✓

CA	Strategy				
Civil Aviation	Infrastructures/Services			REF	2018
1	Development of airports	1.2	Rehabilitation, expansion and operation of Queen Alia International airport - Phase 2	✓	
		1.2	Rehabilitation of east road access at QAIA cargo area		✓
		1.3	Rehabilitation, expansion and operation of Amman Marka IA: specialized for low cost, charters and executive flights		✓
		1.4	Enhance road and PT connections to AMIA		✓
		1.5	Passenger terminal development at Aqaba King Hussein International Airport	✓	

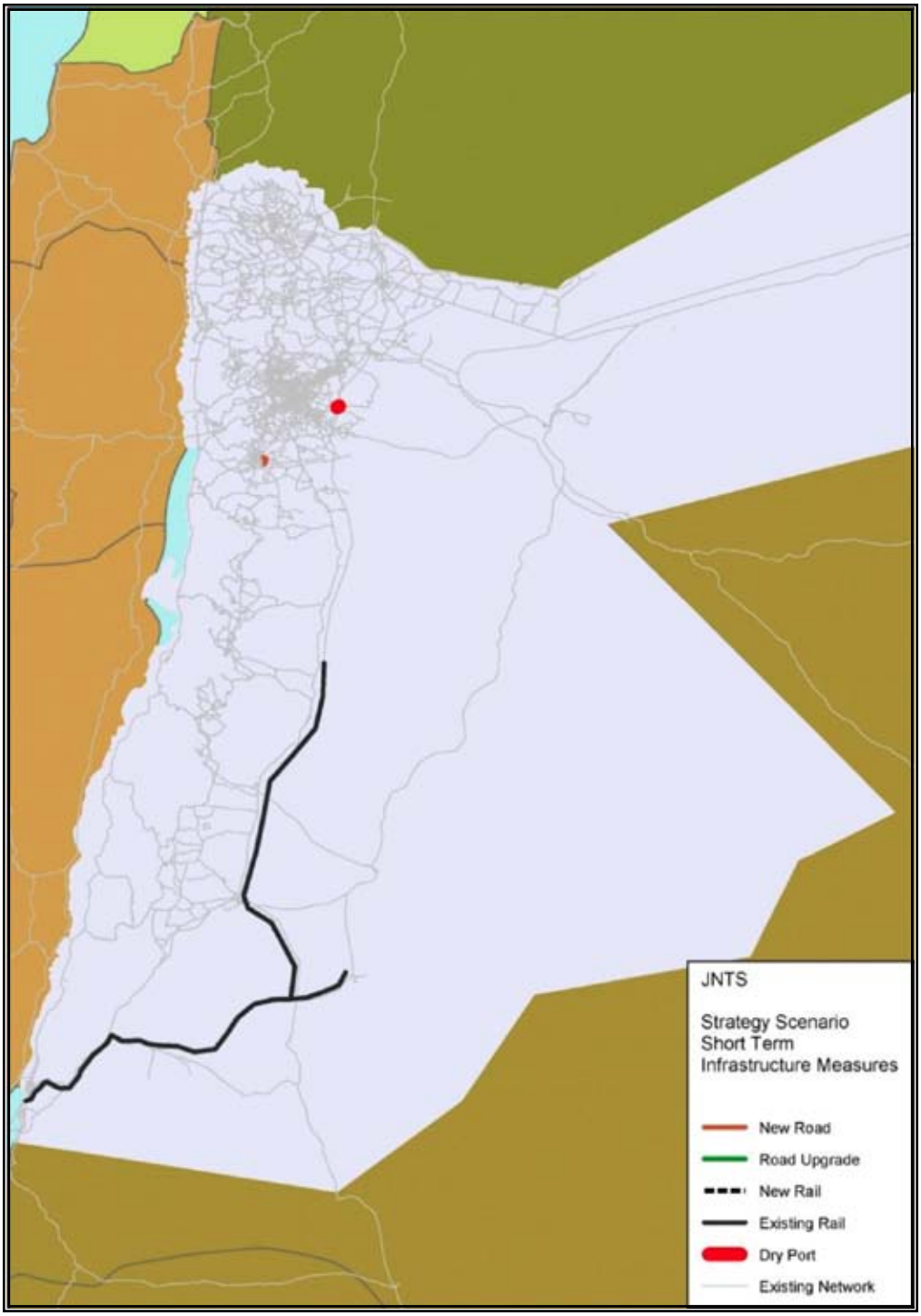
CA	Strategy				
Civil Aviation	Policies/Regulations			REF	2018
1	Holding bilateral agreements to liberalize air transport on a reciprocal basis				✓
2	Development of civil aviation legislations and harmonizing it with the European aviation legislations				✓
3	Develop programs to monitor noise levels and aircraft emissions in coordination with airport operators and relevant government organizations and the State's plan of action to reduce greenhouse gas CO2				✓
4	Improving the use of air sectors and its dynamic use (The Flexible airspace)				✓
5	Licensing new airline companies based on the market's demands				✓

PT	Strategy				
Public transport	Infrastructures/Services			REF	2018
1	Bus services to be operated according to a timetable and with intermediate stops (with different average distance according to the hierarchical level)				✓
2	New bus network, as proposed by the LTRC Jordan Bus Restructuring Interim Master Plan (JBRIMP), with a hierarchical and integrated structure of services (route numbering)	2.1	Level 1 – Premium Inter City: a series of high quality premium price express services linking the cities of Jordan		✓
		2.2	Level 2 – Core National Network; a more extensive network of limited stop services that connect the main cities and towns in Jordan		✓
		2.3	Level 3 - Other Inter Governorate Services: the remaining standard regional services operating between the Governorates		✓
		2.4	Level 4 – Intra Governorate: those regional services which operate within a single Governorate		✓

PT	Strategy				
Public transport	Infrastructures/Services			REF	2018
3	Upgrade of facilities for passengers. Guidelines for bus terminal and bus stops has to be defined (location, layout, facilities and services to passengers, information provision to travellers also by means of ITS, interchanges and intermodality) and main terminals have to be upgraded whenever not compliant with basic standards				✓
4	Service areas for buses and passengers at border crossings	4.1	Karama (border crossing with Iraq)		✓
		4.2	Omari (border crossing with KSA)		✓
Public transport	Infrastructures/Services			REF	2018
1	Renewing the fleet of public transport buses (to be coordinated with the progressive implementation of hierarchical network levels)				✓
2	Minimum standards for vehicles. Definition of quality standards, technical specifications, maximum age for busses, enforcement				✓
3	Restructuring of the sector/ industry: consolidating small operators into bigger organisations, competition and efficiency				✓
4	Fares and contracts	4.1	New contracts replacing old licences (never expiring)		✓
		4.2	Revision of fare system (incl. technologies, ETMs electronic ticket machines)		✓
		4.3	Separate services for which fares can be liberalised from regulated services and assess the need to introduce subsidies (to be coordinated with the progressive implementation of hierarchical network levels)		✓

FL	Strategy				
Freight transport & logistics	Infrastructures/Services			REF	2018
1	Dry ports and logistic centres, to be developed as hubs for services to drivers and vehicles (maintenance), transhipment and freight distribution		Amman - Madounah site (124 ha), with the primary focus to function as storage/ distribution center for consumer goods (3 phases)		✓
2	Service areas for trucks (services for drivers and vehicles near borders, dry ports and industrial areas)		Karama (border crossing with Iraq)		✓
			Omari (border crossing with KSA)		✓
			Aqaba (border crossing with KSA)		✓
Freight transport & logistics	Policies/Regulations			REF	2018
1	Impose Higher Registration Fees for Old Trucks and/or define restrictions on operational age				✓
2	Establish Enforcement Unit				✓
3	Improve Motor Vehicle Inspections				✓
4	Implement Dangerous Goods Regulations				✓
5	Improve Custom Procedures / Bilateral Agreements				✓
6	Restructuring of the sector/ industry: consolidating small operators into bigger organisations				✓

Figure 23: Short term infrastructural projects



4.5.2 Medium term

Table 18: Medium term strategies

RD	Strategy				
Roads	Infrastructures/Services			REF	2024
1	Road maintainence: recovery programme to achieve a minimum standard of pavement conditions across the main road network and to maintain existing bridges	1.1	Maintenance of road network after priority packages		✓
		1.2	Maintenance of main structures after priority packages		✓
2	Road widenings: improvement of existing narrow road links and increasing of road capacity of selected links to solve existing or future bottlenecks	2.1	Widening of narrow roads to a minimum section of 7.3m		✓
		2.2	Widening to 6 lanes (selected and phased according to model results)		✓
3	New links	3.1	Madaba Ring Road - Phase 2 (West-North)		✓
Roads	Policies/Regulations			REF	2024
1	Road measures included in the JNTS National Transport Safety Programme	1.1	Training and driving licenses (also for professional drivers)		✓
		1.2	Post-crash medical care		✓
2	Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts				✓
3	Tolled highways for trucks				✓

RW	Strategy				
Railways	Infrastructures/Services			REF	2024
1	New National railway network, core South-North corridor from Aqaba to Syrian border, as part of the Red Sea-Black Sea "landbridge"	1.1	Amman Logistics Center-Ma'an		✓
		1.2	Sahab link		✓
		1.3	Ma'an-Aqaba South Industrial Area (coastal alignment)		✓
		1.4	Investments in new rolling stock (locos and waggons)		✓

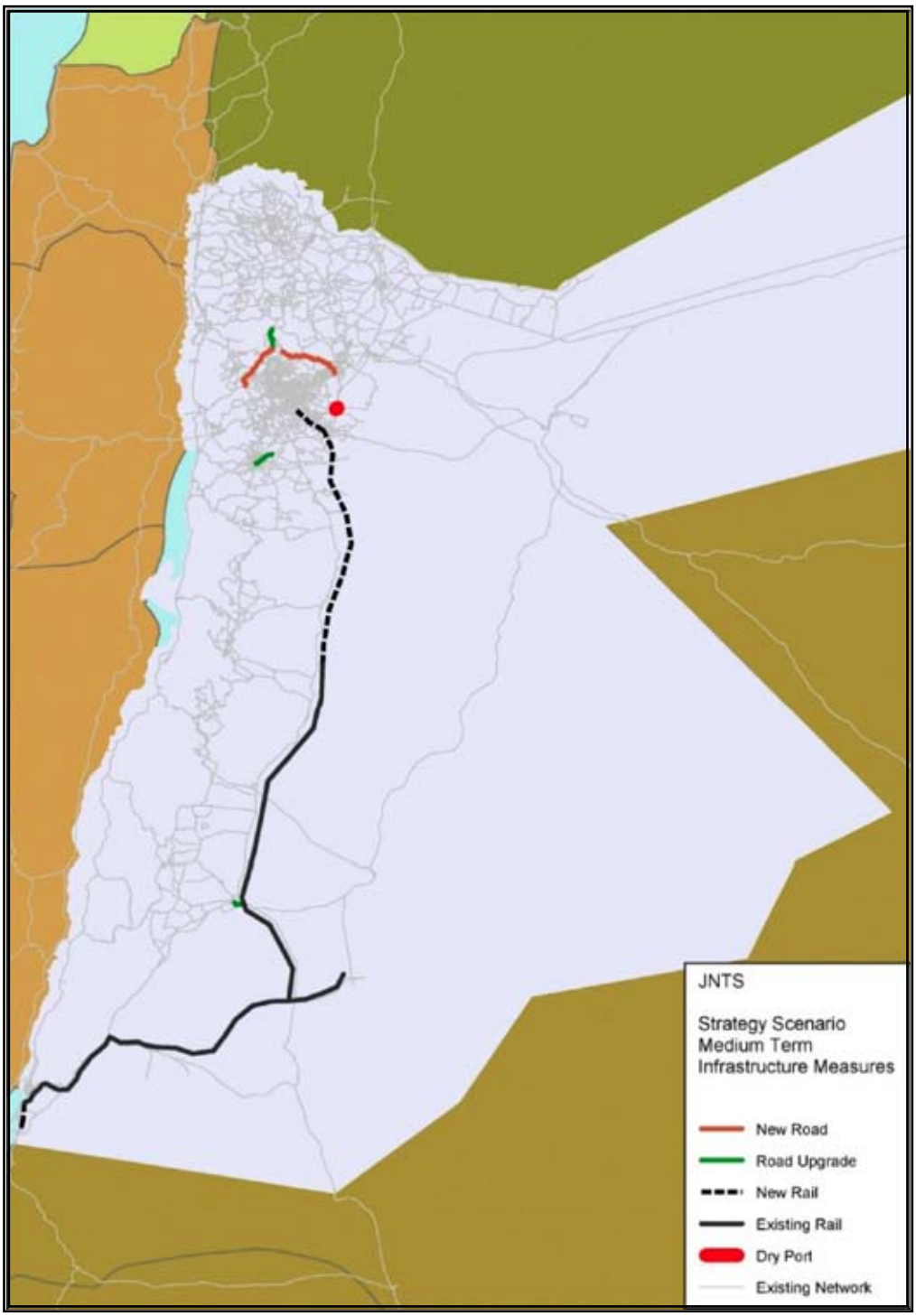
PM	Strategy				
Port and Maritime	Infrastructures/Services			REF	2024
1	Integration of port and railway project development				✓
Port and Maritime	Policies/Regulations			REF	2024
1	Port community Information System and Vessel traffic Service				✓

CA	Strategy				
Civil Aviation	Infrastructures/Services			REF	2024
1	Development of airports	1.1	Rehabilitation of east road access at QAIA cargo area		✓
		1.2	Rehabilitation, expansion and operation of Amman Marka IA: specialized for low cost, charters and executive flights		✓
		1.3	Enhance road and PT connections to AMIA		✓

PT	Strategy				
Public transport	Infrastructures/Services			REF	2024
1	Bus services to be operated according to a timetable and with intermediate stops (with different average distance according to the hierarchical level)				✓
2	New bus network, as proposed by the LTRC Jordan Bus Restructuring Interim Master Plan (JBRIMP), with a hierarchical and integrated structure of services (route numbering)	2.1	Level 3 - Other Inter Governorate Services: the remaining standard regional services operating between the Governorates		✓
		2.2	Level 4 – Intra Governorate: those regional services which operate within a single Governorate		✓

PT	Strategy				
Public transport	Infrastructures/Services			REF	2024
3	Mass rapid transit in the main (high demand) corridors	3.1	Amman-Zarqa BRT	✓	
4	Upgrade of facilities for passengers. Guidelines for bus terminal and bus stops has to be defined (location, layout, facilities and services to passengers, information provision to travellers also by means of ITS, interchanges and intermodality) and main terminals have to be upgraded whenever not compliant with basic standards				✓
5	Service areas for buses and passengers at border crossings	2.1	Jaber (border crossing with Syria)		✓
		2.2	Aqaba (border crossing with KSA)		✓
		3.1	Jordan Valley (border crossing with Palestine)		✓
Public transport	Policies/Regulations			REF	2024
	Renewing the fleet of public transport buses (to be coordinated with the progressive implementation of hierarchical network levels)				✓

Figure 24: Medium term infrastructural projects



4.5.3 Long term

Table 19: Long term strategies

RD	Strategy				
Roads	Infrastructures/Services			REF	2030
1	Road maintainence: recovery programme to achieve a minimum standard of pavement conditions across the main road network and to maintain existing bridges	1.1	Maintenance of road network after priority packages		✓
		1.2	Maintenance of main structures after priority packages		✓
2	Road widenings: improvement of existing narrow road links and increasing of road capacity of selected links to solve existing or future bottlenecks	2.1	Widening of narrow roads to a minimum section of 7.3m		✓
		2.2	Widening to 6 lanes (selected and phased according to model results)		✓
3	New links	3.1	Madaba Ring Road - Phase 2 (West-North)		✓
Roads	Policies/Regulations			REF	2030
1	Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts				✓
2	Tolled highways for all traffic				✓

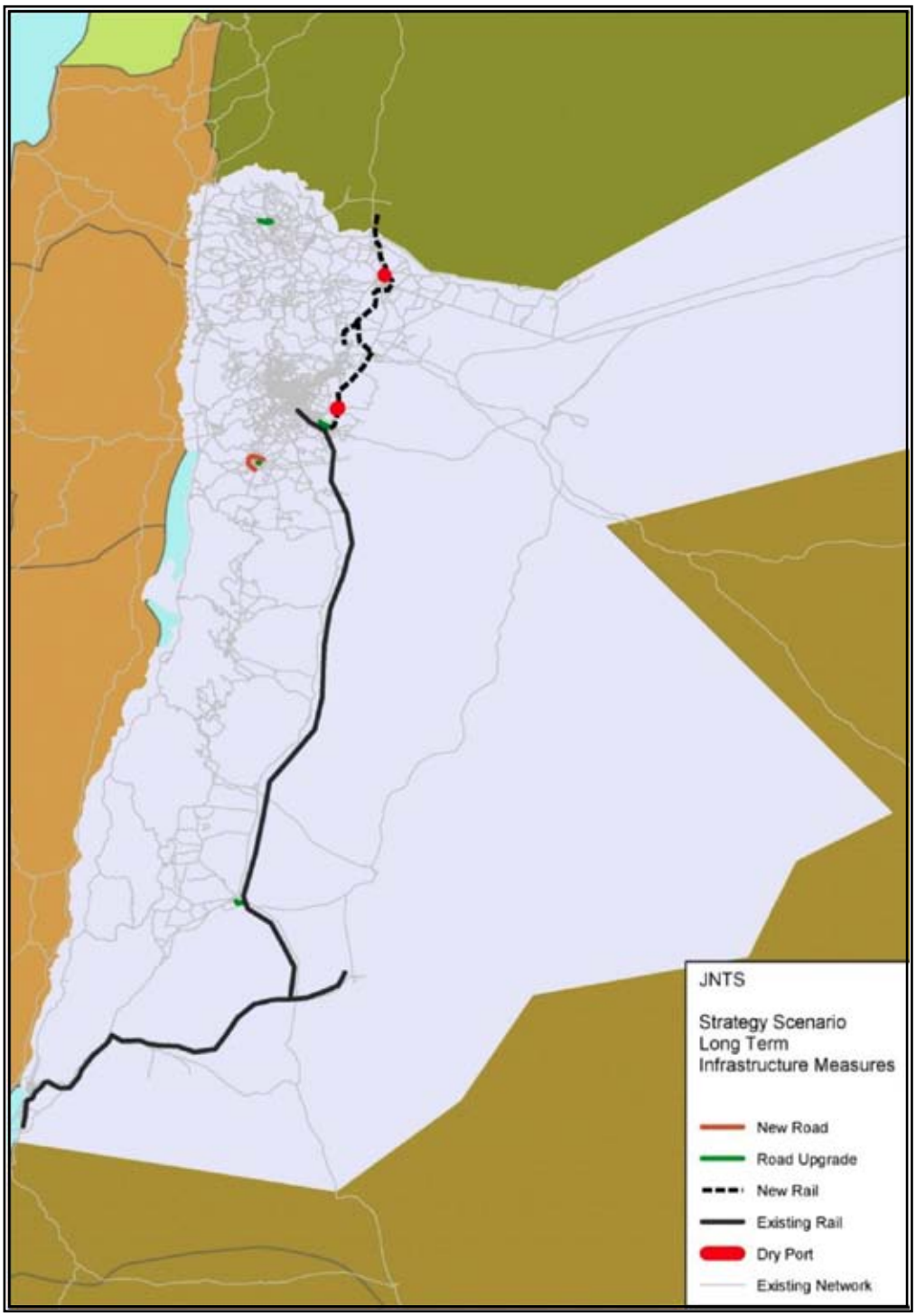
RW	Strategy				
Railways	Infrastructures/Services			REF	2030
1	New National railway network, core South-North corridor from Aqaba to Syrian border, as part of the Red Sea-Black Sea "landbridge"	1.1	Syrian border-Zarqa Junction		✓
		1.2	Zarqa link		✓
		1.3	Zarqa J.-Amman Logistics Center		✓
		1.4	Investments in new rolling stock (locos and waggons)		✓

PM	Strategy				
Port and Maritime	Infrastructures/Services			REF	2030
1	Expansion Container terminal at Middle port, phase 3				✓

CA	Strategy				
Civil Aviation	Infrastructures/Services			REF	2030
1	Development of airports	1.1	Rehabilitation, expansion and operation of Amman Marka IA: specialized for low cost, charters and executive flights		✓

FL	Strategy				
Freight transport & logistics	Infrastructures/Services			REF	2030
1	Dry ports and logistic centres, to be developed as hubs for services to drivers and vehicles (maintenance), transhipment and freight distribution	1.1	Amman - Madounah site (124 ha), with the primary focus to function as storage/ distribution center for consumer goods (3 phases)		✓
		1.2	Mafraq - KHBT (170 ha), with primary potential to provide logistic services to facilitate the supply chains of industrial companies that will be located in the King Hussein Bin Talal (KHBT) development zone (3 phases)		✓
2	Service areas for trucks (services for drivers and vehicles near borders, dry ports and industrial areas)	1.2	Jordan Valley (border crossing with Palestine)		✓

Figure 25: Long term infrastructural projects



5 The implementation of the strategy and the Action Plan

The Long term Transport Strategy would be of little use if the proper tools and procedures weren't put in place.

In this chapter, first of all a five year action plan is proposed to set out prioritized actions that are key steps in implementing the strategies.

The progress of the included measures, and importantly their adherence to the objectives of the overall Strategy and to the evolving context, should be periodically assessed with a monitoring and evaluation procedure. An assessment of the risks associated with successful implementation of the Strategy and the action planning is also provided.

In this respect, it is fundamental the role of the Incubator team which has been installed at the MoT Development and Strategic Planning directorate.

5.1 Five-years rolling Action Plan

For each short term measure (both infrastructures and policies) included in the Strategy, a set of relevant information and objectives is provided with the purpose of providing a concise tool for the first five-year-period Strategy implementation.

In particular, the action plan contains:

- A synthetic description and the type of the measure
- The responsible authority(ies) in charge for the implementation of the measure and/or for the achievement of the results
- The Key Performance Indicator (KPI) for the measurement of the implementation progress
- The time frame (years 2014 to 2018) in which measures (or part of them, according to the phasing) should be implemented
- The required economic resources, stated in million JD
- The availability and sources of funding resources partially or entirely allocated (see Res. allocated), as reported in the Governmental transport sector "schedule of programs and projects for the period 2013-2016". If no figure is indicated, it means that the budget has not been already allocated

Please note that the following abbreviations are used in the tables:

- N/Ap. (Not applicable), whenever no (or negligible) direct costs can be associated (i.e. regulamentary and legislative measures, holding agreements etc.)
- N/Av. (Not available), whenever no detailed and specific cost estimations are available.

Measures belonging to the Reference Scenario (RS) are listed below just for the purpose of monitoring their progress. Details about their implementation plan are out of scope, considering that it is assumed that related measures are an invariant and their implementation must be considered as given disregard of the Strategy itself.

5.1.1 Road

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Maintenance recovery of Road 15 (Desert Highway), as included in the HMPS short term priority package 1	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing		25.6	25.6	25.6		
KPI: Completed km over the total (60% within 2016; 100% within 2017)			■	■	■		

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Maintenance recovery of other main roads, asincluded in the HMPS short term priority package 2	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	34.0	34.0	34.0	34.0	34.0	
KPI: Completed km over the total (60% within 2016; 100% within 2018)		■	■	■	■	■	

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Maintenance recovery of tertiary roads, as included in the HMPS short term priority package 3	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing			11.4	11.4	11.4	
KPI: Completed km over the total (60% within 2017; 100% within 2018)				■	■	■	

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Bridge recovery action plan (routine maintenance or immediate action), as included in the HMPS short term priority package 4	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	3.1	4.0	4.6	3.5	1.5	
Works within sub-package 1: immediate action	**KPI:** Bridges (10 within 2015)	■	■				
Works within sub-package 1: routine maintenance	**KPI:** Bridges (13 within 2015; 26 within 2016)		■	■			
Works within sub-package 2: immediate action	**KPI:** Bridges (22 within 2015; 44 within 2017)	■	■	■	■		
Works within sub-package 2: routine maintenance	**KPI:** Bridges (40 within 2017; 57 within 2018)			■	■	■	

Road safety measures, aimed at enhancing road safety by addressing poor alignments, crossing of settlements and pavement widening	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		15.6	26.9	26.9	26.9	15.6	
Package 1 - Road 15 (Desert Highway)	**KPI:** Completed works (60% within 2016; 100% within 2017)						
Package 2 - Other main roads	**KPI:** Completed works over the total (60% within 2016; 100% within 2018)						

Widening of narrow roads to a minimum section of 7.3m	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
				5.2	5.2	5.2	
KPI: Completed km over the total (65% within 2017; 100% within 2018)							

New links: Madaba Ring Road - Phase 1 (East)	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			3.5	10.5	10.5	10.5	
Design stage	**KPI:** Project completion (100% in 2015)						
Building stage	**KPI:** Building completion (100% within 2018)						

Reference Scenario: new links	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing
Tafelah Ring Road	**KPI:** Building completion (100% within 2018)
Amman Ring Road - Phase 1	**KPI:** Building completion (100% within 2018)
Amman to Airport Road	**KPI:** Building completion (100% within 2018)
Al-Mafraq - Irbid	**KPI:** Building completion (100% within 2018)
Irbid Ring Road – Phase 1	**KPI:** Building completion (100% within 2018)
Al-Hashimeyah - Bal'ma	**KPI:** Building completion (100% within 2018)
Parallel Road to Al Dura Check Point	**KPI:** Building completion (100% within 2018)
Madaba Road - Jalul Airport	**KPI:** Building completion (100% within 2018)
Salt By-pass – Phase 2	**KPI:** Building completion (100% within 2018)

Road safety (JNTS National Transport Safety Programme)	**Type:** Policy, Regulation **Responsibility:** Ministry of Transport, Ministry of Public Works and Housing, Ministry of Education, Ministry of Health, Ministry of Planning, General Dir. of Security, Public Security Dept., LTRC, Jordan Traffic Institute	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		0.4	0.7	1.0	1.5	1.5	
National legislation	**KPI:** Achievement (100% in 2015)						
Control and enforcement (compliance with road traffic rules)	**KPI:** Road controls over the 2013 value (+20% within 2014; +50% within 2016; +100% within 2018)						
Campaigns and programmes: Awareness campaigns at national level	**KPI:** Awareness campaigns (1 in 2014; 2 in 2015; 3 in 2016, 2017, 2018)						
Campaigns and programmes: Educational programmes	**KPI:** Schools involved (30 in 2015, 2016; 50 in 2017, 2018)						
Vehicle safety	**KPI:** Roadside inspections over the 2013 value (+20% within 2014; +50% within 2016; +100% within 2018)						
Statistics and monitoring	**KPI:** Monitoring (to be done every year 2014 to 2018)						
Accompanying measures: Establishing and strengthening of a lead agency	**KPI:** Achievement (100% in 2015)						

Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts	**Type:** Policy **Responsibility:** Ministry of Transport	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			6.2	6.2	6.2	6.2	
Renewed vehicles (7.500 private cars in 2015, 2016, 2017, 2018 and 70 trucks in 2015, 2016, 2017, 2018)							

5.1.2 Railways

New National railway network, core South-North corridor from Aqaba to Syrian border	**Type:** Infrastructure **Responsibility:** Ministry of Transport	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
					N/Av.	N/Av.	
Preliminary activities: Design stage, expropriations	**KPI:** Achievement (100% in 2018)						

Reference Scenario: Mini project	**Type:** Infrastructure **Responsibility:** Ministry of Transport
	KPI: Achievement (100% within 2018)

5.1.3 Port and maritime

Reference Scenario: Development and the reconfiguration of Aqaba Port	**Type:** Infrastructure **Responsibility:** ADC
Relocation of Main Port facilities to South Port	**KPI:** Achievement (100% in 2018)
New cruise ship terminals at Main port	**KPI:** Achievement (100% in 2018)
Development of Mustarak & Mo'ata Berths (bulk commodities) at Middle port	**KPI:** Achievement (100% in 2018)
Upgrade of the existing passenger ferry terminal at Middle port (new halls and security facilities, new logistics facilities and yards)	**KPI:** Achievement (100% in 2018)
Rehabilitation of Oil terminal at South port (to boost handling capacity and enhance safety and environmental protection)	**KPI:** Achievement (100% in 2018)
New miscellaneous liquids, LPG (Liquid Petroleum Gas), LNG (Liquid Natural Gas) terminals at South port	**KPI:** Achievement (100% in 2018)
Rehabilitation of industrial port at South port	**KPI:** Achievement (100% in 2018)
New general cargo, Ro-Ro and grain terminals at South Port	**KPI:** Achievement (100% in 2018)
New port area infrastructures at South Port	**KPI:** Achievement (100% in 2018)

Marine services development	**Type:** Service **Responsibility:** JMA	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		0.9					✓ General budget
KPI: Achievement (100% in 2014)							

Issuing Jordanian Maritime Law	**Type:** Regulation **Responsibility:** Ministry of Transport, JMA	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			N/Ap.				N/Ap.
KPI: Achievement (100% in 2015)							

Ratification of international maritime conventions	**Type:** Policy **Responsibility:** JMA	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
				N/Ap.			N/Ap.
KPI: Achievement (100% in 2016)							

5.1.4 Civil aviation

Reference Scenario: Rehabilitation expansion and operation of Queen Alia International airport – Phase 2	**Type:** Infrastructure **Responsibility:** AIG
	KPI: Achievement (100% in 2018)

Reference Scenario: Passenger terminal development at Aqaba King Hussein International Airport	**Type:** Infrastructure **Responsibility:** ADC
	KPI: Achievement (100% in 2018)

Rehabilitation of east road access at QAIA cargo area	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		0.1	1.5				
Design stage	**KPI:** Project completion (100% in 2014)						
Building stage	**KPI:** Building completion (100% in 2015)						

Rehabilitation, expansion and operation of Amman Marka IA: specialized for low cost, charters and executive flights	**Type:** Infrastructure **Responsibility:** Ministry of Public Works and Housing	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		13.1	8.6	N/Ap.	N/Ap.	N/Ap.	✓ Govern. units
Building stage: rehabilitation of runway and taxiway	**KPI:** Building completion (70% within 2014; 100% within 2015)						
Building stage: rehabilitation of departures terminal	**KPI:** Building completion (50% within 2014; 100% within 2015)						
New car park for 1000 cars	**KPI:** Completion (100% in 2015)						
Specialization for low cost, charters and executive flights	**KPI:** LCC and charters share (20% within 2017; 35% within 2018)						

Enhance road and PT connections to AMIA	**Type:** Infrastructure, Service **Responsibility:** Ministry of Public Works and Housing, GAM, JAC	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			0.5	5.0			
Planning stage for public transport connections	**KPI:** Project completion (100% in 2015)						
Design stage for road upgrade	**KPI:** Project completion (100% in 2015)						
Building/implementation stage	**KPI:** Completion (100% in 2016)						

Holding bilateral agreements to liberalize air transport on a reciprocal basis	**Type:** Policy **Responsibility:** CARC	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		N/Ap.					N/Ap.
KPI: Achievement (100% in 2014)							

		Cost (Million JD) and time frame					Res. allocated
Development of civil aviation legislations and harmonizing it with the European aviation legislations	**Type:** Regulation **Responsibility:** Ministry of Transport, CARC	2014	2015	2016	2017	2018	
		N/Ap.					N/Ap.
KPI: Achievement (100% in 2014)							

		Cost (Million JD) and time frame					Res. allocated
Develop programs to monitor noise levels and aircraft emissions	**Type:** Policy **Responsibility:** CARC	2014	2015	2016	2017	2018	
		N/Ap.					N/Ap.
KPI: Achievement (100% in 2014)							

		Cost (Million JD) and time frame					Res. allocated
Improving the use of air sectors and its dynamic use (The Flexible airspace)	**Type:** Policy **Responsibility:** CARC	2014	2015	2016	2017	2018	
		2.8	2.8	2.8			✓ General budget
KPI: Achievement (100% in 2016)							

		Cost (Million JD) and time frame					Res. allocated
Licensing new airline companies based on the market's demands	**Type:** Policy **Responsibility:** CARC	2014	2015	2016	2017	2018	
		N/Ap.	N/Ap.				N/Ap.
KPI: Achievement (100% within 2015)							

5.1.5 Public transport

		Cost (Million JD) and time frame					Res. allocated
Bus services to be operated according to a timetable and with intermediate stops	**Type:** Service **Responsibility:** LTRC, Ministry of Transport	2014	2015	2016	2017	2018	
		0.2	0.2	0.5	0.5		✓ General budget
Detailed planning stage for national and local public transport networks	**KPI:** See following table						

		Cost (Million JD) and time frame					Res. allocated
New bus network, as proposed by the LTRC Jordan Bus Restructuring Interim Master Plan, with a hierarchical and integrated structure of services	**Type:** Service **Responsibility:** LTRC, Ministry of Transport, GAM, ASEZA	2014	2015	2016	2017	2018	
		N/Ap.	N/Ap.	N/Ap.	N/Ap.	N/Ap.	
Planning stage: Level 1 - Premium Inter City network	**KPI:** Project completion (100% within 2015)						
Implementation stage: Level 1 - Premium Inter City network	**KPI:** Restructured bus-km/pax-km (100% in 2017)						
Planning stage: Level 2 - Core National network	**KPI:** Project completion (100% within 2015)						
Implementation stage: Level 2 - Core National network	**KPI:** Restructured bus-km/pax-km (100% within 2017)						
Planning stage: Level 3 - Other Inter Governorate services	**KPI:** Projects completion (50% within 2015; 100% within 2017)						
Implementation stage: Level 3 - Other Inter Governorate services	**KPI:** Restructured bus-km/pax-km (50% within 2017; 75% within 2018)						
Planning stage: Level 4 - Intra Governorate services	**KPI:** Projects completion (35% within 2015; 100% within 2017)						
Implementation stage: Level 4 - Intra Governorate services	**KPI:** Restructured bus-km/pax-km (35% within 2017; 50% within 2018)						

Upgrade of facilities for passengers. Guidelines for bus terminal and bus stops has to be defined and main terminals have to be upgraded whenever not compliant with basic standards (44 terminals)	**Type:** Infrastructure **Responsibility:** LTRC, Ministry of Transport, GAM, ASEZA, Municipalities	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		N/Ap.	2.2	22.0	22.0	22.0	✓ General budget
Setting standards for bus terminal and bus stops	**KPI:** Achievement (100% in 2014)						
Design stage	**KPI:** Projects completion (22 within 2017; 30 within 2018)						
Building stage	**KPI:** Upgraded terminals (15 within 2017; 22 within 2018)						

Service areas for buses and passengers at border crossings	**Type:** Infrastructure **Responsibility:** Ministry of Transport, LTRC, MoPWH	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			0.3	1.9	1.9	1.9	
Design stage	**KPI:** Projects completion (100% in 2015)						
Building stage: Karama (border crossing with Iraq)	**KPI:** Building completion (100% within 2017)						
Building stage: Omari (border crossing with KSA)	**KPI:** Building completion (100% within 2018)						

Renewing the fleet of public transport buses	**Type:** Policy **Responsibility:** LTRC, Ministry of Transport	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
				1.4	1.4	1.4	N/Ap.
KPI: Buses renewal over the 2015 fleet (10% within 2016; 20% within 2017; 30% within 2018)							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Minimum standards for vehicles. Definition of quality standards, technical specifications, maximum age for busses, enforcement	**Type:** Policy, Regulations **Responsibility:** LTRC, Ministry of Transport		N/Ap.				N/Ap.
KPI: Achievement (100% in 2015)							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Restructuring of the sector/ industry: consolidating the actual fragmented industry of small operators into bigger organisations, competition and efficiency	**Type:** Policy **Responsibility:** LTRC			N/Ap.	N/Ap.	N/Ap.	N/Ap.
KPI: Coordinated with the progressive implementation of new networks, see table "New bus network"							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Fare and contracts	**Type:** Policy, Regulations **Responsibility:** LTRC, Ministry of Transport			N/Ap.	N/Ap.	N/Ap.	N/Ap.
New contracts replacing old licenses	**KPI:** New operators complying with the new policy on the implemented networks (100% in 2016, 2017, 2018)						
Revision of fare system (incl. technologies, ETMs electronic ticket machines)	**KPI:** Coordinated with the progressive implementation of new networks, see table "New bus network"						
Separate services for which fares can be liberalised from regulated services and assess the need to introduce subsidies	**KPI:** Coordinated with the progressive implementation of new networks, see table "New bus network"						

5.1.6 Freight transport and logistics

Amman dry port and logistic centre, to be developed as hubs for services to drivers and vehicles (maintenance), transhipment and freight distribution	**Type:** Infrastructure **Responsibility:** Ministry of Transport, LTRC, MoPWH, GAM, TTF	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
		0.3	5.6	9.9	9.5	13.1	✓ General budget
Design stage	**KPI:** Projects completion (100% in 2014)						
Land acquisition	**KPI:** Land acquisition completion (100% within 2016)						
Building stage: first phase	**KPI:** Building 1st phase completion (80% within 2018)						

Service areas for trucks (services for drivers and vehicles near borders, dry ports and industrial areas)	**Type:** Infrastructure **Responsibility:** Ministry of Transport, LTRC, MoPWH, GAM, TTF	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			1.2	6.5	6.7	5.7	✓ General budget
Design stage	**KPI:** Projects completion (100% in 2015)						
Building stage: Karama (border crossing with Iraq)	**KPI:** Building completion (100% within 2017)						
Building stage: Omari (border crossing with KSA)	**KPI:** Building completion (100% within 2018)						
Building stage: Aqaba (border crossing with KSA)	**KPI:** Building completion (100% within 2017)						

Impose higher registration fees for old trucks and/or define restrictions on operational age	**Type:** Policy, Regulation **Responsibility:** Ministry of Transport, LTRC	Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
			N/Ap.				N/Ap.
KPI: Achievement (100% in 2016)							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Establish enforcement unit	**Type:** Policy **Responsibility:** LTRC, Public Security Department			N/Av.			N/Ap.
KPI: Achievement (100% in 2016)							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Improve motor vehicle inspections	**Type:** Policy **Responsibility:** Public Security Department		N/Ap.	N/Ap.	N/Ap.		N/Ap.
KPI: Motor vehicle inspections over the 2014 value (+25% in 2015; +40% in 2016; +50% in 2017)							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Implement dangerous goods regulations	**Type:** Regulation **Responsibility:** Ministry of Transport, LTRC, Public Security Department			N/Ap.			N/Ap.
KPI: Achievement (100% in 2016)							

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Improve custom procedures/ bilateral agreements	**Type:** Policy **Responsibility:** Ministry of Transport, Ministry of Industry and Trade, Customs, TTF		N/Ap.	N/Ap.	N/Ap.	N/Ap.	N/Ap.
Improve custom procedures/ bilateral agreements	**KPI:** Achievement (100% in 2018)						

		Cost (Million JD) and time frame					Res. allocated
		2014	2015	2016	2017	2018	
Restructuring of the sector/ industry: consolidating small operators into bigger organisations	**Type:** Policy **Responsibility:** Ministry of Transport, LTRC			N/Ap.	N/Ap.	N/Ap.	N/Ap.
KPI: Mean vehicles number per operator over the 2015 value (+10% in 2016; +20% in 2017; +30% in 2018)							

5.1.7 Summary of required financial resources

A summary of the estimated total financial resources required by year, sector and overall, is provided in the following table.

Table 20: Summary of required resources (Million JD)

Sector	2014	2015	2016	2017	2018	**Total**	%
Roads	53,1	100,9	125,4	124,8	85,9	**490,1**	**73,5**
Railways	0,0	0,0	0,0	0,0	0,0	**0,0**	**0,0**
Port and Maritime	0,9	0,0	0,0	0,0	0,0	**0,9**	**0,1**
Civil Aviation	16,0	13,4	7,8	0,0	0,0	**37,2**	**5,6**
Public Transport	0,2	2,7	25,8	25,8	25,3	**79,8**	**12,0**
Freight Transport and Logistics	0,3	6,8	16,4	16,2	18,8	**58,5**	**8,8**
Total	**70,5**	**123,8**	**175,4**	**166,8**	**130,0**	**666,5**	**100,0**
%	**10,6**	**18,6**	**26,3**	**25,0**	**19,5**	**100,0**	

5.2 Monitoring and evaluation framework

Project monitoring is key while implementing a transport Strategy. It is important to review the initial assumptions and regularly re-evaluate the Strategy to constantly update the goals and the subsequent measures according to the achieved results and the evolved context.

The main objectives and steps of monitoring and evaluation are:

- Measuring the progress of the strategies
- Evaluating the outcomes of the implementation of the prioritised actions
- Identifying and avoid operative, technical and financial barriers (risk assessment)
- Deploying corrective actions and update the rolling action plan

The MoT Incubator, that has been fully trained and provided with the necessary tools (the multimodal transport model, the appraisal and prioritisation methodology and working tools), shall be the structure in charge of monitoring the implementation of the Strategy and its periodic updating.

5.2.1 Measuring the implementation progress

Monitoring of the progress of the Strategy is somehow part of consolidated processes at MoT that may possibly be improved with the recommendations below. The progress of transport measures included in the rolling action plan (see section above) can be measured by means of the listed KPIs.

Project monitoring is currently managed by the MoT Transport Follow up and Evaluation Directorate. They process inputs provided on a quarterly frequency by each authority responsible for project implementation through a web-based Prime Ministry portal for evaluating the implementation of governmental projects.
Some recommendations about how the current monitoring procedures can be improved in the future and suggestions on the necessary changes to make it more efficient and effective are provided in the following table.
Indeed, increasing the efficiency and the effectiveness of monitoring procedures can help improving the timeliness and the quality of their results. Margins of improvement can be identified at different levels and they are related to data gathering, data mining and processing, and quality of data.

Table 21: Monitoring procedures: how to improve them in the future

Items	Issues and shortcomings	Recommendations
Data gathering	Uploading data in the system is somehow intricate and confirmations about successful uploading is missing. As a result of this, not all the uploads are successful from the concerned authority side.	The structure and the forms of the system could be improved in terms of user friendliness and data security. Instructions about the use of the system should be easy and clear to users.
	Whenever new data about the status and the specifications of one project are uploaded in the system, there is no immediate way to detect what has been changed, why and what was the previous value. This happens not only to the project status (% achieved), but also e.g. to the KPI targets.	The system should be improved in order to: ▪ Keep track of historical data ▪ Highlight any change ▪ Perform automatic consistency checks (only certain data / certain values are allowed to be inserted)
	Timeliness: delays in follow-up activities in most cases are related to delays in the provision of inputs from the concerned authorities.	The relevance of monitoring in the planning process should be made clear to all the stakeholders involved. Reasonable but strict deadlines should be agreed upon.
Data mining and data processing	Data exports and local storage for analysis by the Monitoring and Evaluation directorate is made manually per single project fiche. This is prone to errors and time consuming.	The system should include basic but automated exporting functionalities in the most common data formats. Basic elaborations to present summary data and statistic about the project progress can be standardized and performed directly by the software.
Quality of data	The project progress is stated by each implementing authority comparing the per cent value of the associated key performance indicator (KPI) achieved in each period with the target value. This implies that: ▪ The selection of proper key performance indicators (KPI) is fundamental ▪ Target values may be updated during time as part of the normal monitoring process ▪ Data are "self-declared" and their validation is missing.	Changes of target values should be made explicit and justified to avoid any disguise of underperformance. It is recommended that data on the progress provided by the implementing authorities is validated by third parties (audits) even on a sample basis.

5.2.2 Evaluating the performance of the implemented strategies

A "mid-term assessment" of the Strategy, based on a comprehensive evaluation of the performance of the implemented measures, shall be performed after two or three years.

This section describes how performance and outcomes of the strategies can be judged through the preparation of a set of mode specific indicators showing the development of the sector performance and operational issues of the transport industry. The indicators focus on:

- Performance of the different transport modes
- Safety issues for all modes of transport
- External costs (environment)

The respective performance indicators are listed and briefly described in the following tables. The evaluation of the performance of the future transport systems in the different proposed scenarios will be described in the following tasks of the project and the respective deliverables and reports, using the indicators described below:

Table 22: Performance indicators

Indicator	Description	Segmentation	Unit
Improved network efficiency	Average travel speed for domestic passenger trips, for domestic freight trips Average travel costs for domestic passenger trips, for domestic freight trips	Mode (road passenger, road freight, railways, maritime, aviation) Domestic international	Speed (kph) Costs (JOD)
Improved network interconnectivity	Passengers volumes using more than one transport mode Freight volumes using more than one transport mode	Passengers – freight; different mode combinations	Passenger volumes (pax/d) Freight volumes (t/d)
Improved congestion	Percentage of congested road network (Load/capacity ratio > 0.X) Average speed on road network Average speed on extra urban road network	Different networks: road (motorway, primary, secondary, other)	Percentage Average speed (kph) Average speed (kph)

Table 23: Safety indicators

Indicator	Description	Segmentation	Unit
Accidents by mode	Number of accidents (with injuries or fatalities) by mode	Mode (road passenger, road freight, railways, maritime, aviation)	Accidents
Injuries by mode	Number of individuals involved in accidents by accident seriousness, by mode	Mode (road passenger, road freight, railways, maritime, aviation) Type of accident (serious and light injuries)	Pers.
Fatalities by mode	Number of victims by mode	Mode (road passenger, road freight, railways, maritime, aviation)	Pers.
Severity rate by mode	Ratio between the number of injuries and fatalities divided by number of accidents, by mode	Mode (road passenger, road freight, railways, maritime, aviation)	Casualties/ accidents
Causalities (fatalities, injuries) by mode per capita	Ratio between the number of individuals involved in accidents and total population by accident seriousness, by mode	Mode (road passenger, road freight, railways, maritime, aviation) Type of accident (fatalities, serious and light injuries)	Pers./ 100.000 inhab.
Traffic causalities (fatalities, injuries) per vehicles	Ratio between the number of individuals involved in accidents by accident seriousness, per number of registered vehicles	Type of accident (fatalities, serious and light injuries)	Pers./ 100.000 vehicles
Traffic causalities (fatalities, injuries) per travelled km	Ratio between the number of individuals involved in accidents by accident seriousness, per km of vehicle travelling	Type of accident (fatalities, serious and light injuries)	Pers. / Mio vkm

Table 24: Environmental indicators

Indicator	Description	Segmentation	Unit
CO_2 transport emissions	Transport CO_2 emissions	Country	tons / year
CO_2 transport emissions per capita	Transport CO_2 emissions per inhabitant	Country	tons / person
CO_2 transport emissions by mode	Transport CO_2 emissions by mode	Mode (road passenger, road freight, railways, maritime, aviation)	tons / year
Average CO_2 emissions of car fleet	Average CO_2 emissions per km of cars travelling	Country	g / V-km
Transport emissions by pollutant	Transport polluting emissions by pollutant	Pollutant (NOx, VOC, CO, PM2.5)	tons / year
Transport emissions per capita by pollutant	Transport polluting emissions per inhabitant by pollutant	Pollutant (NOx, VOC, CO, PM2.5)	tons / person
Transport emissions by pollutant by mode	Transport polluting emissions by mode and by pollutant	Pollutant (NOx, VOC, CO, PM2.5) Mode (road passenger, road freight, railways, maritime, aviation)	tons / year
Total transport fuel consumption	Total transport fuel consumption	Country	M tons
Total transport fuel consumption per capita	Total transport fuel consumption per inhabitant	Country	M tons / person
Transport fuel consumption by mode and fuel type	Transport fuel consumption by mode and by fuel type	Mode (road passenger, road freight, railways, maritime, aviation) Fuel type (Diesel, Gasoline, Kerosene, Biofuel, CNG, LPG)	M tons
Total transport fuel consumption by fuel type	Transport fuel consumption by fuel type	Fuel type (Diesel, Gasoline, Kerosene, Biofuel, CNG, LPG)	M tons
Total transport fuel consumption per capita by fuel type	Transport fuel consumption per inhabitant and by fuel type	Fuel type (Diesel, Gasoline, Kerosene, Biofuel, CNG, LPG)	M tons / person

5.2.3 Risk assessment

In the table below, major risks that may affect the successful implementation of the Strategy are listed, underlining their likelihood, impact and actions to cope with them.

Table 25: Risk assessment of the Strategy

Risk	Likelihood	Impact	Taken actions	Future mitigation
Key decision makers not interested to support creation and implementation of Jordan National Transport Strategy	Low	High	Key decision makers have been openly and constructively involved from the beginning and have participated in all the main steps of the design of the Strategy. All the important stakeholders plans and suggestions have been duly examined, discussed and as far as possible taken on board.	
Lack of ownership and leadership of key actors	Low	High	The Strategy is fully owned by the MoT Incubator.	Emphasis on the communication of the Strategy and on the progresses will help in keeping and maintaining ownership.
Lack of availability of qualified staff	Low	High	The MoT Incubator staff is fully prepared to follow the implementation of the Strategy and to adapt the Strategy to the changing environment.	Monitor the implementation, verify the validity of the original assumptions and adapt the Strategy to the changing environment.
Shortage of financial resources	Medium/ High	High	Guaranteeing a flow of resources for the implementation of the Strategy is the core precondition for the success. The Strategy has been designed targeting the investment to a realistic availability of funds.	The recommended pricing policies and the possibility to involve private funding can contribute to reduce the risk, but uncertainties remain high.

Risk	Likelihood	Impact	Taken actions	Future mitigation
Active coordination among the most important players	Low	High	There are well identified responsibilities, the process of identifying the Strategy has been shared with all the structures involved.	The MoT should monitor and coordinate the implementation and provide feedbacks to all structures involved.
Technological	Low	Medium	All the investments and policies proposed are based on available and tested technologies.	
Imbalanced participation of decision makers	Medium	Medium	The Strategy requires a strong coordination in order to fully exploit the benefits of a coordinated multimodal approach.	Monitoring the implementation is a key instrument for a balanced and coordinated implementation.
Escalation of regional conflicts	High	High	The regional conflicts might affect significantly the implementation of those component of the Strategy dealing with international trade, by reducing international flows, making some investments impossible to be completed and or less urgent.	Review the assumption and adapt the Strategy to a changing environment

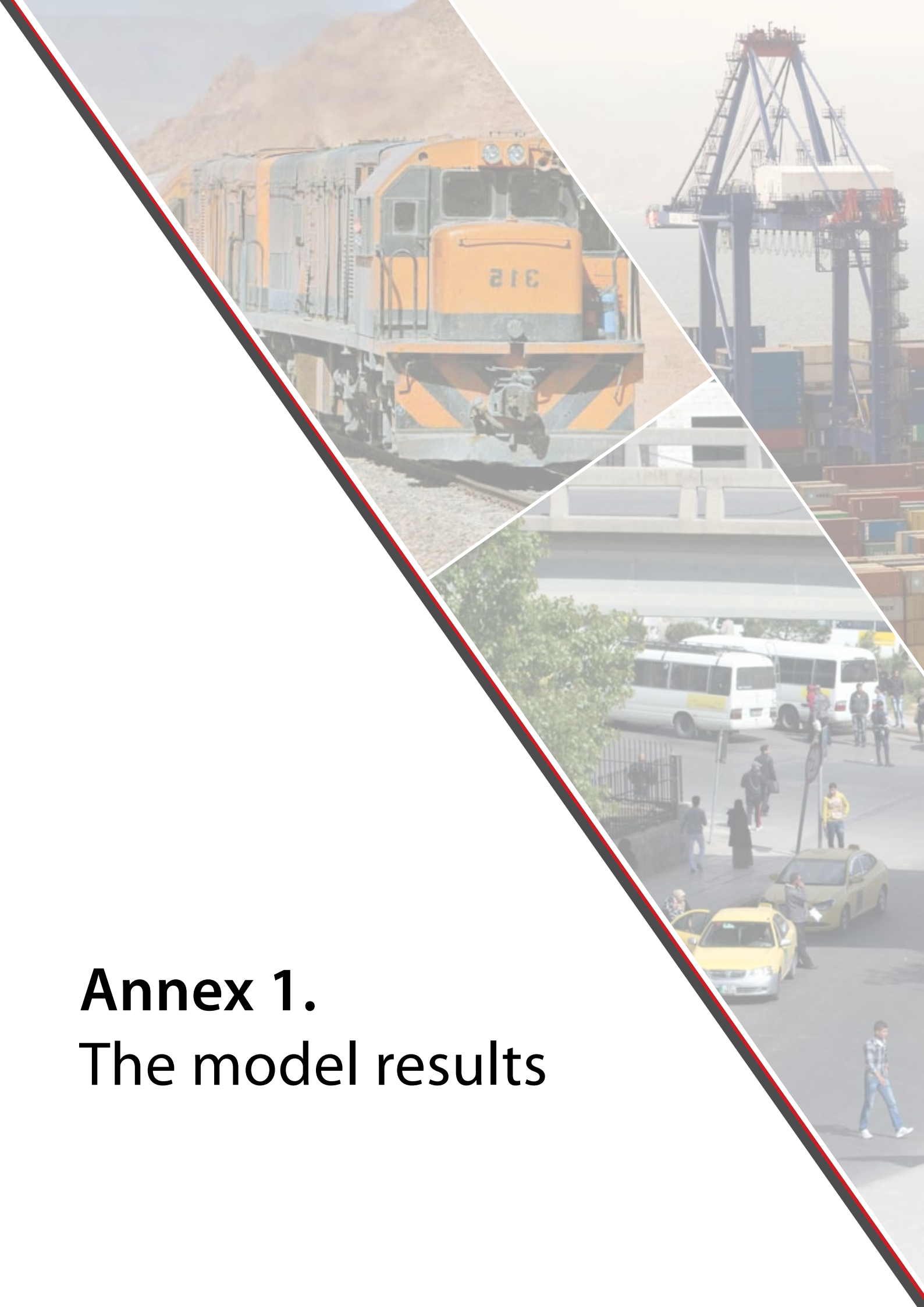
5.2.3 Risk assessment

Annex 1. The model results

Annex 2. The assumptions

Annex 3. The five alternative scenarios

Annex 4. The Multi-Criteria assessment



Annex 1.
The model results

Annex 1. The model results

On the following pages the model results of the Baseline Scenario and the 5 Development Scenarios are presented and compared for the horizon year 2030.

For each scenario, the following maps are presented:
Infrastructure measures that have been implemented in the particular scenario

- Freight volumes by transport mode
- Road traffic volumes
- Public transport passenger volumes

Regarding the infrastructure measures, the following types of measures are shown:

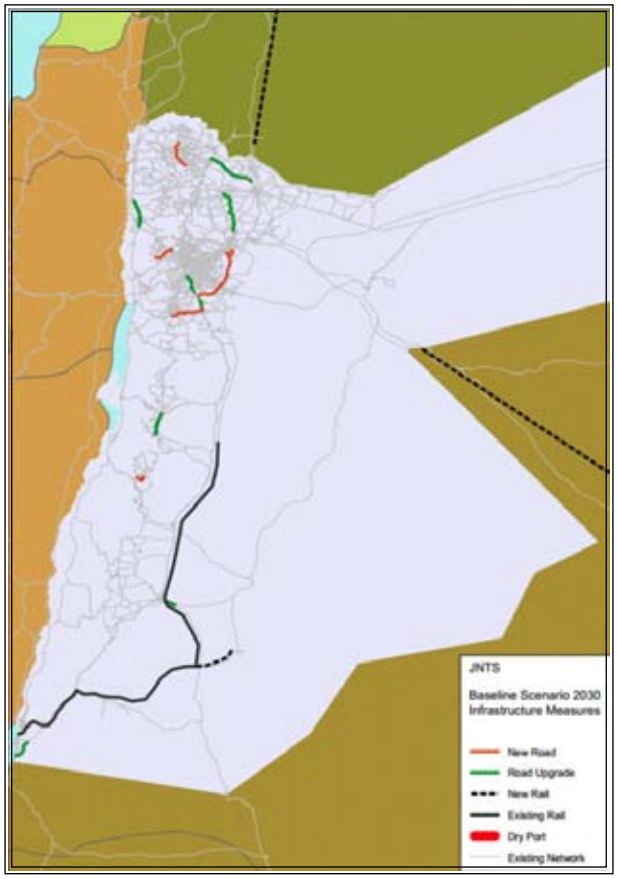
- Construction of a new road
- Road upgrade
- Construction of a new railway link
- Implementation of a dry port

Please note, that all infrastructure measures of the baseline scenario are also implemented in the development scenarios. However, for reasons of a better comparability the maps with the infrastructure measures of the development scenarios do only show the measures that are proposed in addition to the baseline scenario measures.

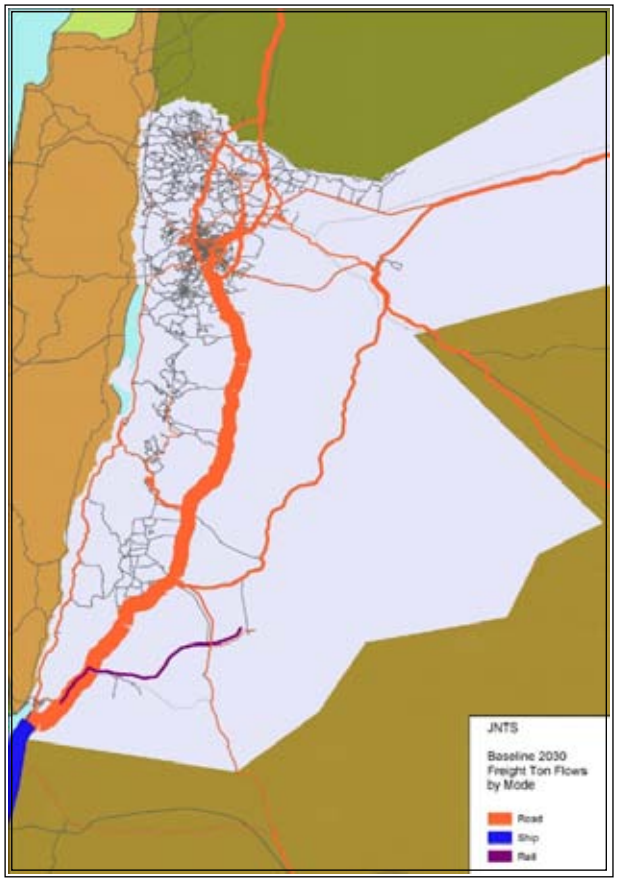
Comparing the modal freight volumes, it is clearly noticeable that the main differences between the scenarios result from the implementation of the freight railway. Especially on the link between Aqaba and Amman a significant shift of freight volumes from road to rail can be observed in the scenarios where the new rail links are implemented.

Regarding the total road and public transport volumes, the differences on national level are not that significant as for the freight volumes. However, especially in the urban areas in Northern Jordan differences mainly due to the construction of bypasses can be recognised.

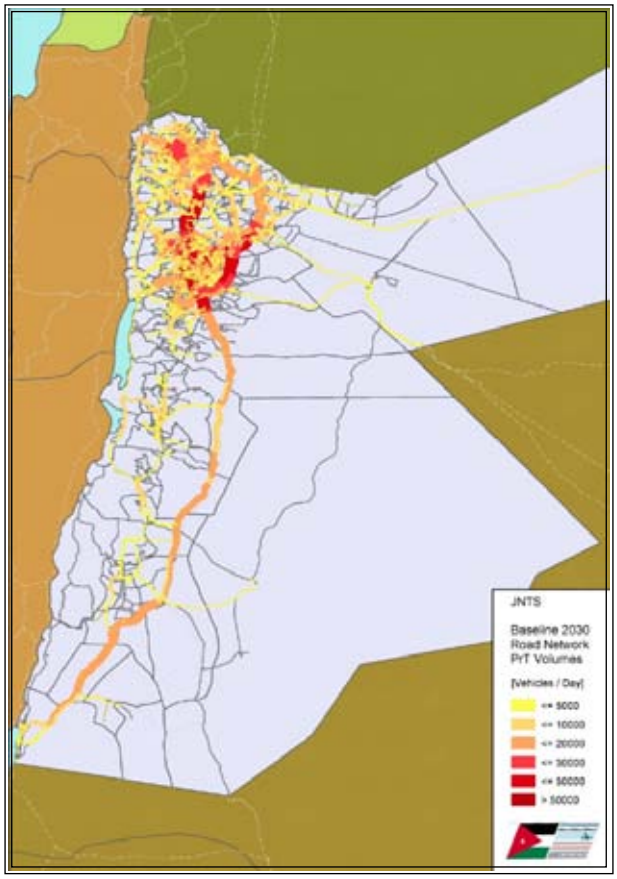
Baseline Scenario 2030 – Infrastructure Measures



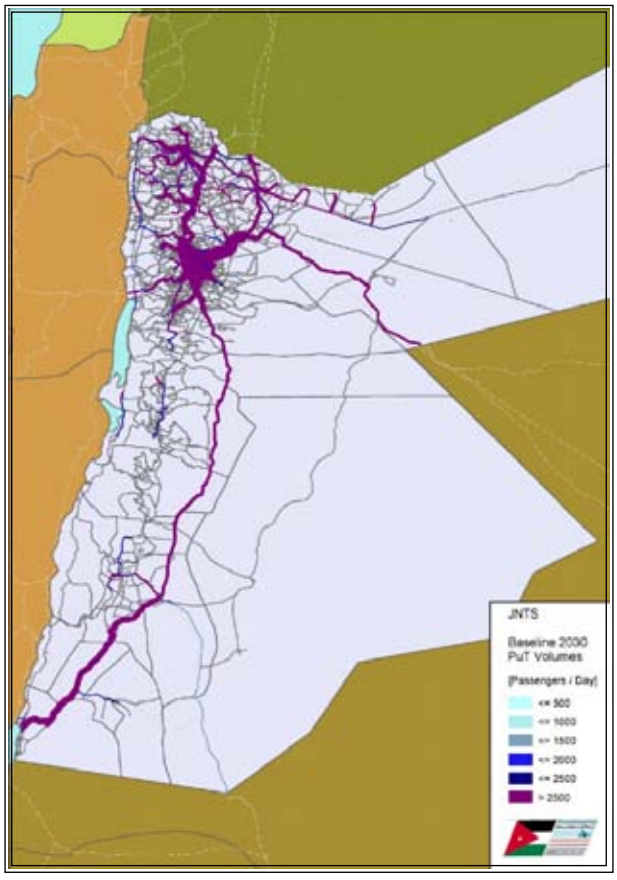
Baseline Scenario 2030 – Freight Volumes by Mode



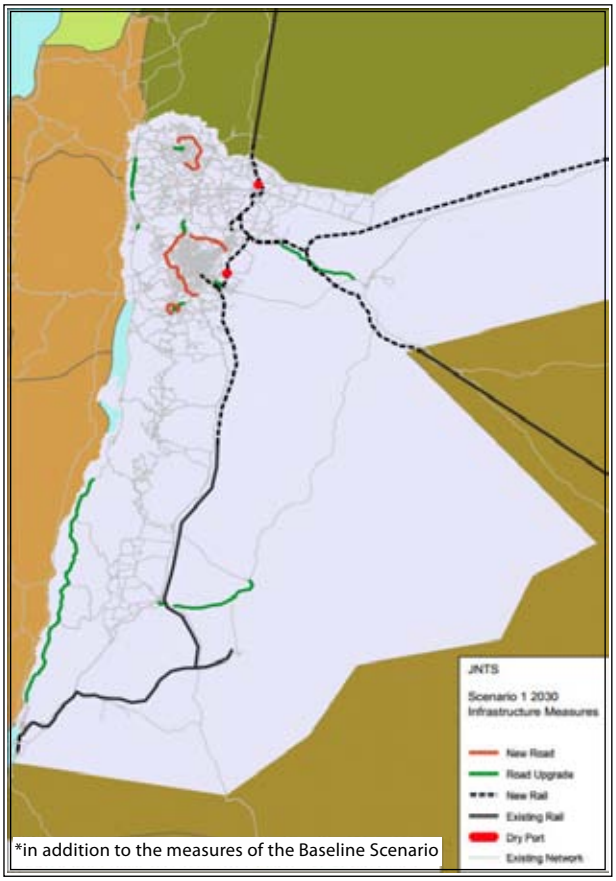
Baseline Scenario 2030 – Road Traffic Volumes



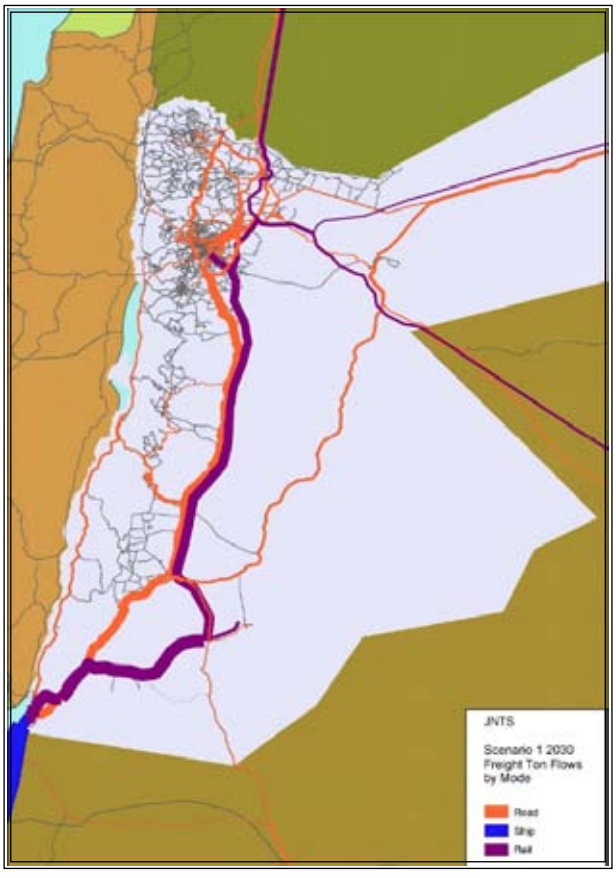
Baseline Scenario 2030 – Public Transport Volumes



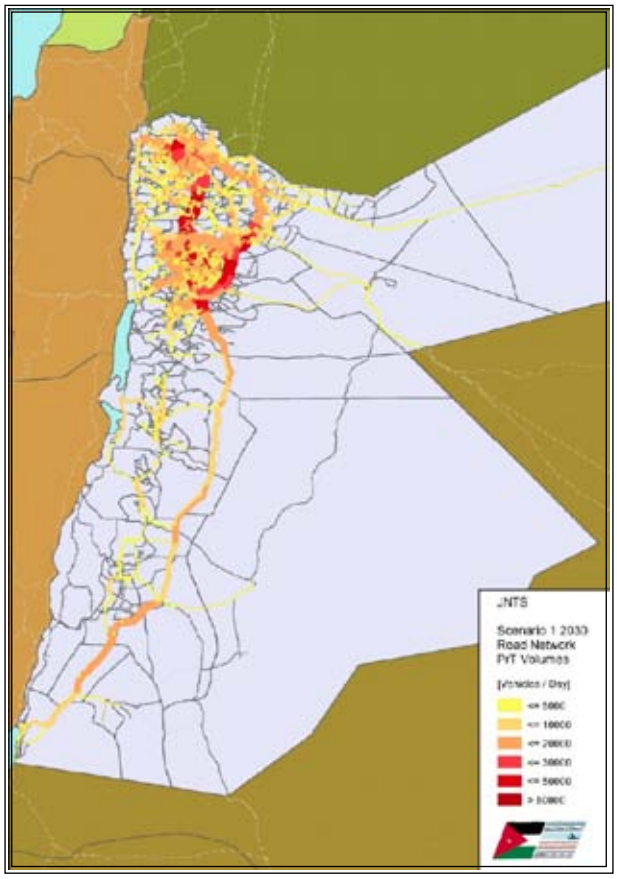
Scenario 1 2030 – Road Traffic Volumes



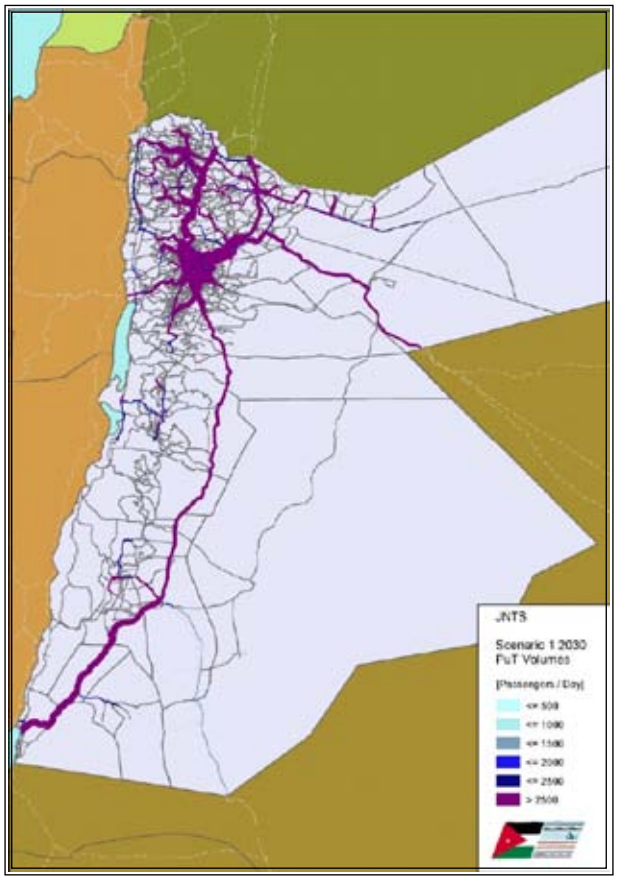
Scenario 1 2030 – Public Transport Volumes



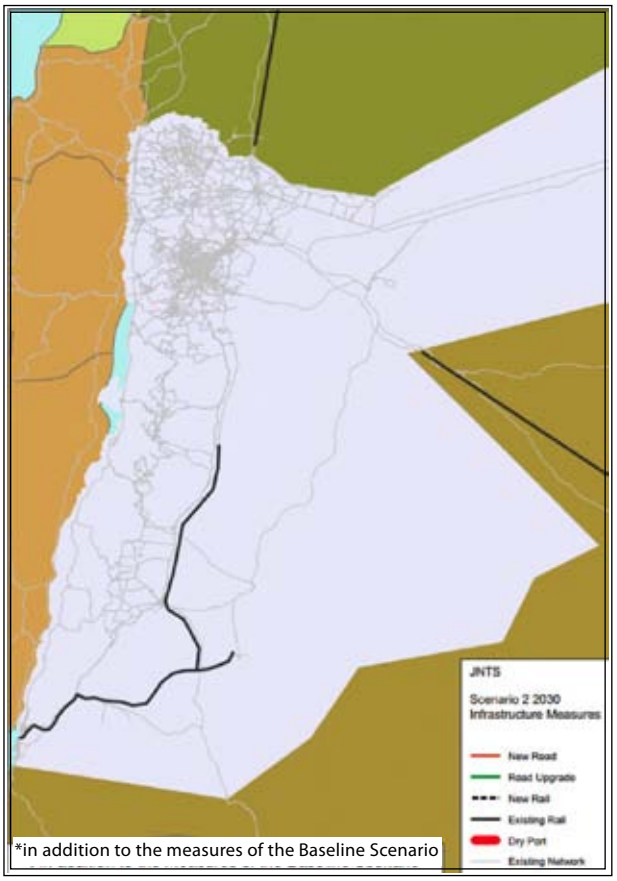
Scenario 1 2030 – Road Traffic Volumes



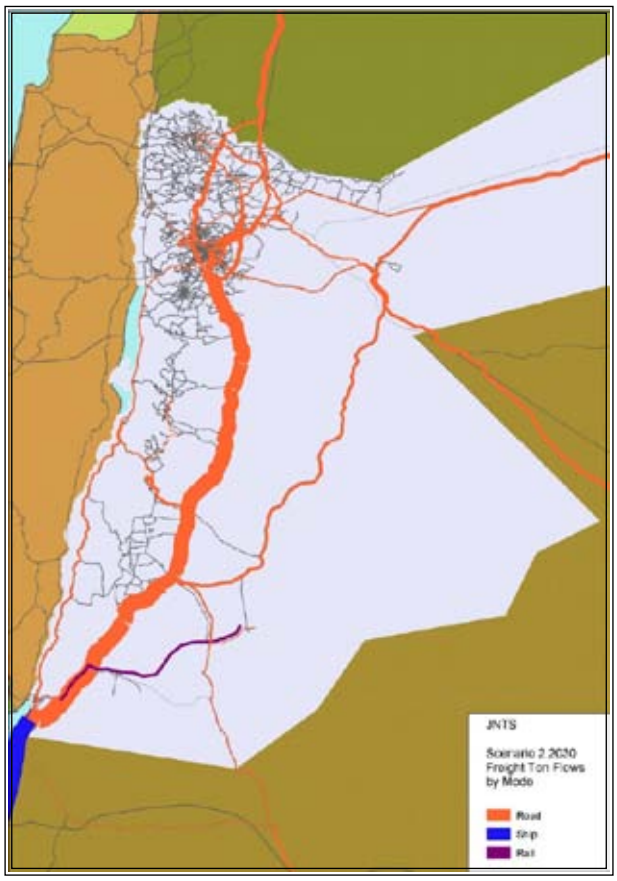
Scenario 1 2030 – Public Transport Volumes



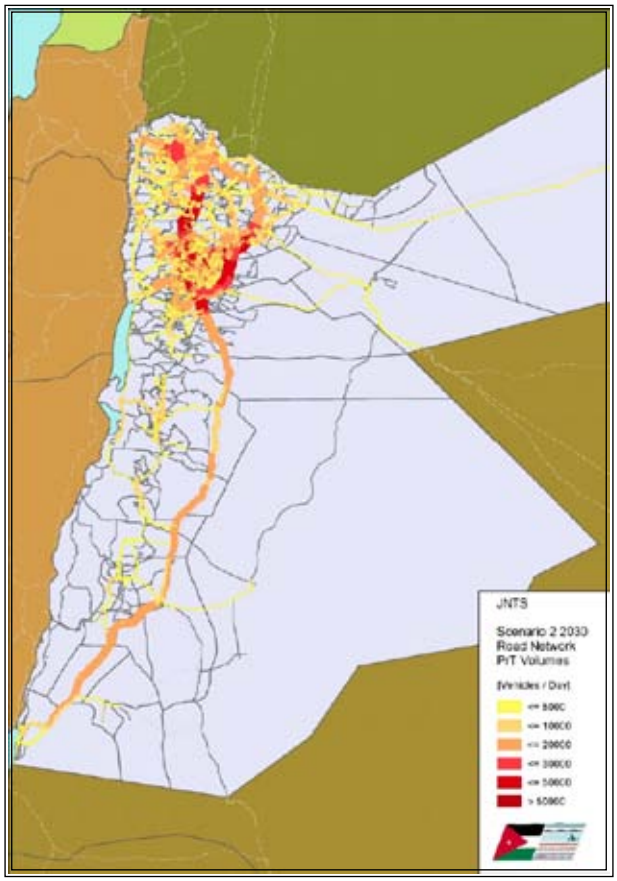
Scenario 2 2030 – Infrastructure Measures*



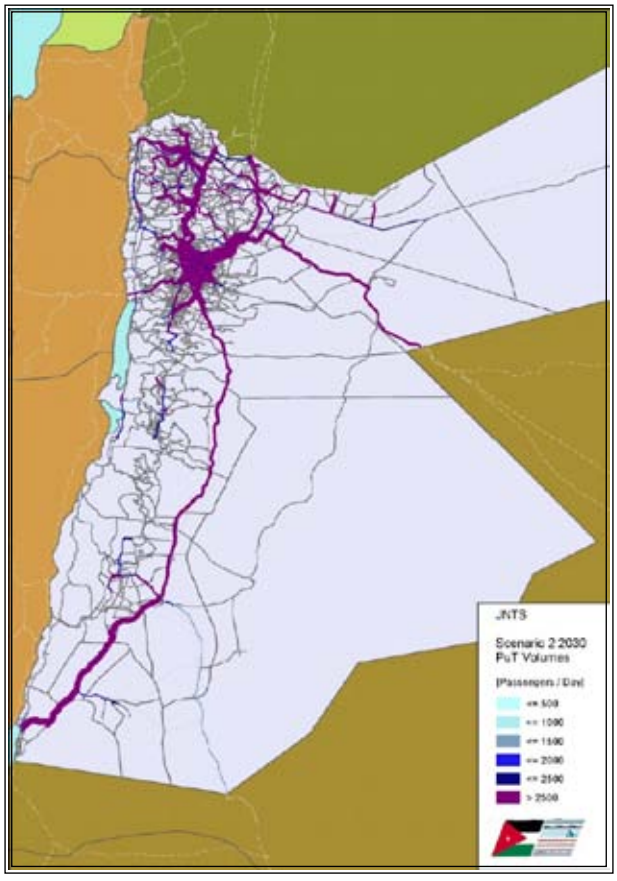
Scenario 2 2030 – Freight Volumes by Mode



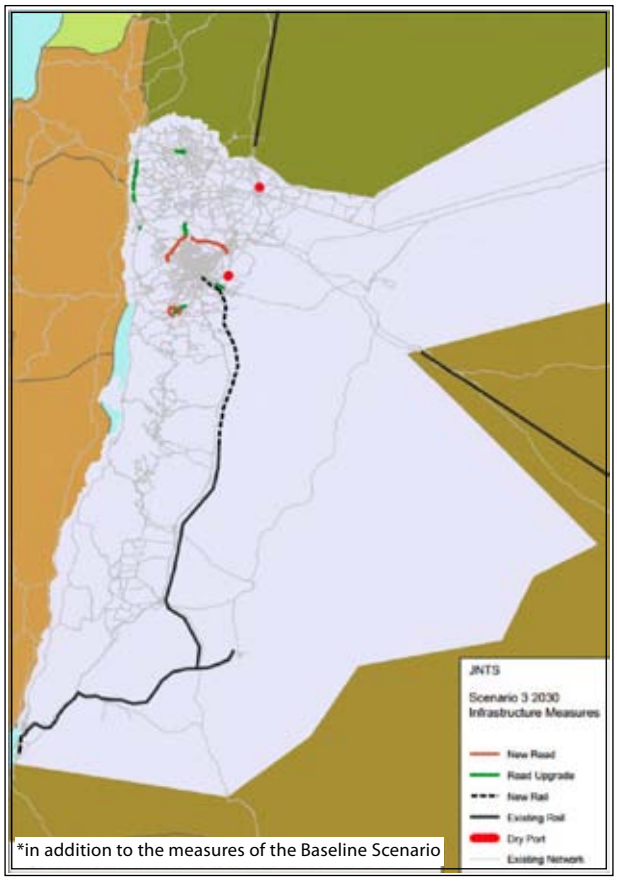
Scenario 2 2030 – Road Traffic Volumes



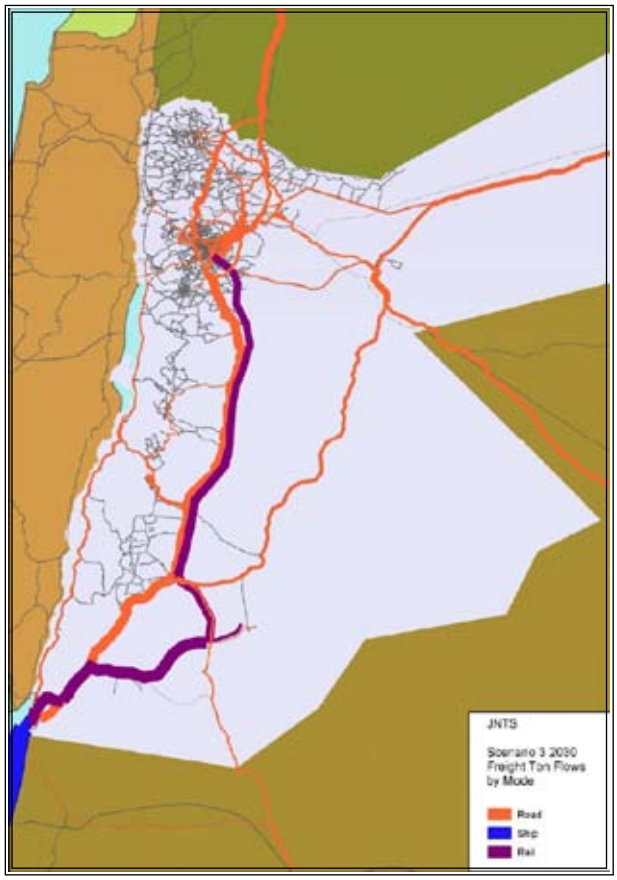
Scenario 2 2030 – Public Transport Volumes



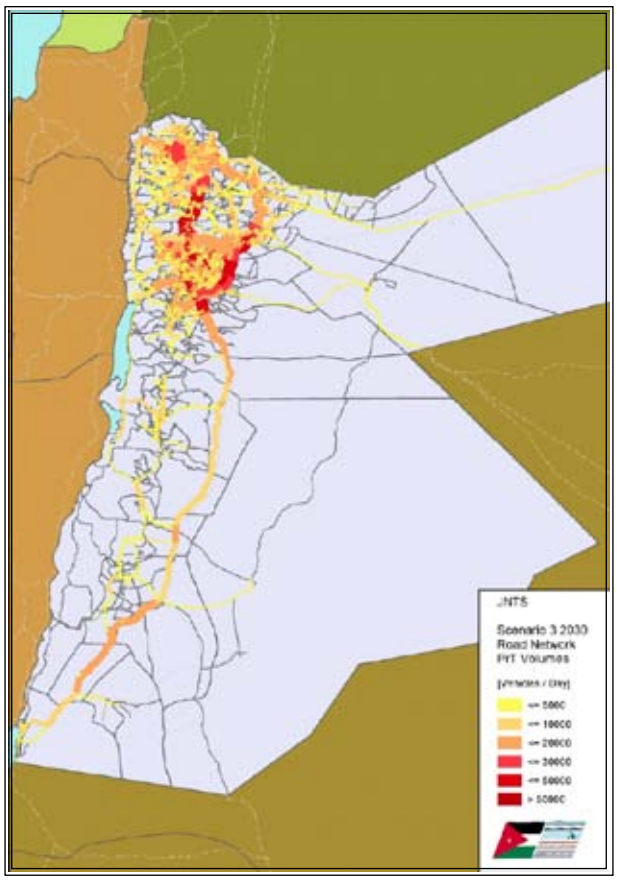
Scenario 3 2030 – Infrastructure Measures*



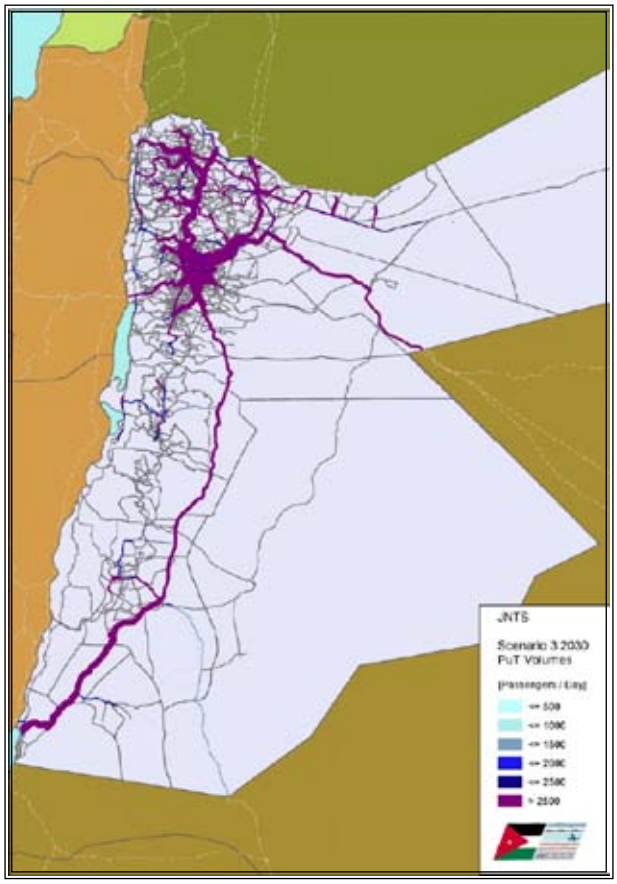
Scenario 3 2030 – Freight Volumes by Mode



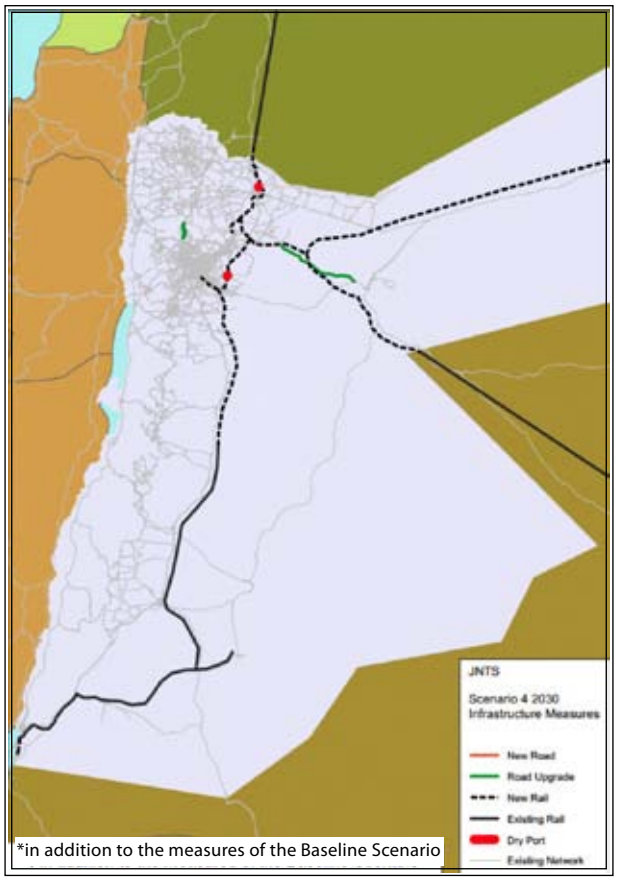
Scenario 3 2030 – Road Traffic Volumes



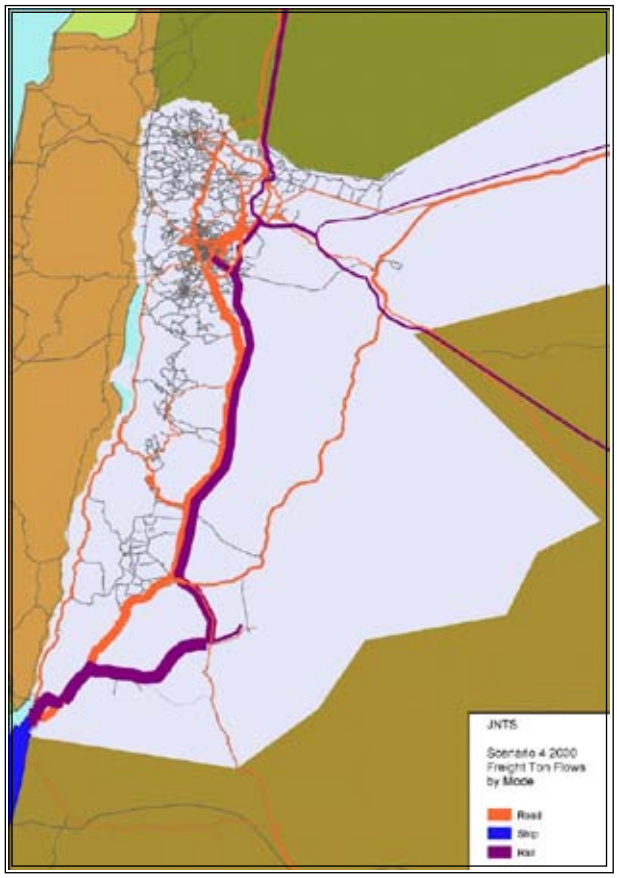
Scenario 3 2030 – Public Transport Volumes



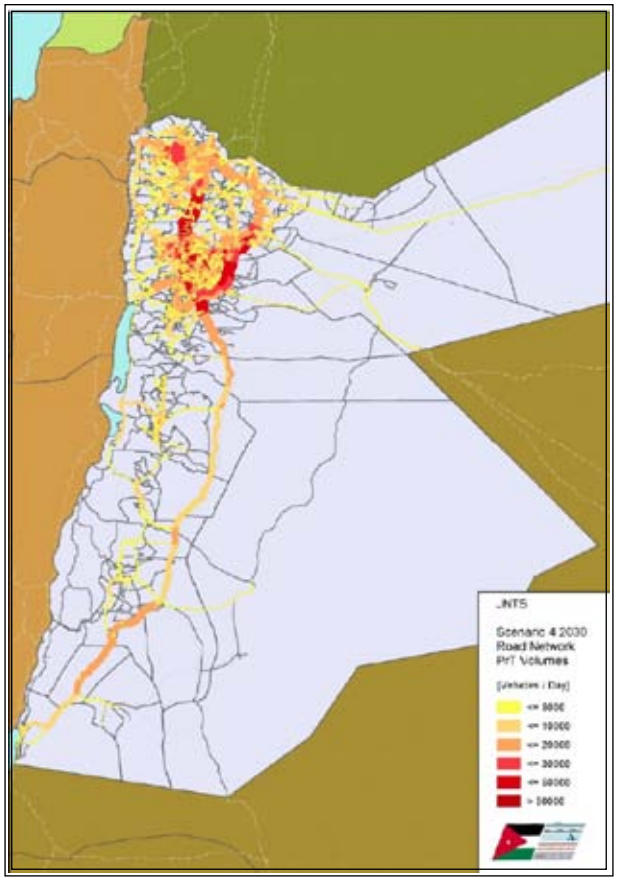
Scenario 4 2030 – Infrastructure Measures*



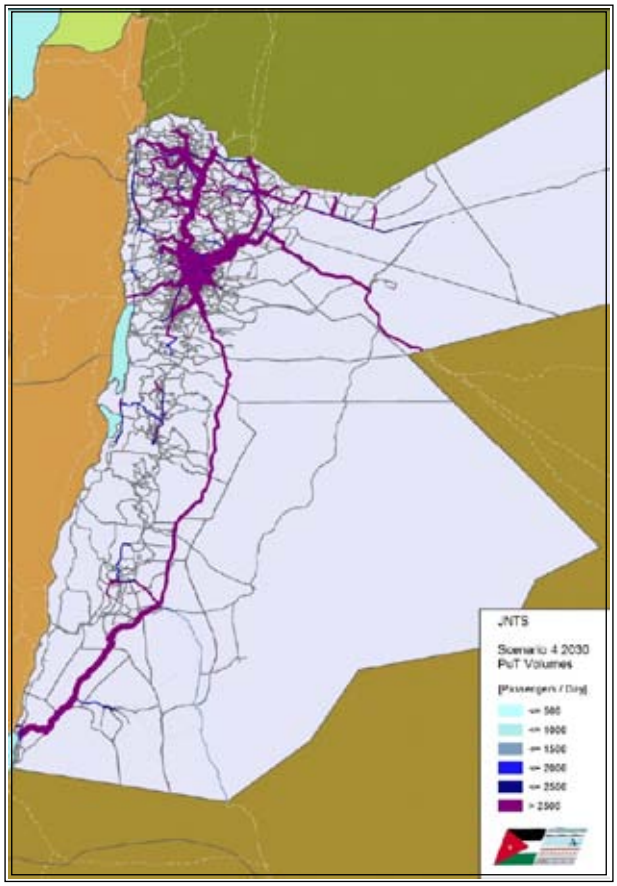
Scenario 4 2030 – Freight Volumes by Mode



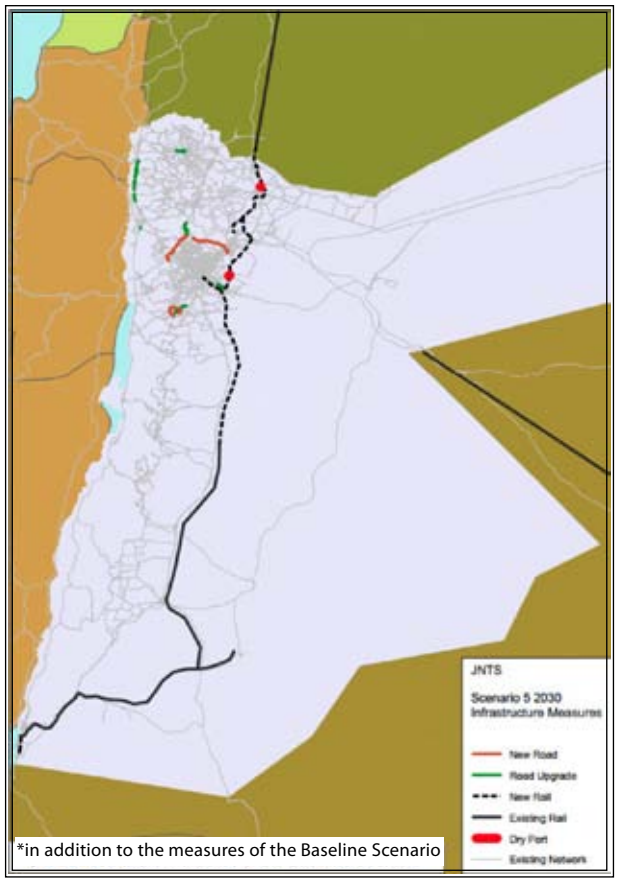
Scenario 4 2030 – Road Traffic Volumes



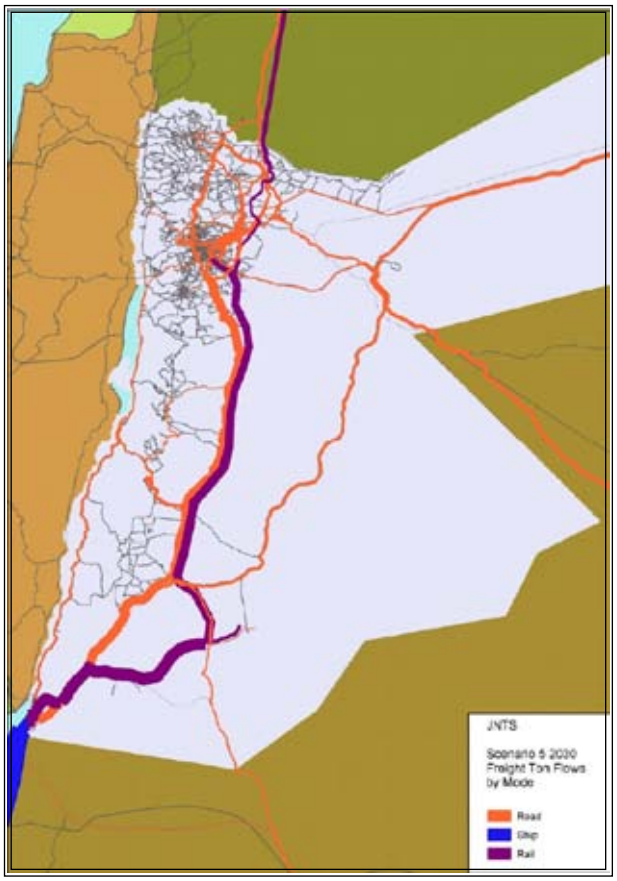
Scenario 4 2030 – Public Transport Volumes



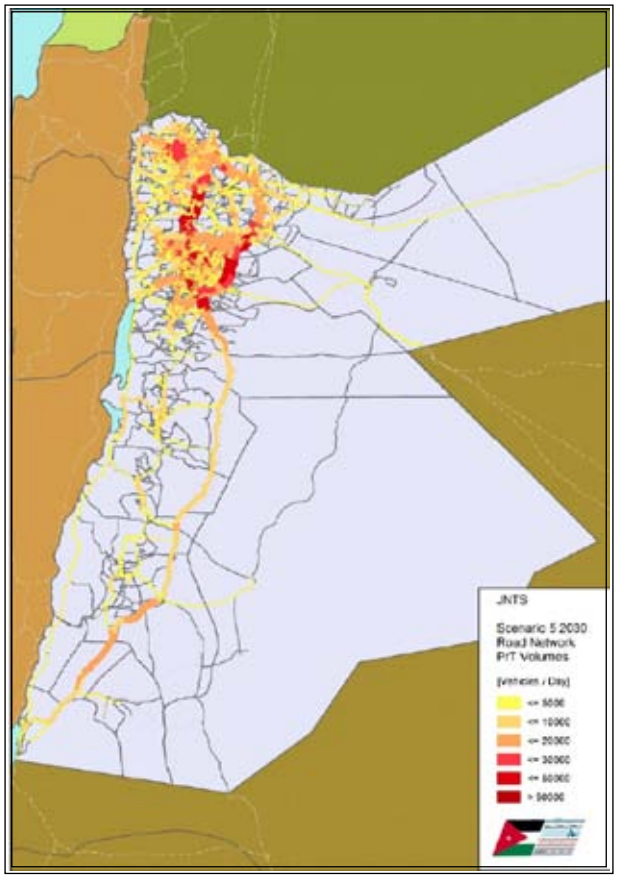
Scenario 5 2030 – Infrastructure Measures*



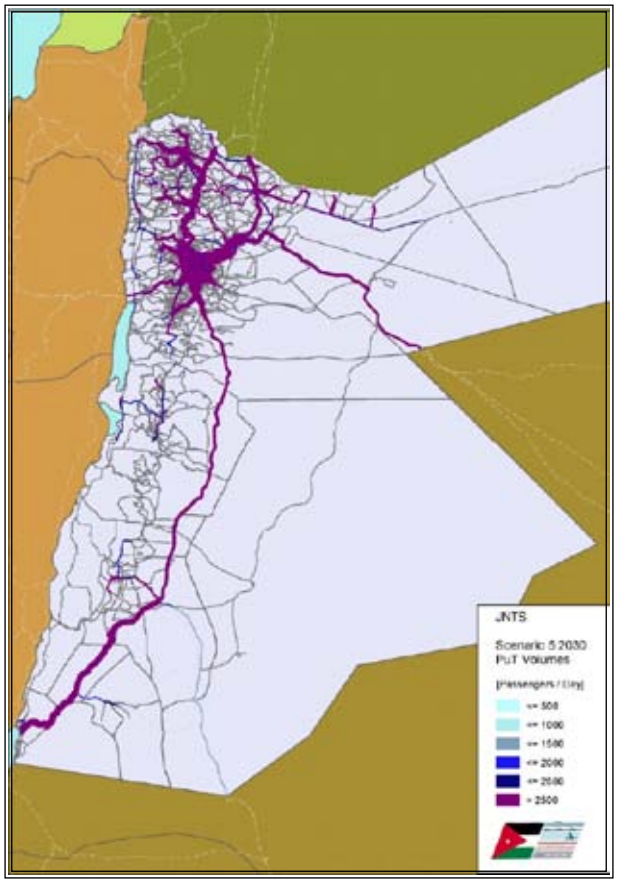
Scenario 5 2030 – Freight Volumes by Mode



Scenario 5 2030 – Road Traffic Volumes

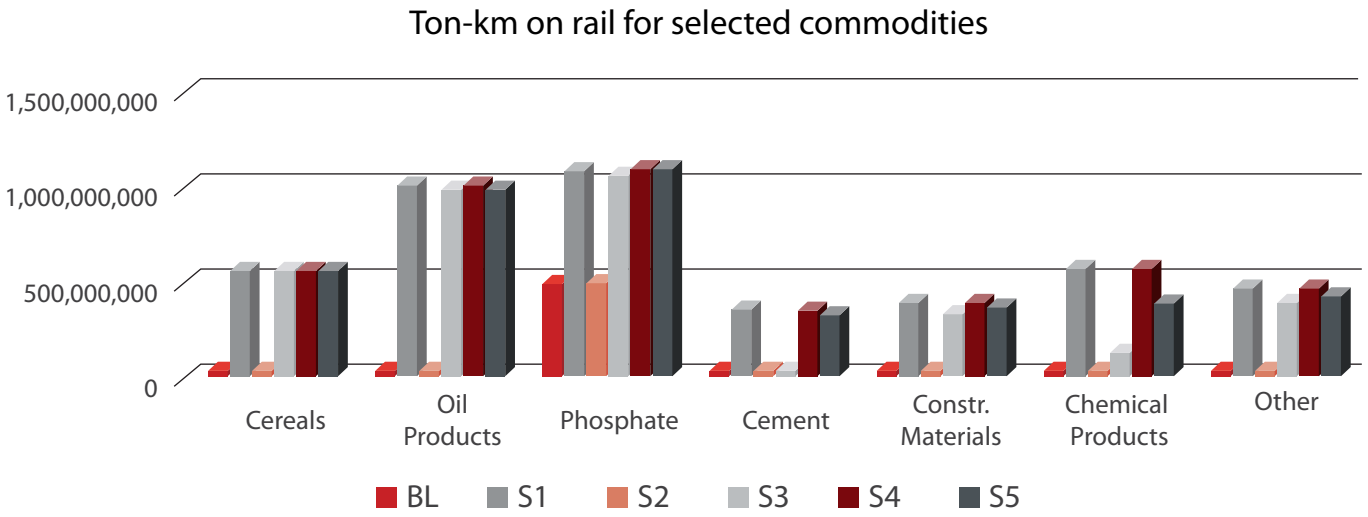


Scenario 5 2030 – Public Transport Volumes

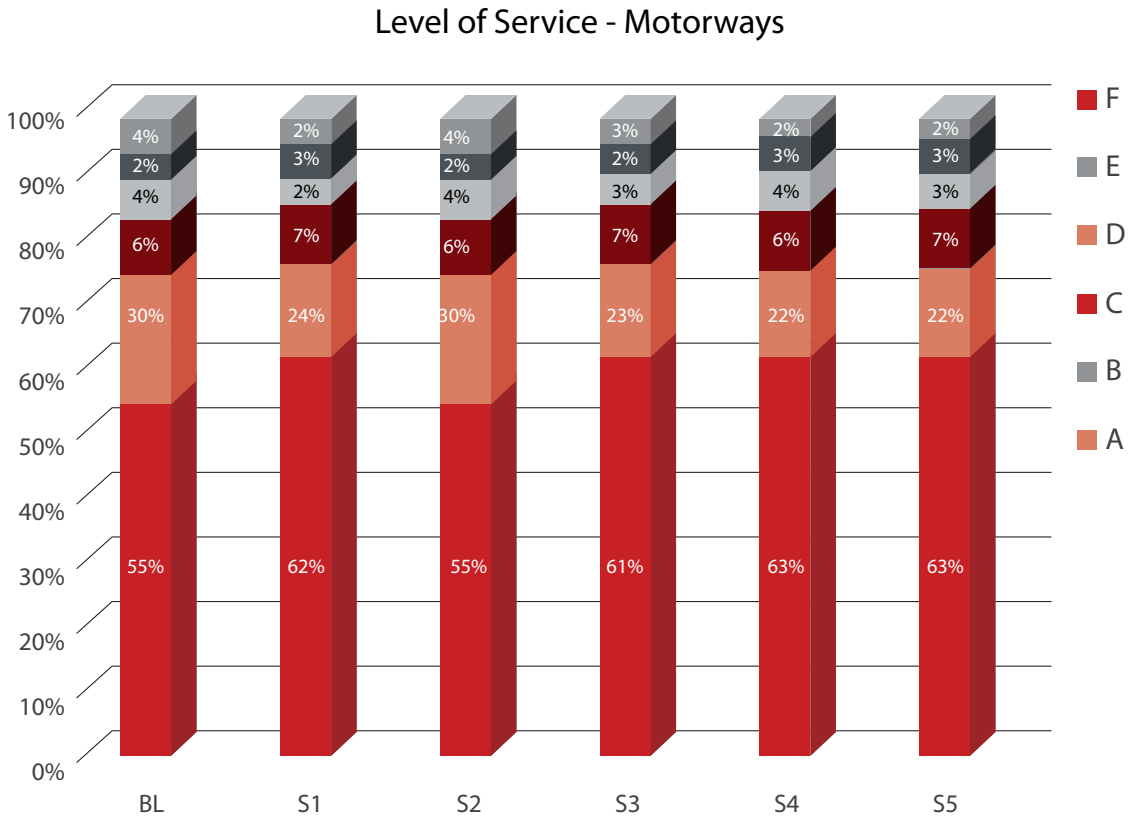


The following charts present a comparative overview of the main indicators.

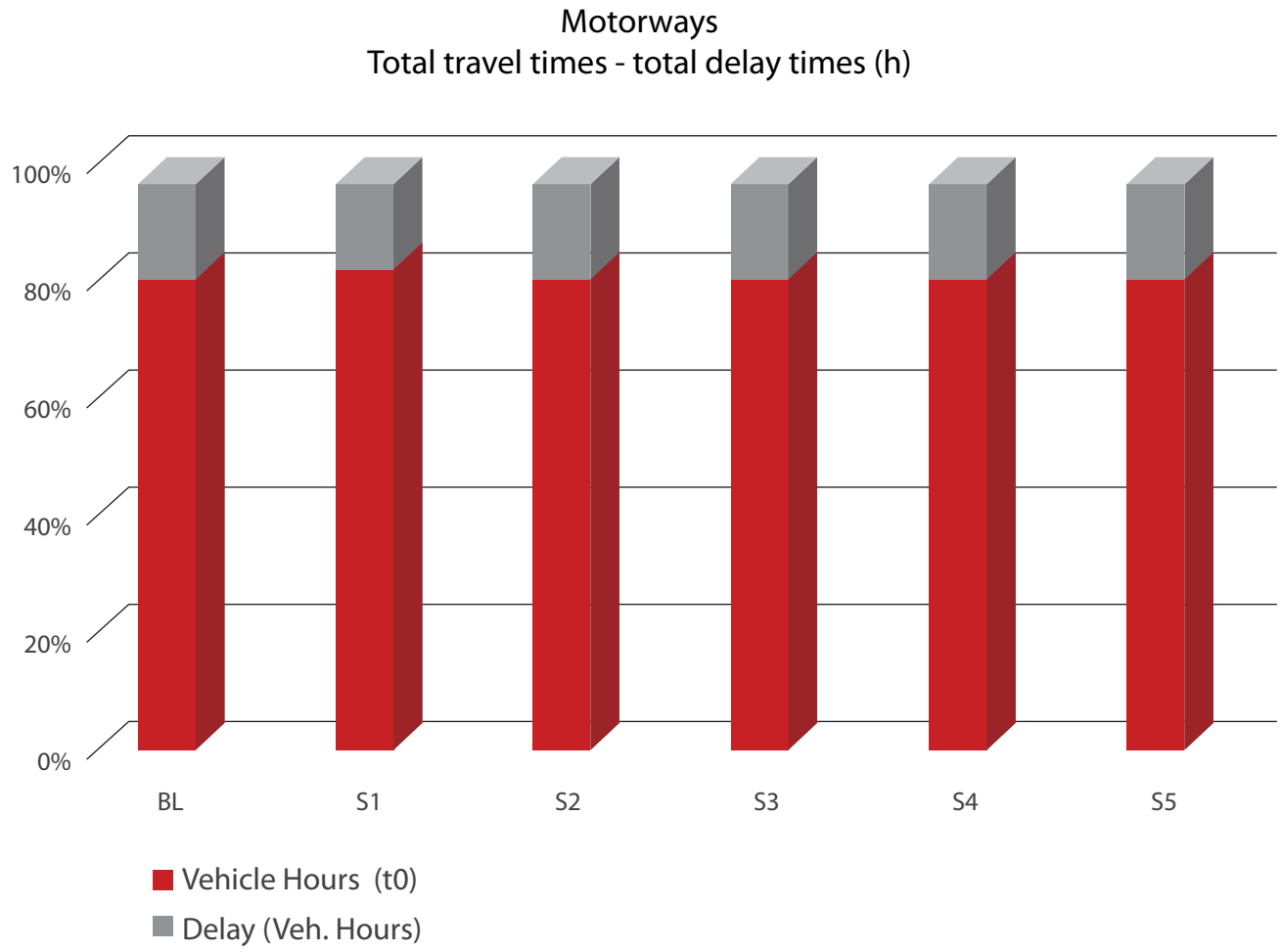
Analysing the ton kilometres for selected commodities, Phosphate and oil products can be identified as commodities with the highest number of ton kilometres transported on the new freight railway. The differences between the scenarios result from different freight railway networks that are proposed for each scenario.



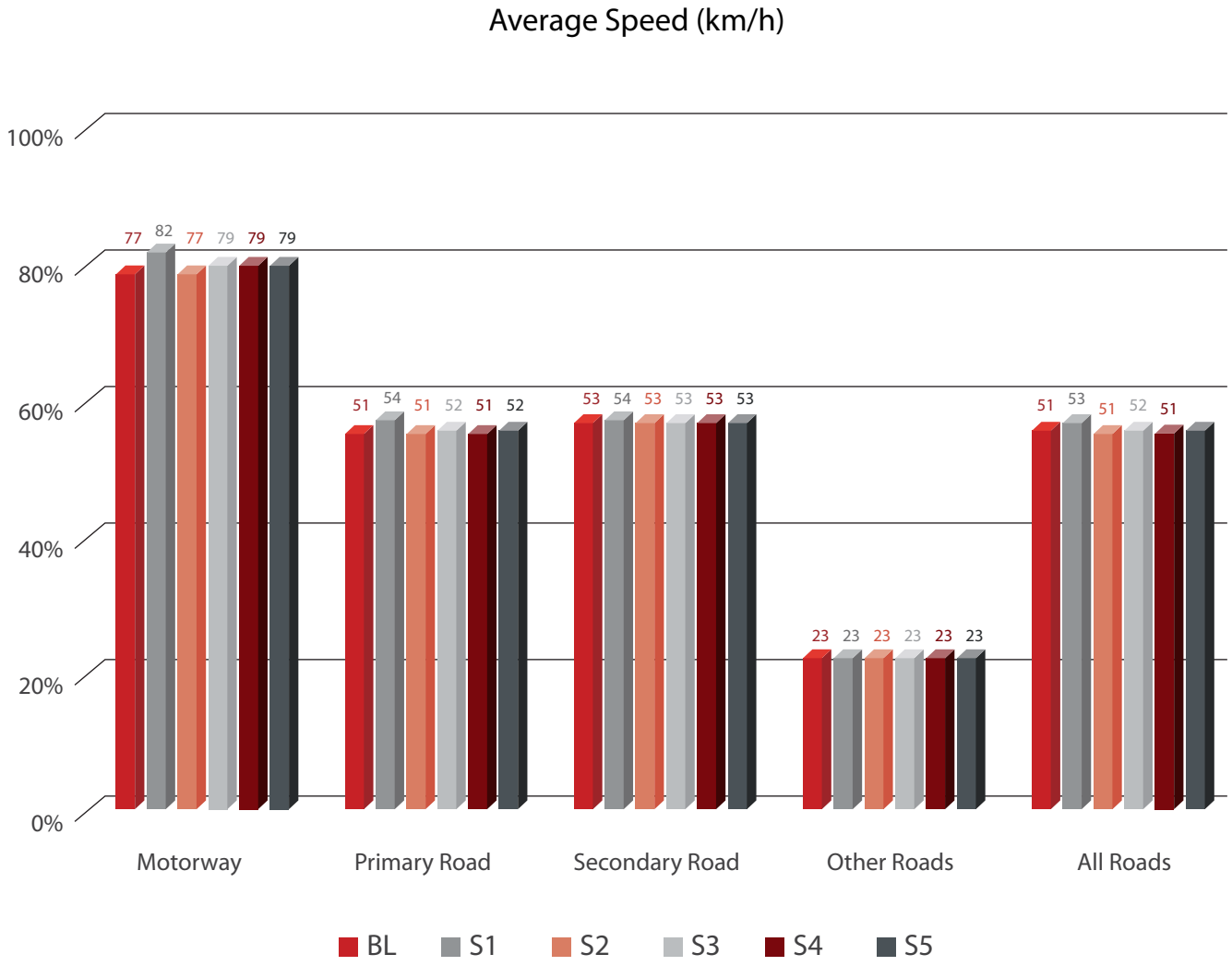
Comparing the level of service for the motorway network, it can be seen that Scenarios 4 and 5 provide the best results.



Regarding the delay times for the traffic on motorways, the best results can be observed for Scenario 1, whereas for the other scenarios the percentage of the delay time is quite equal.



Comparing the average travel speeds on different road categories, Scenario 1 shows the best results, because the investments in the road infrastructure are the highest in Scenario 1. The other scenarios are quite equal with small benefits for scenarios 3 and 5.


Average Speed (km/h)
100%
80%
60%
40%
20%
0%
77 82 77 79 79 79
51 54 51 52 51 52
53 54 53 53 53 53
23 23 23 23 23 23
51 53 51 52 51
Motorway
Primary Road
Secondary Road
Other Roads
All Roads
BL
S1
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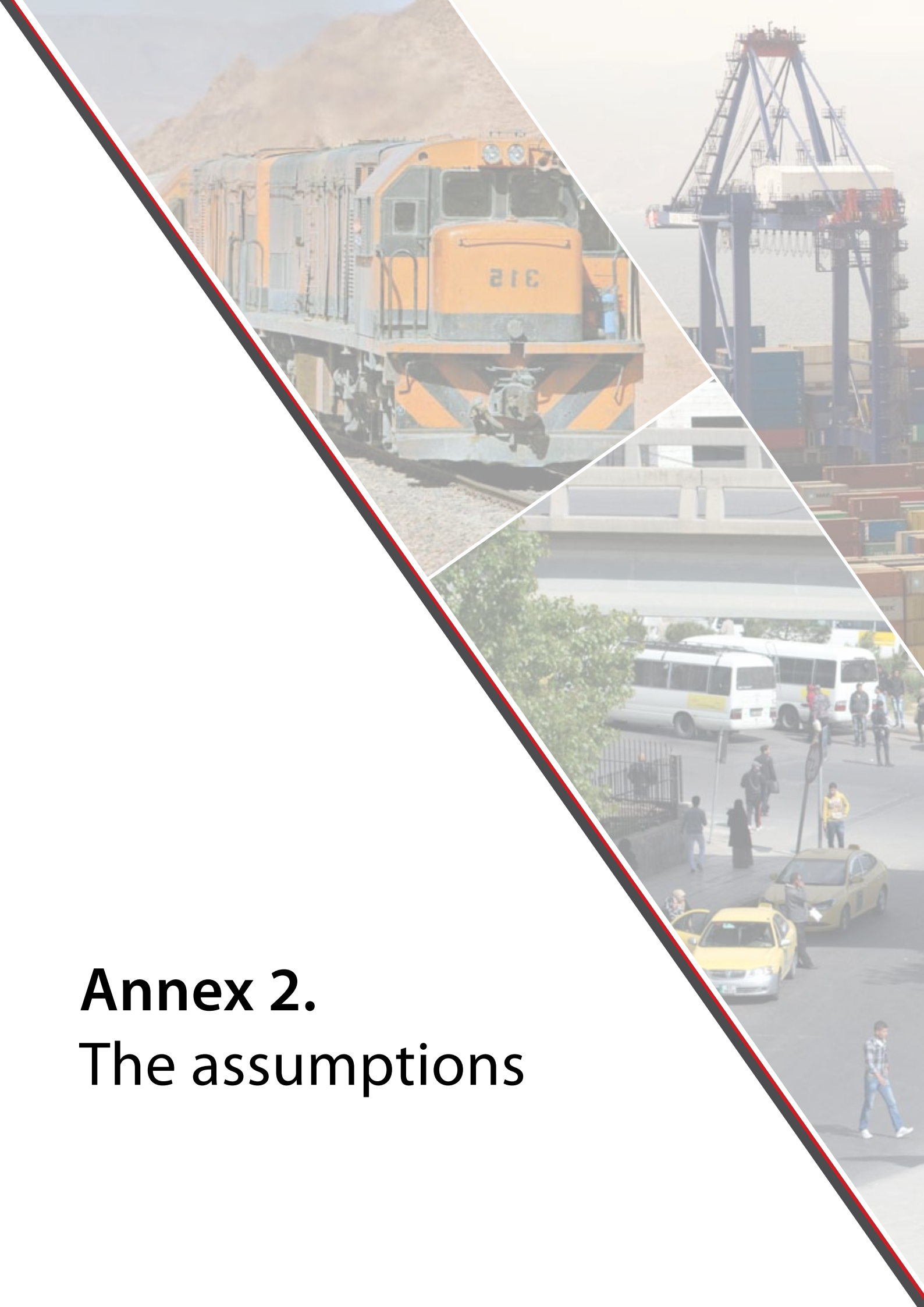
S4
S5



Annex 2.
The assumptions

A2.1 The relevant factors of future development

The following factors have a strong influence on the development of the future transport system in Jordan. However, they are exogenous to the planning process, as the project or the related stakeholders cannot directly influence them. Consequently, the development of these factors has to be forecasted separately and then formed an input to the modelling process itself. The major exogenous factors are given below.

1. Demographic factors

- Population Development

2. Economic factors

- Macro-Economic factors:
  - GDP and GDP Per Capita; Import and Export Development; Development of oil prices
- Socio-economic factors:
  - Expenditures and incomes per capita; Economically actives, employed and unemployed; Value of Time; Motorisation; Vehicle fleet; Tourism sector development, Airports' volume development

3. Political factors

- The region is politically unstable. Conflicts between neighbouring countries, internal disputes, closure of borders have a severe influence on traffic flows. Currently, particularly the following conditions influence the regional transport sector:
  - Situation in Syria; Mobility of Syrian Refugees; Situation in Iraq

4. Other factors with direct transport involvement

- Development of External Freight Volumes by Commodity Group

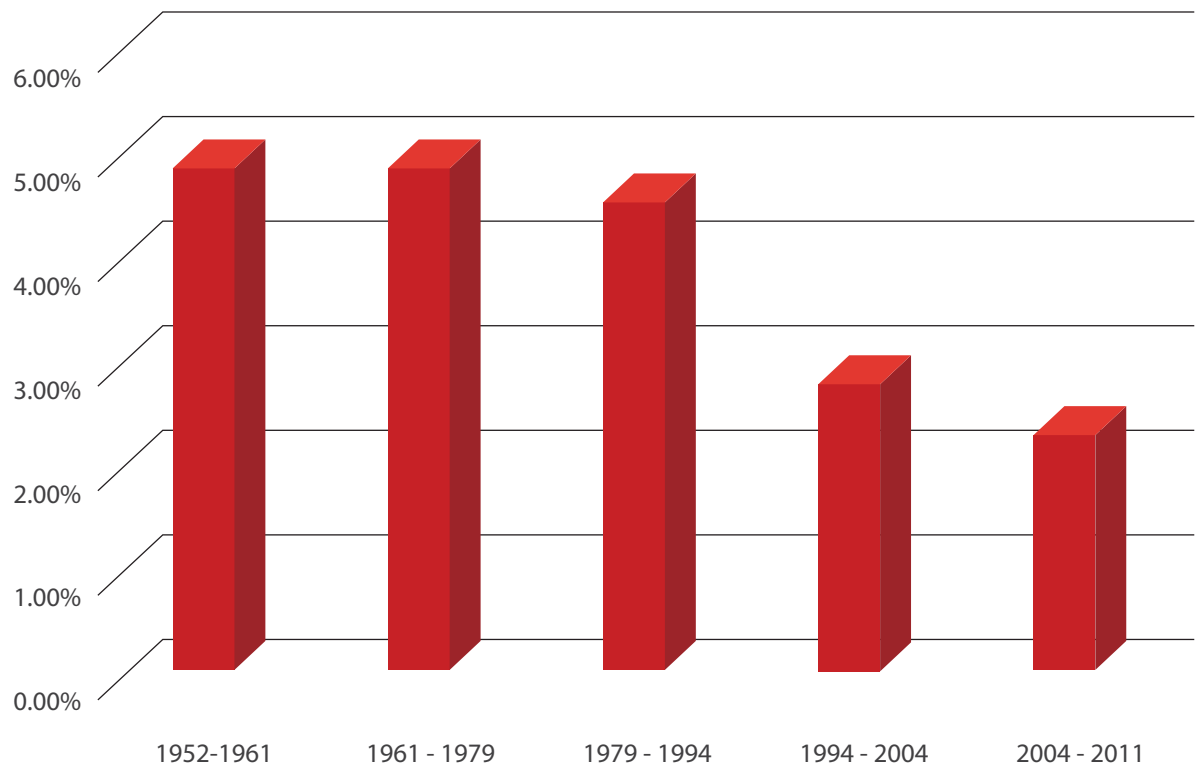
A2.2 Population Development

Population growth and distribution

The population of Jordan increased from 586,200 of 1952 to 6,249,000 (2011). Forced migration due to wars and displacement of population (1948, 1967, the "Gulf War" in 1990 and currently Syria) gave a huge contribution to the population development. The unstable conditions in the region (Iraq, Lebanon, Palestine, Syria and even Egypt) made Jordan an attractive destination to people from other countries. The population growth rate between 1952 and 2004 declined from 4.8% to 2.56%.

Population distribution in Jordan is affected by a variety of factors, among which are internal migration due to socio-economic development disparities. 39% of population live in Amman Gov., followed by Irbid and Zarqa governorates (18% and 15% respectively). Less than 10% lives in the southern region (Karak, Tafeleh, Ma'an and Aqaba), which forms half of the total area of the Kingdom. North region (Irbid, Mafraq, Jerash and Ajlun) constitutes 28% on 1/3 of the area.

Population growth rate during the period between census



The case of Aqaba

The dynamic of the economic system is pushing also the demographic dynamic; factors related to accelerated internal migration to Aqaba can be identified as follows:

- **Establishment of ASEZA** contributed to attract major foreign and local direct investments, creating jobs and speeding up the movement of migrants to Aqaba
- Investment spending will have direct and indirect impact (multiplier effects) on a variety of economic activities (construction, transport and storage, wholesale and retail trade, health, and education services)

The study "Internal Migration Trends & Future Demographic Projections: Aqaba Governorate" (USAID, 2007), provides estimations on the future trends of population.

Year	Aqaba City		Aqaba Governorate	
	Total Population	Y.G.R	Total Population	Y.G.R
2006	100325		118030	
2010	122536	5.13%	144160	5.13%
2015	153450	4.60%	180530	4.60%
2020	161218	0.99%	201522	2.22%

Syrian refugees

Syrian refugees have been included in population projections, taking into account the following assumptions:

- The distribution of the refugees among the governorates has been carried out according to the UNCHR data, and considering a total amount of 655,000 refugees: 180,000 in camps and 475,000 in urban areas
- At the end of the Syrian conflict, the refugees hosted in the camps will come back at home
- The refugees who reside out of the camps will stay in Jordan also after the end of the conflict and will grow with the same growth rate of Jordan

Projections

Estimations of population are substantially based on DoS estimations by localities (2010). To differentiate the growth amongst the different governorate, according to their socio-economic dynamic, the following assumptions have been taken into account:

- Average annual growth rates applied at the national level are the same as the DoS Basic scenario forecast
- Aqaba Governorate has been considered as the most economically and demographically dynamic area of Jordan; the following annual growth rates was retained: 5% (2010-15), 4.5% (2015-20), for 2020-30 the same rates as the DoS forecast
- Amman, Balqa, Zarqa, Irbid and Mafraq Governorates have been identified as the second level economically and demographically dynamic areas; for them the same average annual growth rates as for the DoS forecast have been retained

For the other Governorates, the average annual growth rates of DoS forecast have been reduced uniformly in order to get the same total Jordan population.

Table 1: Population by Governorate (2010; 2018; 2024; 2030)

Governorate	Population			
	2010	2018	2024	2030
Amman	2.367.000	3.017.221	3.356.260	3.664.642
Balqa'a	409.500	516.543	581.081	642.871
Zarqa	910.800	1.112.664	1.251.092	1.386.299
Madaba	152.900	188.711	210.141	231.401
Irbid	1.088.100	1.485.876	1.670.066	1.841.706
Mafraq	287.300	448.218	507.805	566.258
Jarash	183.400	236.770	271.676	308.446
Ajlun	140.600	180.696	204.253	228.454
Karak	238.400	291.078	322.188	352.311
Tafiela	85.500	105.522	120.143	135.296
Ma'an	116.200	146.480	165.946	185.872
Aqaba	133.200	196.814	232.658	260.068
Total Kingdom	6.113.000	7.926.395	8.893.209	9.803.623

Source: Consultant estimations on DoS data

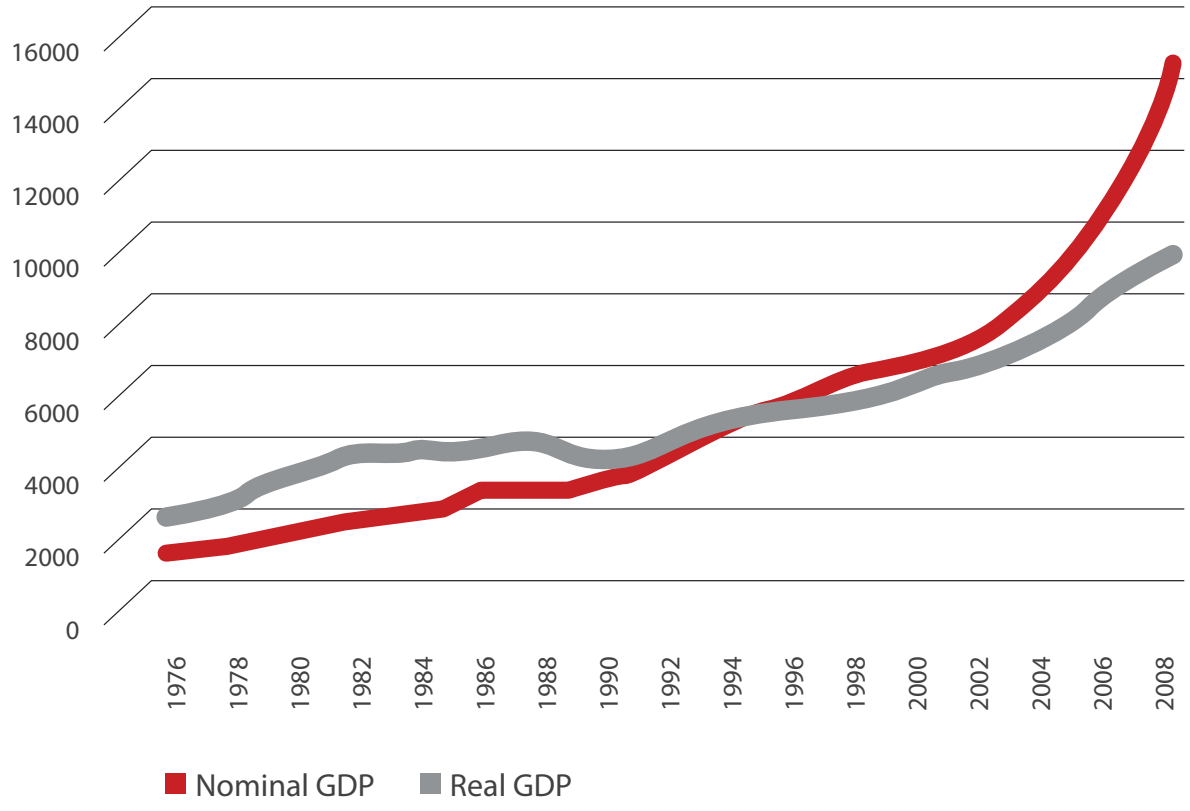
A2.3 Macro-economic factors

GDP and GDP per capita at national level

Jordan has experienced high growth rates during the last decade. The economy expanded at an average growth rate of about 6% (2000–10). Real GDP growth doubled from 4 in 2000 to 8% in 2007, in line with strong global growth. After 2007 growth rates declined, amplified by the global economic crisis.

Growth rates are projected to recover in the medium term. During the last 5 years, the economy continued to grow, in spite of the negative effects of the Syrian crisis, which is affecting the economic systems of all the Mashreq area's countries.

Forecast of GDP and GDP per capita is based on the projections of IMF, presented in its last World Economic Outlook of April 2013, where the average yearly rate of GDP growth to 2018 is estimated at 4.5%.



For the purposes of the study, the following average yearly rates have been considered:

- 2010-18: 3.5%
- 2018-24: 5.0%
- 2024-30: 4.5%

For the period 2010-18, the growth rate of IMF has been reduced to 3.5%, taking into account the negative impacts of the Syrian crisis; in the following period (2018-24), once the crisis will be hopefully overcome, the growth rate has been enhanced to 5%, while in the last period (2024-30) has been stated at 4.5%. Syrian refugees have not been included in calculation of 2018 GDP per capita, because not still integrated in the country economy.

Table 2: GDP and GDP per capita; average yearly growth rate

	2010 – 2018	2018 – 2024	2024 – 2030
GDP	3.5%	0.5%	5.4%
GDP per capita	1.07%	1.8%	2.82%

Source: Consultant Estimations

Import and Export Development

Different developments will apply for the commodities. For some commodities, import and export have been tied to population development while for other, the GDP expected growth (eventually adjusted by the elasticity) has been the estimation basis. Finally, for a second set of variables, "ad hoc" rates have been retained, taking into account the sector potential.

Commodity	Commodity Group	Import (demand)/ Export (supply)	Source
Living animals	Agriculture	Population Growth (2018: 1.30 / 2024: 1.45 / 2030:1.60)	▪ UN COMTRADE ▪ FAO
Cereals			
Potatoes			
Pulses			
Other vegetables			
Fruits			
Oil crops			
Meat	Food & Beverages		
Vegetable oil			
Food products			
Luxury products			
Raw wood	Wood & Paper	GDP Growth (2018: 1.32 / 2024: 1.76 / 2030: 2.30)	▪ UN COMTRADE ▪ FAO ▪ Mineral Industrial Yearbook 2010
Processed wood (sawn)			
Wood products			
Paper			
Paper pulp (cellulose)			
Passenger cars	Consumer Goods		
Heavy vehicles			
Machinery			
Textile products			
Other consumer goods			
Coal	Energy	GDP Growth with elasticity of 0.75 (2018: 1.23 / 2024: 1.53 / 2030: 1.87)	▪ UN COMTRADE, ▪ Mineral Industrial Yearbook 2010 and sector reports
Natural gas			
Crude oil			
Oil products			
Petroleum Coke			
Oil Shale			

Commodity	Commodity Group	Import (demand)/ Export (supply)	Source
Phosphate	Fertilizer	1% per year	▪ UN COMTRADE ▪ Mineral Industrial Yearbook 2010 and sector reports
Phosphoric Acid			
POTASH			
Fertilizer			
Cement	Construction	Population Growth (2018: 1.30 / 2024: 1.45 / 2030: 1.60)	▪ Jordan Railway Network Project
Clinker			
Construction steel			
Pozzolana			
Other construction material			
Kaolin+Clay	Raw Materials	GDP Growth (2018: 1.32 / 2024: 1.76 / 2030: 2.30)	▪ UN COMTRADE ▪ Mineral Industrial Yearbook 2010
Crude steel			
Aluminium			
Other Minerals			
Sulphur			
Other Ores			
Other Metals			
Steel tubes	Metal Products		
Other steel products			
Other metal products			
Chemical products	Chem. Prod.		
Other	Other		

Development of oil prices

The projections of crude oil price have been carried out, through the comparison of the main international institutions forecasts: WB (Word Bank), IMF (International Monetary Fund), EU (European Union), IEA (International Energy Association) and EIA (US Energy Information Administration).

Table 3: Crude oil price forecast (2010; 2018; 2024; 2030)

	2010	2018	2024	2030
Real 2010 US$/bbl	79.04	95.00	105.00	110.00
Index (2010 = 100)	100	120	133	139

* Petroleum price is average of spot prices for U.K. Brent, Dubai and WTI
Source: Consultant Estimations

A2.4 Socio-economic factors

Expenditures per capita and Incomes per capita, by sub-districts level

Estimations of expenditures per capita and incomes per capita have been based on the following:

- Average Annual Household and members Expenditure and Incomes by Governorate (2010)
- Average Annual Household and members Expenditure and Incomes by District and sub-District (2006)
- GDP per capita estimations to 2018; 2024 and 2030.

Employed, unemployed, economically actives by sub-districts level

Estimations of employed, unemployed and economically actives have been based on the Survey on Employment/Unemployment by Governorate, carried out by DoS (2010).

Jordanian rates of employment are very low; the total rate of Jordan is 36.5, only higher than the Palestine one (32.6) and very far from the 47.6 of Lebanon. Also Egypt, Syria and UAE show much higher rates.

In the light of the current, very low performance of the activity rate, such index has been increased by 10%, uniformly for all governorates, between 2018-24 and 2024-30, while for 2018 the same rates observed in 2010 have been used.

Value of Time

The basis for the Value of Time (VoT) is the report Greater Amman Multi-Modal Transport Model - Base Year Report - Volume 2.

The VoT related to the other scenario years have been determined by applying the specific GDP per capita rates of growth.

Table 4: VoT in 2018

Car Owning level	Hourly Salary (JD per hour)	Work VOT (JD per hour)	Non Work VOT (JD per hour)
Non Car Owning	1.96	2.34	0.49
Car Owning 1	4.16	4.99	1.04
Car Owning 2+	70.6	92.7	1.52

Table 5: VoT in 2024

Car Owning level	Hourly Salary (JD per hour)	Work VOT (JD per hour)	Non Work VOT (JD per hour)
Non Car Owning	2.18	2.61	0.54
Car Owning 1	4.64	5.56	1.16
Car Owning 2+	6.76	8.11	1.69

Table 6: VoT in 2030

Car Owning level	Hourly Salary (JD per hour)	Work VOT (JD per hour)	Non Work VOT (JD per hour)
Non Car Owning	2.57	3.09	0.63
Car Owning 1	5.48	6.57	1.37
Car Owning 2+	7.99	9.59	2.00

Motorisation

Motorisation data was derived from the Statistical Yearbook 2010 and the Household and Expenditure Survey (2010 – DoS). In contrast to the DoS data, the Greater Amman household survey (2008) determined with 178 vehicles per 1,000 inhabitants significant lower motorisation rates for Amman. Besides, differences in the number of vehicles per 1,000 inhabitants from 285 in Amman to 21 (Zarqa) or 22 (Ajlun) seem unrealistic.

So it was assumed that a certain share of private vehicles registered in Amman is used elsewhere. With the aim to:

- Reduce motorization rate in Amman approximately to the values determined in the household survey
- Reach motorization rates approximately half the values for Amman in the north – western parts of Jordan (Balqa, Zarqa, Madaba, Irbid)
- Distribute the remaining vehicle surplus from Amman across the southern parts of Jordan

a manual estimation and distribution was carried out by the consultant.

For projecting Private vehicles and Public cars to the forecast horizons, the following methodology has been used:

- Analysis of elasticity between vehicles fleet and GDP;
- Projection of Private vehicles and Public cars, according to GDP growth rates, taking into account the elasticity (1.52).

Different elasticity levels have been considered for each governorate, taking into account:

- The different level of economic and demographic dynamic
- The rate of car ownership at 2010

The sum of Governorates projected vehicles must ensure an elasticity equal to 1.5 for Jordan. Resulting from the vehicle growth rates above the following numbers of private cars per governorate were calculated as in the following table.

Table 7: Private vehicles projections to 2018, 2024 and 2030

Governorate	2018		2024		2030	
	priv. vehicles	priv veh. / 1000 inhab.	priv. vehicles	priv veh. / 1000 inhab.	priv. vehicles	priv veh. / 1000 inhab.
Amman	607.422	215	791.021	251	1.003.785	292
Balqa'a	58.060	117	78.924	141	104.115	168
Zarqa	131.779	119	184.302	148	249.462	181
Madaba	26.639	149	36.211	182	47.769	219
Irbid	172.065	130	233.897	157	308.551	188
Mafraq	36.020	103	50.376	127	68.186	153
Jarash	23.003	103	31.269	122	41.250	142
Ajlun	16.678	100	22.672	120	29.908	141
Karak	29.601	106	40.238	130	53.080	157
Tafiela	11.009	107	14.965	128	19.742	150
Ma'an	13.577	98	18.456	117	24.347	138
Aqaba	22.438	116	36.607	160	56.970	222
Total	**1.148.290**	**156**	**1.539.938**	**186**	**2.007.164**	**219**

Source: Consultant estimations on DoS data

Vehicle fleet

The analysis is based on the data of vehicle licencing department (VLD), for passenger cars, trucks and bus. The composition of the fleets in terms of fuel consumption and pollutant emission is based on:

- Assumptions from Handbook Emission Factors for Road Transport (HBEFA)
- Comparison of model results with data of The statistical Yearbook stating the fuel (diesel and gasoline) sold in Jordan 2010

For the future it was assumed that:

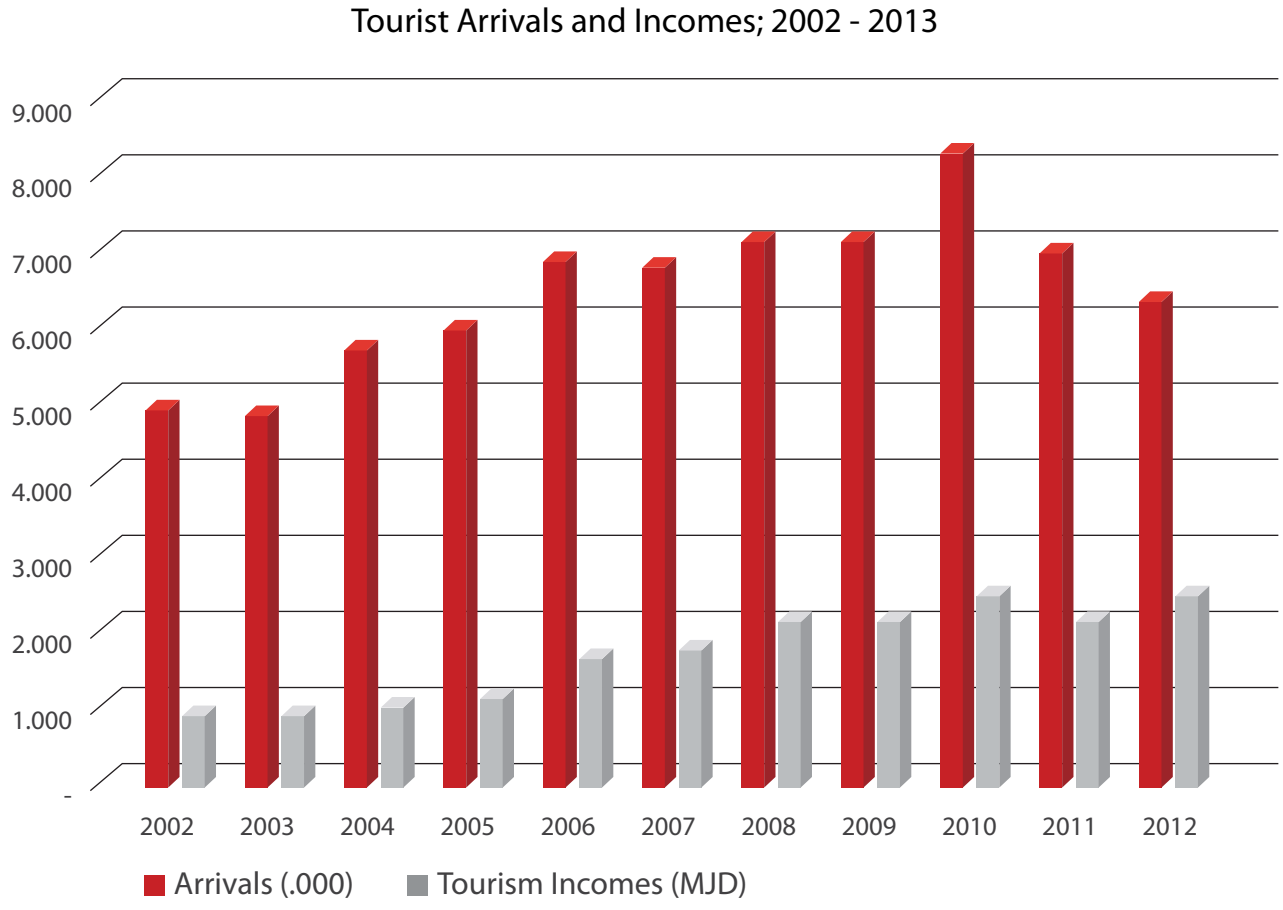
- Each year, the vehicles of the oldest year of manufacture are substituted by 80% new and 20% used cars;
- The additional vehicles from the growing motorization rates are also 80% new and 20% used cars

Tourism sector development

Tourism is predicted to remain the fastest growing sector globally for the next two decades. During the first ten years of "00, has shown a 10-12% annual growth. The country reached over 8.2 million tourism arrivals in 2010 of which 4.5 million were overnight visitors. In the last 2 years registered a strong shrinkage: the total number of arrivals decreased by 12.5% per year.

WTO Long-term Forecast Tourism 2020 Vision is that Middle East will record growth rates of over 5% per year, compared to the world average of 4.1%. Coherently with the assumptions regarding the time of Syrian crisis solution, projections of tourist flows have been based on the following:

- The recovery of the 2010 level of tourist arrivals in 2018
- An average annual growth rate of 5%, in 2018-24 period
- An average annual growth rate of 3%, in 2024-30 period
- A stable length of stay, equal to 4.3 (value registered in 2008)

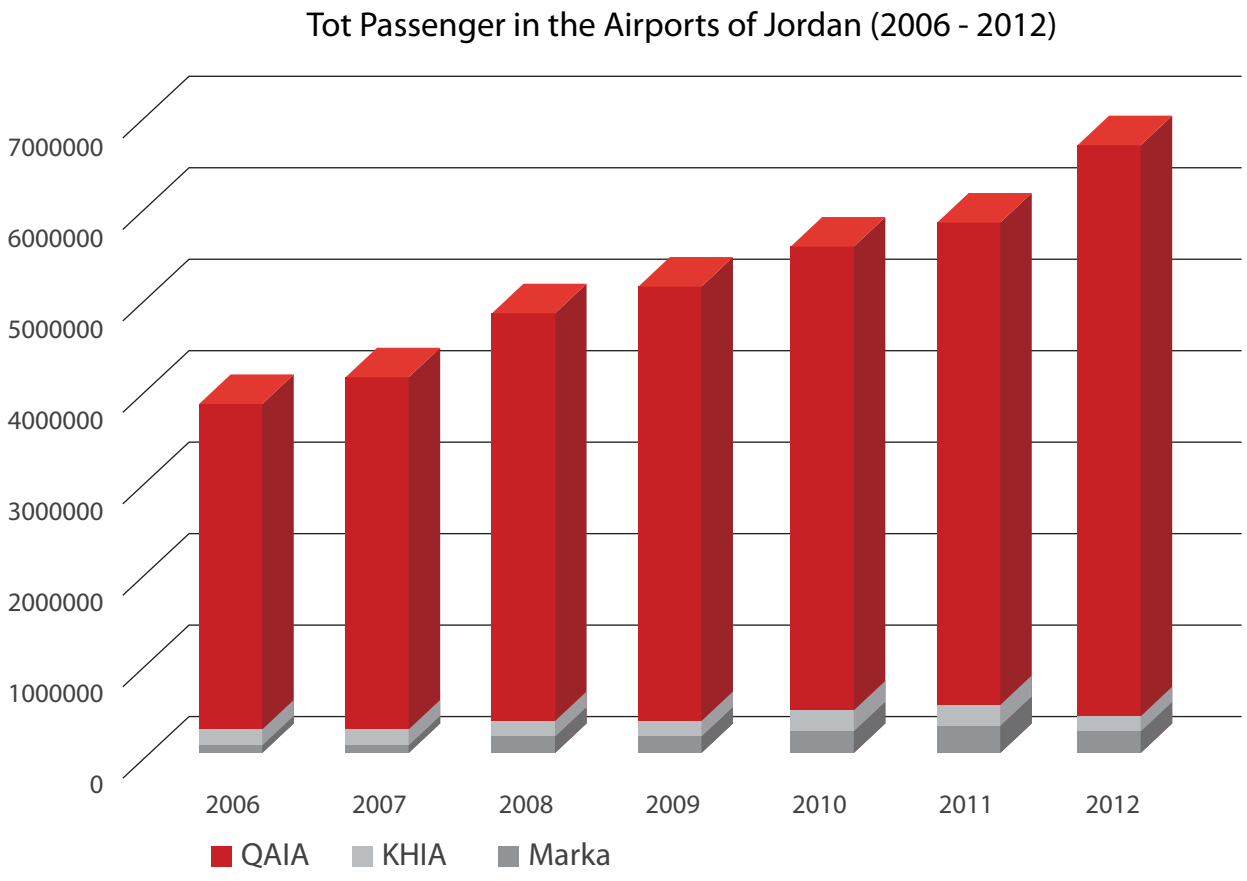


Projection of tourist arrivals and nights spent; 2018,2024, 2030

	2010	2018	2024	2030
Total Number of Arrivals	8.247.136	8.250.000	11.055.789	13.201.190
Tourist (Overnight Visitors)	4.557.024	4.560.000	6.110.836	7.296.658
Same Day Visitors	3.690.112	3.690.000	4.944.953	5.904.532
Nights Spent	23.285.315	23.298.000	31.221.548	37.280.161

Source: Consultant estimations

Airport: volumes of passengers



In the period 2006-12, the number of passengers (all Jordan airports) increased from 3.8 million passengers to 6.7, with an average growth rate of 10% per year, and a growth peak of 16.5% in 2008. The contribution of the 3 Jordan civil airports is very different: in 2012, QAIA with its 6.25 million pax, represented more than 93% of national traffic, KHIA 2.6% and Marka 4.3%.

Taking into account the different infrastructure development lay-outs of the 5 supply scenarios, 3 projections have been carried out:

- **High investment scenario:** Marqa, after QAIA exceeds 8.5 million pax, in 2019 reaches 500,000 pax, and steadily grows till reaching its full capacity (1,513,600 pax) in 2028; QAIA traffic is equal to: Jordan total pax – KHIA pax – Marqa pax
- **Integrated scenario:** Marqa will reaches 500,000 pax in 2024 and will steadily grow till arriving to 1,150,000 in 2030
- **Low cost, Regional and Environmental scenario:** no intervention is foreseen for Marqa; its traffic is of 290,000 pax for all the period

All the 3 projections are based on:

- The same growth assumptions for KHIA (growth rates of low scenario are applied from 2013)
- For total traffic flow: the CARC rates are applied for 2013 (6%), 2014 (7%), 2015-16 (6%), 2017 (5%), after 2016 (3%)

Regional Passenger Flows

The basis for the calculation of border crossing passenger flows is tourist arrivals and departures for 2010 from the Statistical Year Book 2011: annual pax volumes for airports, port Aqaba and land border crossings are provided. The flows distribution between tourists and Jordanians has been carried out according to the data of Statistical Yearbook 2012. The annual border crossing volumes are projected according to:

- Population growth of Jordan, for the Jordanians share
- Tourist growth, for tourist share

Considering the special situation in Syria and the assumptions on its impact on the future development, reduced growth rates for the border crossing flows between Jordan and Syria are applied:

- For 2018: After the end of the crisis and a recovery, the level of 2010 is reached again. Hence, an increase factor of 1.0 is assumed compared to base year border crossing flows.
- For 2024: the 2018 increase factors are applied
- For 2030: the 2024 increase factors are applied

A2.5 Other factors with direct transport involvement

Regional Passenger Flows

The basis for the calculation of border crossing freight flows is The UN Commodity Trade Statistics Database (UN Comtrade). The projection of the transit flows is based on the analysis of the GDP recent evolution and forecast for the concerned countries: Iraq, Israel, Saudi Arabia, Syria, Egypt, Iran, Lebanon, Turkey, Arabic Peninsula.

Baseline Scenario; transit flows growth factors (2018, 2024, 2030)

	2018	2024	2030
Iraq	1.91	2.56	3.24
Israel	1.33	1.59	1.90
Saudi Arabia	1.49	1.83	2.25
Syria	1.00	1.38	1.85
Egypt	1.41	2.00	2.68
Iran	1.11	1.25	1.41
Lebanon	1.28	1.53	1.82
Turkey	1.42	1.80	2.21
Arabic Peninsula	1.39	1.75	2.16

Source: IMF - World Economic Ourlook (april 2013) and Consultant Estimations

A2.6 Political factors

Situation in Syria

The crisis will soon be over and Syria will recover with a delay of 10-15 years. Hence, for 2024, the same level of import / exports from / to Jordan and border crossing volumes is expected as in the base year. From 2024 to 2030 the same increase rates are applied as originally proposed for the period 2010 to 2016.

Refugees actually hosted in the camps will return after (short-term) crisis to Syria, while the ones currently resident outside the camps will stay in Jordan and have to be considered for the Jordan forecast transport demand.

Situation in Iraq

For the baseline scenario it is assumed that:

- The pipeline from Iraq will be erected
- Zarqa refinery remains operating (presuming a capacity upgrade to meet the demand of oil products)

Import of crude oil will come entirely from Iraq through the pipeline.

A2.7 Alternative development scenarios

Invariant factors

For the purposes of the traffic model settings, 2 more scenarios have been identified: Low scenario and High scenario. One of the basic assumptions of the scenario definition has been to maintain the same population growth rates in all the 3 defined development options. From such assumption, it derives that all the population related variables are invariant among the 3 scenarios, i.e. besides population:

- Import/Export/Production/Consumption of the following commodities:
  - Agriculture, food and beverages
  - Construction materials
- Regional Passenger Flows (Share Residents)

Other invariant factors are the ones defined as "with direct transport involvement", i.e.:

- Development of External Freight Volumes by Commodity Group
- Special growth factors for Syria

Variant Factors; Macro-economic: GDP

Different assumptions have been considered, regarding GDP and GDP per capita, as listed in the following tables.

Table 8: Low Scenario; average year growth rate

	2010 – 2018	2018 – 2024	2024 – 2030
GDP	3.20%	4.00%	3.00%
GDP per capita	0.78%	0.84%	2.32%

Source: Consultant Estimations

Table 9: High Scenario; average year growth rate

	2010 – 2018	2018 – 2024	2024 – 2030
GDP	4.50%	5.40%	5.20%
GDP per capita	2.05%	2.20%	3.51%

Source: Consultant Estimations

Variant Factors; Macro-economic: Import/export

Projections of commodities based on GDP vary in low and high scenario. Particularly, for "Consumer Goods" and "Raw materials, metal products, chemical products and other materials", annual growth rates equal to GDP growth rates have been retained.

Regarding "Energy" commodities, growth rates are tied to GDP, but they also take into account the elasticity (0.75).

Finally, for fertilizer, the following assumptions have been retained for the Low and High scenarios.

	2010 – 2018	2018 – 2024	2024 – 2030
Low Scenario	0.50%	0.50%	0.50%
High Scenario	2%	2%	2%

Development of Oil Prices

	2010 – 2018	2018 – 2024	2024 – 2030
Low Scenario	2.50%	2.00%	1.50%
High Scenario	2.00%	1.00%	0.50%

Variant Factors; Socio-economic

Projections of Expenditures and Incomes have been carried out, by applying the GDP per capita growth rates to the values referred at 2010; therefore, for the 2 alternative scenarios, they vary consequently.

Variables related to employment have been calculated as:

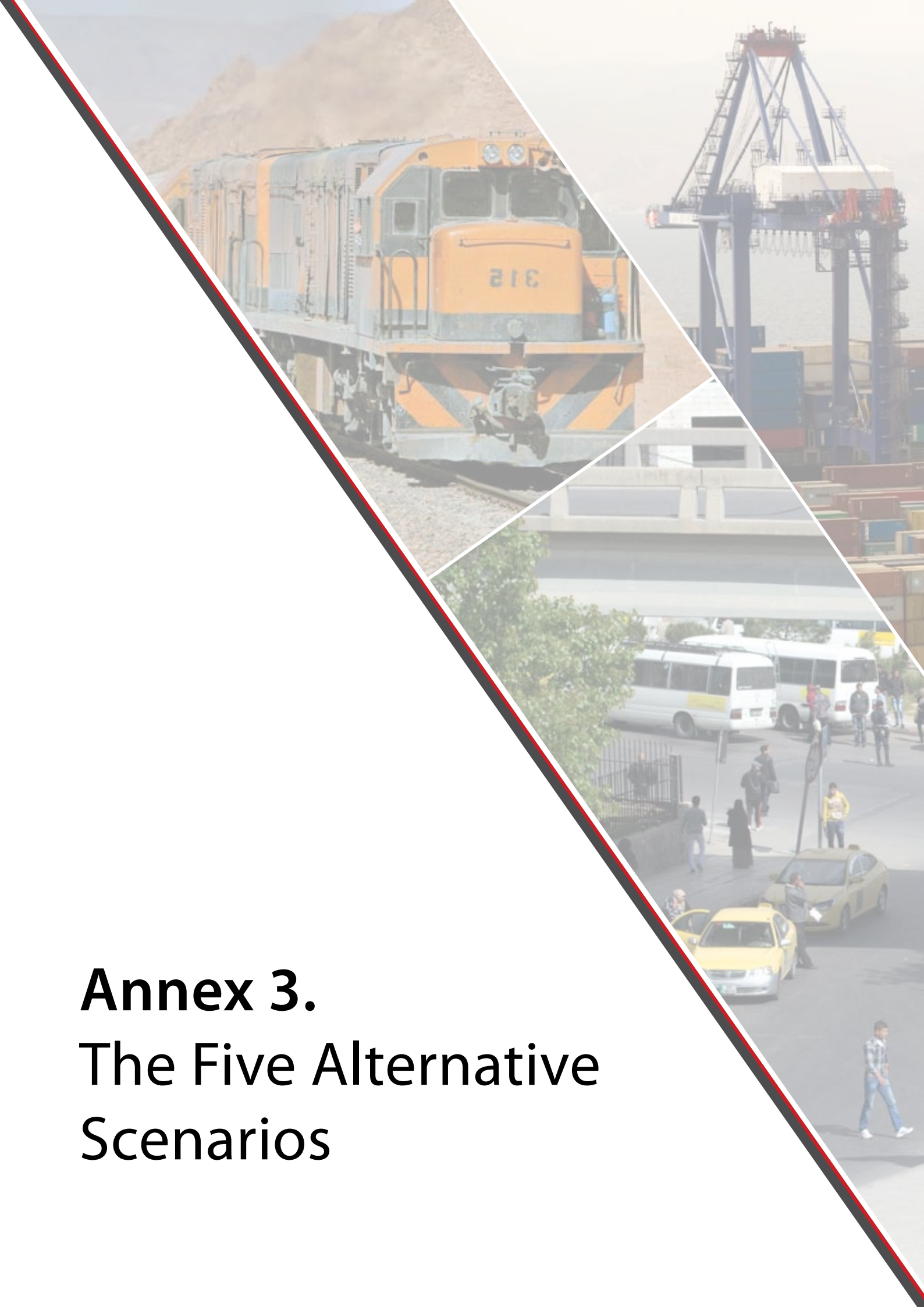
- Same rate of unemployment;
- Rate of activity:
  - Low scenario: stable for all the target years (25.2%)
  - High scenario: +20% (from 2018); +20% (from 2024)

Projections of **Value of Time,** by applying the GDP per capita growth rates; therefore, for the 2 alternative scenarios, they vary consequently.

Projections of **Motorization,** by applying the GDP growth rates, they vary consequently.

In the following table, the annual growth rates retained for Tourism sector development projections are listed. For Regional Passenger Flows (Share Tourists&Business guests) the same yearly growth rates of Tourism sector development have been retained.

	2010 – 2018	2018 – 2024	2024 – 2030
Low Scenario	=2010	3%	1%
High Scenario	=2010	7%	5%



Annex 3.
The Five Alternative Scenarios

Annex 3. The Five Alternative Scenarios

The following alternative scenarios have been designed as a combination of different sets of integrated measures with a different phasing of implementation (short term, 2018, medium term, 2024, long term, 2030):

- **High Investment Scenario** (HI)
- **Low Cost Scenario** (LO)
- **Integrated Scenario** (IN)
- **Regional Scenario** (RE)
- **Environmental Scenario** (EN)

All the scenarios include policy measures for both passengers and freight. The rationale and the approach behind each scenarios is quite different, even if they share some common measures (that however may differ in terms of phasing) and assumptions.

Two scenarios are based on different assumptions on the level of budget constraints, one with very tight budget constraints, the so called **Low Cost Scenario** (LO) and a second one with no constraints, the **High Investment Scenario** (HI). In the **Integrated Scenario** (IN) the budget constraints are not so tight as in the Low Cost one, but still playing a significant role. The fourth **Regional Scenario** (RE) stresses the regional role of the Jordanian transport sector, while the fifth **Environmental Scenario** (EN) has the protection of the environment at the core of the proposed measures.

Importantly, in coherence with the objectives of the project, every scenario strives for fostering trade and integration of Jordan in the region, as well as reducing impacts of the transport sector on the environment. The Regional Scenario and the Environmental, however, give more emphasis to the latter objectives.

Each one of the alternative scenarios builds on and will be compared with the so-called:

- **Reference** (or do-minimum) **Scenario** (RS), which include transport measures that in reason of their advanced level of technical definition, political decision and/or secured funding might be considered as invariant and their implementation might be considered as given. Often those measures and projects are under the responsibility of entities different from the MoT and its direct affiliates (e.g. MoPWH, ASEZA-ADC).

Measures and projects included in each scenario are listed and phased in the tables at the end of this annex.

A3.1 High Investment Scenario

The underlying hypothesis is that the development of the Jordan transport sector is to based mainly on new infrastructures and a high level of investments. Notably, that includes the full execution of the set of infrastructural projects proposed in the Highway Master Plan Study, the National Railway Project, the Aqaba port and Jordan airports' Master Plans.

More in details, main interventions include:

- *Roads,* full implementation of the projects included in the Highway Master Plan Study including all the proposed new links and roads widening; policy (safety) measures only in the medium term
- *Railways,* full implementation of the projects included in the National Railway Network Project
- *Port and maritime,* includes (by definition) all reference scenario's measures (see relocation of the existing facilities from the Main port to the South port) and, in addition, the relocation of the Ferry Terminal from Middle Port to South Port (longterm)
- *Civil aviation,* development of Jordan airport infrastructure (QAIA, AMIA, Mafraq airport and Aqaba airport) as foreseen in the respective master plans
- *Public transport,* full implementation of the new bus network. Amman-Zarqa BRT (included in the Reference Scenario)
- *Freight transport and logistics,* investments in new intermodal facilities (dry ports/ logistic centers in Amman and Mafraq)

A3.2 Low Cost Scenario

In contrast with the High Investment scenario, this scenario is characterized by a minimum level of investments in challenging (in terms of financial resources but also complexity of the implementation process) infrastructural projects. Therefore the focus is more on less ambitious measures, (soft) policy measures and regulations, low cost solutions.

More in details, main interventions include:

- *Roads,* only maintenance and safety-enhancing measures of the existing network and policy measures
- *Railways,* no interventions because of the high costs of infrastructural projects
- *Port and maritime,* reference scenario's measures have been considered (mainly linked with the relocation of port activities in the Middle Port and in the South Port)
- *Civil aviation,* no major developments to airport infrastructures
- *Public transport,* no specific interventions in infrastructures (a part from the Amman-Zarqa BRT, included in the Reference Scenario) nor in policy measures.
- *Freight transport and logistics,* no investments in intermodal facilities

A3.3 Integrated Scenario

This scenario is aimed at addressing all the major challenges and shortcomings of the transport sector with a good balance of infrastructure projects and policy measures. Major investments in new transport infrastructures are to be carefully selected from existing plans and programs with the modeling and appraisal tools. On the other side, some less ambitious and more cost-effective solutions are proposed whenever this is feasible.

More in details, main interventions include:

- *Roads,* higher importance is given to maintenance and safety-enhancing measures of the existing network, rather than investments in new roads or major improvements (the latter include only Section 4 of the Amman ring road and the Madaba ring road)

- *Railways,* dual approach: 1) optimising and making the best use of the existing facilities (narrow gauge line) in the short/medium term to secure the phosphate traffic and 2) implementing the new (core) railway network in the long term (Amman-Aqaba connection)

- *Port and maritime,* only reference scenario's measures have been considered (mainly linked with the relocation of port activities in the Middle Port and in the South Port)

- *Civil aviation,* development of Amman Marka airport to operate scheduled low-costs flights, courier and executive flights, after the trigger of 8 million passengers per year operated by QAIA

- *Public transport,* no implementation of the new bus network, giving priority (2018) to the intercity network; minimum standards for vehicles in order to improve safety and quality. Amman-Zarqa BRT (included in the Reference Scenario)

- *Freight transport and logistics,* investments in new intermodal facilities (dry ports/ logistic centers in Amman and Mafraq; service areas for trucks at main border crossings) and policy measures to restructure the sector/industry

A3.4 Regional Scenario

The focus of this scenario is on infrastructure and regulatory measures aimed at improving connections and trade of Jordan within the region, as well as promoting Jordan as a freight multimodal hub in the region, with a competitive trucking sector. Priority is given to the main trade corridors affecting Jordan:

- North-South corridor, from Turkey to Aqaba trough Syria
- East-West corridor, from Mediterranean ports in Lebanon and Syria to Iraq and KSA

Particularly, a new multimodal **Red Sea – Black Sea "landbridge"** transport corridor along the North-South route, Aqaba-Amman-Syria-Turkey-Samsun and then existing sea connections to Russia, Ukraine, Caucasus, Danube river, alternative to the Suez- Mediterranean sea route is of strategic importance to attract transit flows in Jordan:

- Fostering added-value services for vehicles and freight in Jordan
- Relevant side branches feeding the corridor (e.g. in Jordan, towards Iraq and KSA)
- Freight (mainly) but also passengers
- Road (initially) and rail (long-term)

More in details, main interventions include:

- *Roads,* investments in new roads or major improvements (widenings) are focussed on the links in the main regional corridors; policy measures about safety and enforcement are considered a priority (short term)

- *Railways,* full implementation of the projects included in the National Railway Network Project (links to Aqaba, Syria, Iraq and KSA)

- *Port and maritime,* includes (by definition) all reference scenario's measures and the relocation of the Ferry Terminal from Middle Port to South Port (in 2030); specific policies have been added to improve cross-border procedures

- *Civil aviation,* development of QAIA as main Jordan airport

- *Public transport,* implementation of the long distance intercity network only. Amman-Zarqa BRT (included in the Reference Scenario)

- *Freight transport and logistics,* investments in new intermodal facilities (dry ports / logistic centers in Amman and Mafraq; service areas for trucks at main border crossings) and policy measures to restructure the sector / industry and update operational standards to international levels

A3.5 Environmental Scenario

The scenario is built selecting measures aimed at reducing the impacts of the transport sector on the environment (emissions, green-house effects, noise, land use). Therefore alternatives to pure road transport, such as attractive public transport services, freight and passenger intermodality, a modern railway network are privileged.

More in details, main interventions include:

- *Roads,* higher importance is given to maintenance and safety-enhancing measures of the existing network, rather than investments in new roads or major improvements (the latter include only Section 4 of the Amman ring road and the Madaba ring road)
- *Railways,* implementation of the main north-south railway connection (Syria-Amman-Aqaba) as included in the National Railway Network Project
- *Port and maritime,* as in the "low cost" and "integrated" scenarios, only reference scenario's measures have been considered
- *Civil aviation,* no development of Marka airport and if possible relocation of its military functions to Mafraq and Aqaba airport
- *Public transport,* high priority to the sector with the aim of shifting modal shares from private to collective modes; full implementation of the new bus network; minimum standards for vehicles in order to improve safety and quality. Amman-Zarqa BRT (included in the Reference Scenario)
- *Freight transport and logistics,* stress on policies to improve standards of vehicles (safety and emissions of trucks)

RD Roads		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Road maintainence: recovery programme to achieve a minimum standard of pavement conditions across the main road network and to maintain existing bridges	Maintenance recovery of Road 15 (Desert Highway), as included in the HMPS short term priority package 1		•				•				•				•				•		
	Maintenance recovery of other main roads, as included in the HMPS short term priority package 2		•				•				•				•				•		
	Maintenance recovery of tertiary roads, as included in the HMPS short term priority package 3		•				•				•				•				•		
	Bridge recovery action plan (routine maintenance or immediate action), as included in the HMPS short term priority package 4		•				•				•				•				•		
	Maintenance of road network after priority packages			•	•			•	•			•	•			•	•			•	•
	Maintenance of main structures after priority packages			•	•			•	•			•	•			•	•			•	•
Road safety measures, aimed at enhancing road safety by addressing poor alignments, crossing of settlements and pavement widening	Safety measures for Road 15 (Desert Highway), as included in the HMPS short term priority package 1		•				•				•				•				•		
	Safety measures for other main roads, as included in the HMPS short term priority package 2		•				•				•				•				•		
Road widenings: improvement of existing narrow road links and increasing of road capacity of selected links to solve existing or future bottlenecks	Widening of narrow roads to a minimum section of 7.3m		•	•	•			•	•		•	•	•		•	•			•	•	•
	Widening to 4 lanes (all roads in the HMPS)			•	•																
	Widening to 6 lanes (all roads in the HMPS)			•	•																
	Widening to 6 lanes (selected and phased according to model results)											•	•							•	•
	Widening to 4 lanes (regional corridors only)															•					
	Widening to 6 lanes (regional corridors only)															•					
New links	Tafelah Ring Road	2018				2018				2018				2018				2018			
	Amman Ring Road - Phase 1; Amman to Airport Road; Al-Mafraq - Irbid; Irbid Ring Road - Phase 1; Al Hashimeyah - Bal'ma; Parallel Road to Al Dura Check Point; Madaba Road - Jalul Airport)	2018				2018				2018				2018				2018			

RD Roads		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
	Salt By-pass - Phase 2	2018				2018				2018				2018				2018			
	Amman Ring Road - Phase 2- Sect.1-2		•																		
	Amman Ring Road - Phase 2- Sect.3			•																	
	Amman Ring Road - Phase 2- Sect.4				•								•								•
	Irbid Ring Road - Phase 2			•																	
	Irbid Ring Road - Phase 3				•																
	Madaba Ring Road - Phase 1 (East)		•								•								•		
	Madaba Ring Road - Phase 2 (West-North)			•								•								•	
Policies / Regulations																					
Road measures included in the JNTS National Transport Safety Programme 2012-2014	National legislation			•				•			•				•				•		
	Control and enforcement (compliance with road traffic rules)			•				•			•				•				•		
	Awareness campaigns and educational programmes			•			•				•				•				•		
	Training and driving licenses (also for professional drivers)			•				•				•			•					•	
	Vehicles safety and maintenance			•				•				•			•					•	
	Post-crash medical care			•				•				•			•					•	
	Statistics and monitoring			•			•				•				•				•		
Measures included in NTS 2012-2014 Action Plan	Broad awareness campaigns about the issue of safety and educate workers in the sector to its importance as a prelude to take the necessary measures to apply the standards of road safety		•				•				•				•				•		
Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts	Incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts											•	•						•	•	•
Tolled highways for trucks	Tolled highways for trucks												•							•	
Tolled highways for all traffic	Tolled highways for all traffic																				•

RW Railways		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Optimising and making the best use of the existing facilities (narrow gauge line) in the short/ medium term to secure the phosphate traffic maintainence: recovery programme to achieve a minimum standard of pavement conditions across the main road network and to maintain existing bridges	Mini Project: new narrow gauge link from Shidiya Mine to existing line and a new rail-truck transhipment Wadi Ytum station	2018				2018				2018				2018				2018			
	Rehabilitation/maintenance of the existing narrow gauge line from Wadi Ytum to Aqaba Main Port											•									
	New railway link from Aqaba Main Port to Aqaba South Port, along the corridor preserved for the National Railway Project (i.e. the coastal lignment solution)											•									
	New railway terminal connected with the phosphate berth at the South Port											•									
	Investments in new rolling stock (locos)											•									
New National railway network, core South - North corridor from Aqaba to Syrian border, as part of the Red Sea - Black Sea "landbridge"	Syrian border-Zarqa Junction				•												•				•
	Zarqa link				•												•				•
	Zarqa J.-Amman Logistics Center				•												•				•
	Amman Logistics Center-Ma'an			•									•			•				•	
	Sahab link			•									•			•				•	
	Ma'an-Aqaba South Industrial Area (coastal alignment)			•									•			•				•	
	Zarqa Junction-Saudi Junction				•												•				
	Saudi Junction-Saudi border				•												•				
	Saudi Junction-Iraqi border				•												•				
	Investments in new rolling stock (locos and waggons)			•	•								•			•	•			•	•

PM Port and Maritime		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Relocation of Main Port facilities to South Port		2018				2018				2018				2018				2018			
New cruise ship terminal at Main Port												•									

PM Port and Maritime	High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Expansion Container terminal at Middle port, phase 1											•									
Expansion Container terminal at Middle port, phase 2											•									
Expansion Container terminal at Middle port, phase 3											•									
Development of Mustarak & Mo'ata Berths (bulk commodities) at Middle port				•												•				•
Upgrade of the existing passenger ferry terminal at Middle port (new halls and security facilities, new logistics facilities and yards)				•												•				•
Rehabilitation of Oil terminal at South Port (to boost handling capacity and enhance safety and environmental protection)				•												•				•
New miscellaneous liquids, LPG (Liquid Petroleum Gas), LNG (Liquid Natural Gas) terminals at South Port			•									•			•				•	
New phosphate terminal at South Port			•									•			•				•	
New industrial port at South port			•									•			•				•	
New general cargo, Ro-Ro and grain terminals at South Port				•												•				
New port area infrastructures at South Port (road network, utilities and flood protection)				•												•				
Integration of port and railway project development				•												•				
Relocation of Ferry Terminal from Middle Port to South Port			•	•								•			•	•			•	•

PM Port and Maritime		High Investment				Low Cost				Integrated				Regional				Environmental			
Policies / Regulations		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Marine services development				•				•			•				•				•		
Port community Information System and Vessel traffic Service				•				•			•				•				•		
Measures included in NTS 2012-2014 Action Plan	Issuing Jordanian Maritime Law																				
	Ratification of international maritime conventions			•			•				•				•				•		
Improving cross-border procedures				•				•				•			•					•	

CA Civil Aviation		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Development of airports	Rehabilitation, expansion and operation of Queen Alia International airport - Phase 2	2018				2018				2018				2018				2018			
	Rehabilitation of east road access at QAIA cargo area		•				•				•				•				•		
	Amman Marka: widening the runway strip; building new taxiways; expanding the passenger terminal; enhancing the main access road capacity; implementing new public parkings - Expected passengers/year: 2018 500k, 2023 850k, 2028 1,500k		•	•	•																
	Amman Marka: specialized for low cost, couriers and executive flights (needs infrastructural interventions as defined in the Amman Marka I.A. masterplan)											•	•								
	Enhance road and PT connections to AMIA		•									•							•		
	Mafraq (King Hussein Bin Talal developement area): developement of cargo operation			•	•																
	Mafraq specialized for military use (it could host the Air Force in case of civil traffic growth at AMIA)											•	•							•	•
	Passenger terminal developement at Aqaba King Hussein International Airport	2024				2024				2024				2024				2024			
Policies / Regulations																					
Measures included in NTS 2012-2014 Action Plan	Holding bilateral agreements to liberalize air transport on a reciprocal basis		•				•				•				•				•		
	Development of civil aviation legislations and harmonizing it with the European aviation legislations		•				•				•				•				•		

CA Civil Aviation		High Investment				Low Cost				Integrated				Regional				Environmental			
Policies / Regulations		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
	Develop programs to monitor noise levels and aircraft emissions in coordination with airport operators and relevant government organizations and the State's plan of action to reduce greenhouse gas CO_2		•				•				•				•				•		
	Improving the use of air sectors and its dynamic use (The Flexible airspace)		•				•				•				•				•		
	Licensing new airline companies based on the market's demands		•				•				•				•				•		

PT Public Transport		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Bus services to be operated according to a timetable and with intermediate stops (with different average distanceaccording to the hierarchical level)			•	•							•	•			•				•	•	
New bus network, as proposed by the LTRC Jordan Bus Restructuring Interim Master Plan (JBRIMP), with a hierarchical and integrated structure of services (route numbering)	Level 1 – Premium Inter City: a series of high quality premium price express services linking the cities of Jordan		•								•				•				•		
	Level 2 – Core National Network; a more extensive network of limited stop services that connect the main cities and towns in Jordan		•								•				•				•		
	Level 3 – Other Inter Governorate Services: the remaining standard regional services operating between the Governorates		•	•								•							•	•	
	Level 4 – Intra Governorate: those regional services which operate within a single Governorate		•	•								•							•	•	
Upgrade of facilities for passengers. Guidelines for bus terminal and bus stops has to be defined (location, layout, facilities and services to passengers, information provision to travellers also by means of ITS, interchanges and intermodality) and main terminals have to be upgraded whenever not compliant with basic standards			•	•							•	•							•	•	
Mass rapid transit in the main (high demand) corridors	Amman-Zarqa BRT	2024				2024				2024				2024				2024			

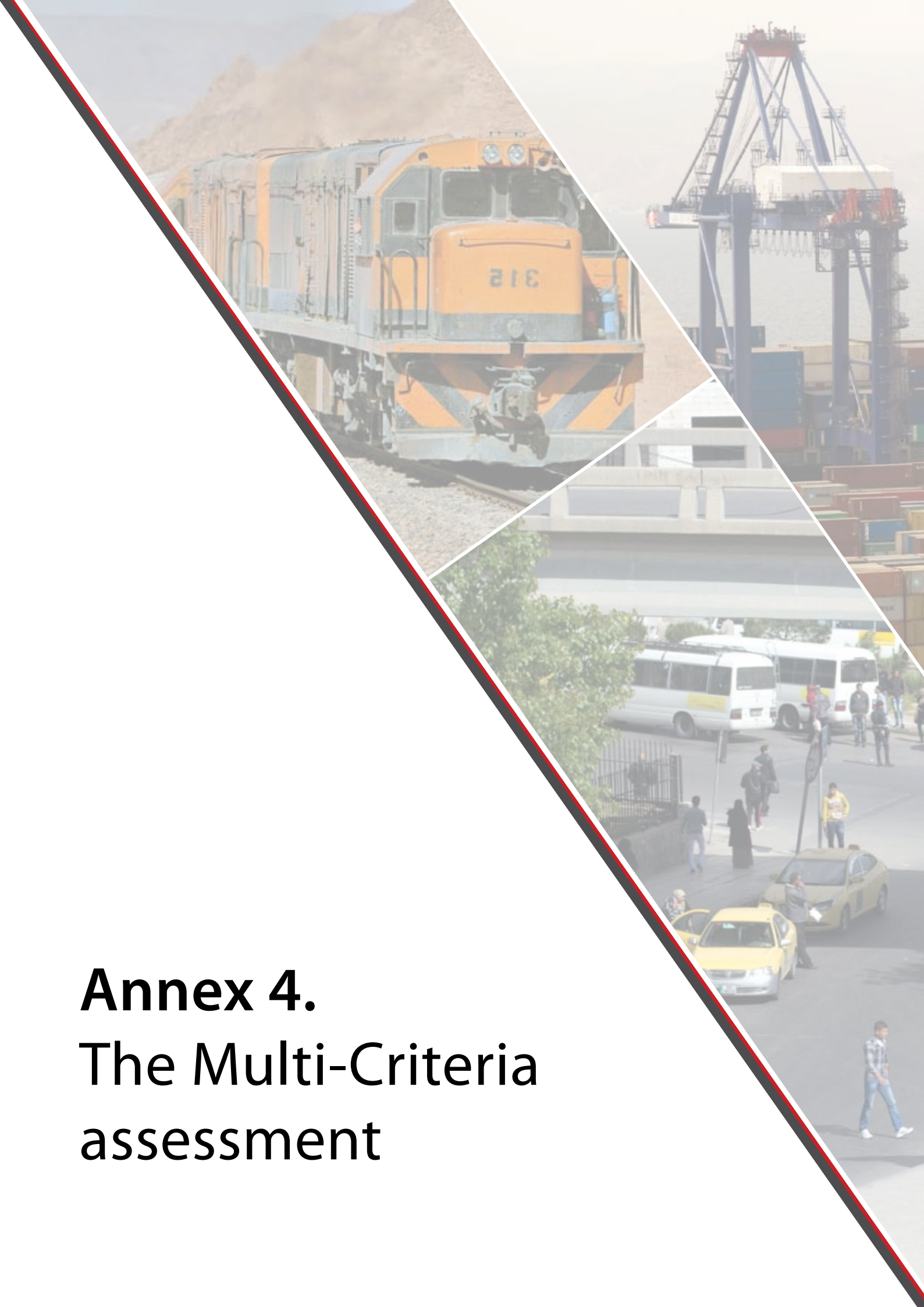
PT Public Transport		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Renewing the fleet of public transport buses (to be coordinated with the progressive implementation of hierarchical network levels)			•	•							•	•							•	•	
Bus terminals at border crossings	Jaber (border crossing with Syria)											•			•					•	
	Karama (border crossing with Iraq)										•			•					•		
	Omari (border crossing with KSA)										•			•					•		
	Aqaba (border crossing with KSA)											•			•					•	
	Jordan Valley (border crossing with Palestine)											•			•					•	
Policies / Regulations																					
Minimum standards for vehicles. Definition of quality standards, technical specifications, maximum age for busses, enforcement											•	•							•		
Restructuring of the sector/industry: consolidating small operators into bigger organisations, competition and efficiency	New contracts replacing old licences (never expiring), bids		•	•							•	•							•		
Fares and contracts	Revision of fare system (incl. technologies, ETMs electronic ticket machines)			•								•							•		
	Introducing subsidies (to be coordinated with the progressive implementation of hierarchical network levels)		•	•							•	•							•		
	Liberalisation of fares (to be coordinated with the progressive implementation of hierarchical network levels)		•	•							•	•							•		

FL Freight transport and logistics		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Dry ports and logistic centres, to be developed as hubs for services to drivers and vehicles (maintenance), transhipment and freight distribution	Amman - Madounah site (124 ha), with the primary focus to function as storage/ distribution center for consumer goods (3 phases)		•	•	•						•	•	•		•	•	•		•	•	•
	Mafraq - KHBT (170 ha), with primary potential to provide logistic services to facilitate the supply chains of industrial companies that will be located in the King Hussein Bin Talal (KHBT) development zone (3 phases)		•	•	•								•		•	•	•				•

FL Freight transport and logistics		High Investment				Low Cost				Integrated				Regional				Environmental			
Infrastructures/Services		REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030	REF	2018	2024	2030
Service areas for trucks (services for drivers and vehicles near borders, dry ports and industrial areas)	Jaber (border crossing with Syria)											•				•					
	Karama (border crossing with Iraq)										•				•						
	Omari (border crossing with KSA)										•				•						
	Aqaba (border crossing with KSA)										•				•						
	Jordan Valley (border crossing with Palestine)												•				•				
Policies / Regulations																					
Purchase Old Trucks & Re-export or Scrap			•								•				•				•		
Impose Higher Registration Fees for Old Trucks			•				•				•				•				•		
Establish Enforcement Unit			•				•				•				•				•		
Develop Regulations (Emission, Trip Inspections, Maintenance Standards, Hours of Work)				•				•				•				•				•	
Improve Motor Vehicle Inspections												•				•			•		
Develop Procedures for Roadside Inspections												•				•					
Develop Safety Rating System												•				•					
Implement Dangerous Goods Regulations											•				•				•		
Permit Program for Large Trucks								•				•								•	
Improve Custom Procedures / Bilateral Agreements											•	•			•	•					
Restructuring of the sector/industry: consolidating small operators into bigger organisations											•	•			•	•			•	•	
Minimum tariff for freight transport												•								•	
Incentives for cleaner and more efficient vehicles											•	•							•	•	

OT Other modes		High Investment				Low Cost				Integrated				Regional				Environmental			
Oil pipeline Iraq-Zarqa		2018				2018				2018				2018				2018			

Key	
2018	Time frame in the Reference scenario



Annex 4.
The Multi-Criteria assessment

A4.1 Methodology

A4.1.1 Evaluation criteria and performance indicators

The multi-criteria assessment builds upon a set of criteria and indicators selected in order to analyse the soundness of the five alternative transport strategies from several perspectives and against the national and international dimensions.

For each criterion, one or more indicators, both quantitative and qualitative, have been identified to measure whether, or to what extent, an alternative contributes to each individual criterion. Indicators provide then a 'scale' against which an alternative's contribution to the criteria is judged.

Quantitative transport indicators are computed by the outcome of the dedicated transport model and expressed in index numbers (being 100 the value of the indicator in the reference scenario). Financial and economic indicators are derived from the Cost Benefit Analysis and the financial analysis and are expressed in index numbers too (being 100 the value of the poorest performing scenario).
All indexes are reported in a way that higher values correspond to a more sustainable situation starting from the reference scenario.

Off-model parametric estimates complemented the analyses when needed by providing more insights on the potential impacts on the national GDP and on road safety. As far as qualitative indicators are concerned, they have been at first rated in qualitative terms according to their level of performance and then the qualitative assessment has been converted into numeric score in order to allow the comparability with quantitative indicators.

The final list of evaluation criteria, sub-criteria and indicators is provided in Table 1, while the description of indicators and criteria is provided into the next sections.

Criteria	Dimension	Criteria description	Sub-criteria	Indicators
Regional Macro-Economic	International	Contribution to Jordan's integration in the Region	International connection	Total travel costs for passengers on international OD relations
				Total travel costs for freights on international OD relations
	National	Contribution to domestic integration	National connection	Total travel costs for passengers on national OD relations
				Total travel costs for freights on national OD relations
		Contribution to Jordan's economic development	Economic development	GDP variation
Technical	National	Improved efficiency and interconnectivity of transportation networks	Improved network efficiency	Total travel time for passenger trips
				Total travel time for freight shipments
			Improved network interconnectivity	Passengers volumes using more than one PT line
				Freight volumes transhipped on rail
			Improved congestion	Percentage of congested road network
				Average speed on road network
Social	National	General effects on society	Safety	Slight injuries
				Severe injuries
				Fatalities
			Social inclusion	Accessibility (passengers) of rural areas and less developed regions
				Accessibility (passengers) by Public Transport
Policy	National	Contribution to transport strategy objectives identified in the Jordan Long Term Transport Strategy	Compliance with strategic Policy Pillars	Complete the existing networks and make the best use of the existing facilities
				Pursue a multimodal approach
				Combine infrastructure investments and policies
				Emphasize the regional dimension
				Make the best of private participation in the transport sector
				Protect the environment and reduce negative impacts
				Have citizens at the core of the transport policy

Criteria	Dimension	Criteria description	Sub-criteria	Indicators
Economic and Financial	National	Economic and financial soundness	Costs & Benefits	NPV (economic)
				NPV (financial)
			Timing	Distribution of investments over time
			Readiness	Institutional Readiness
				Financial Readiness
			Attractiveness for private-sector	Attractiveness for private-sector participation
Economic and Financial	National	Economic and financial soundness	Costs & Benefits	NPV (economic)
				NPV (financial)
			Timing	Distribution of investments over time
			Readiness	Institutional Readiness
				Financial Readiness
			Attractiveness for private-sector	Attractiveness for private-sector participation
Environmental	National	Environmental sustainability	Emissions	CO_2 Emissions (variation)
				CO Emissions (variation)
				PMx Emissions (variation)
				NOx Emissions (variation)
			Fuel consumption	Gasoline consumption
				Diesel consuption
			Traffic reduction	V-km in densely populated areas - CAR
				V-km in densely populated areas - LGV
				V-km in densely populated areas - HGV
				V-km-CAR
				V-km-LGV
				V-km-HGV

Regional macro-economic criteria

Within the context of the promotion of improved integration and economic growth, the creation of a multimodal transport network that facilitates commercial exchange and the movement of people within and between different countries is an important and necessary condition. In this respect, regional macro-economic criteria review the alternative scenarios in terms of their:

- **Contribution to Jordan's integration in the Region**
- **Contribution to domestic integration**
- **Contribution to Jordan's economic development**

The regional macro-economic criteria are divided into three sub-criteria:

- **International connection:** contribution of the alternative in improving international transport relations. The sub-criterion is measured in terms of variation of total travel costs (generalised transport costs) on international OD pairs, for both passengers (JOD per day) and freight (JOD per year), computed from model's output impedance matrices.
- **National connection:** contribution of the alternative in improving national transport relations. Also in this case the sub-criterion is measured in terms of variation of total travel costs (generalised transport costs) on national OD pairs, for both passengers (JOD per day) and freight (JOD per year), computed from model's output impedance matrices.
- **Economic development:** contribution of the alternative to the economic development of the country. In this context it is relevant to analyse the alternative in terms of its potential impact on GDP. GDP variation is estimated off-model on the basis of a multiplier of the construction component of infrastructure investments[1] and is expressed in terms of MJOD 2012.

Technical criteria

These criteria consider the option's relevance in terms of improved efficiency of the transport system at national level. The benefits of well-implemented investments can be seen in reduced transit times leading to lower costs for users and in a more efficient management of transport networks.

Three sub-criteria are encompassed:

- **Improved national network efficiency:** contribution of the alternative to enhancing the efficiency of national connections. This sub-criterion is measured in terms of total travel time for passenger trips (hours per day) and freight shipments (hours per year) as derived from model's output impedance matrices.
- **Improved network interconnectivity:** contribution of the alternative to increasing the level of interconnectivity between different transport networks and within the public transport network. The indicators here considered are passenger volumes using more than one public transport line (in passengers per day) and freight volumes transhipped on rail (in tonnes per year) derived from the model's output.

[1] See BNP PARIBAS, CPCS, Jordan Railway Network Development Project. Economic AnalysisReport 2010, p.41

- **Improved congestion:** contribution of the plan in relieving road congestion measured on the basis of percentage of congested roads and average speed. Both indicators are derived from model's output; the former is related to the length of the road network having a load/capacity ratio higher than 0.40 on total network length, expressed as a percentage; the latter indicates the average speed of road network calculated as weighted average of the speed of each single link (weights being vehicle-km of the link).

Social criteria

Social criteria consider the alternative's relevance in terms of the **general effects on society.** The option should have positive effects on the population in terms of:

- **Safety:** Safety is a very important dimension for transport. Improvements are called for reducing the number of accidents and the severity of their impacts. Indicators here considered are the variation of slight injuries, severe injuries and fatalities (per year) potentially occurring for each of the alternative scenarios in comparison with the reference case. Indicators are estimated off-model, by multiplying the outcome of model's runs in terms of vehicles kilometres - travelled on the different type of roads by different type of vehicles - with accident coefficients specifically estimated: i) on the basis of Jordan statistics on road safety[2] and ii) on literature evidences on the potential impacts of road safety measures.
- **Social inclusion:** by enhancing the global accessibility of rural or less developed regions and by generally improving the accessibility by public transport. Accessibility is derived from model's output and is expressed by the average travel time (in minutes) to reach next governorate's capital city. For the first indicator it is computed only for rural areas and less developed regions by considering all modes (weighted on mode's flow); for the second indicator it is computed for all zones and considers only public transport mode.

Policy criteria

Alternative transport strategies should be also analysed in terms of their contribution to fulfilling the objectives already identified in Jordan's policy papers and strategy plans. In particular the proposed approach focuses on the compliance with the policy pillars already identified in the Jordan Long Term Transport Strategy:

- Complete the existing networks and make the best use of the existing facilities
- Pursue a multimodal approach
- Combine infrastructure investment and policies
- Emphasize the regional dimension
- Make the best of private participation in the transport sector
- Protect the environment and reduce negative impacts
- Have citizens at the core of the transport policy

[2] Traffic Accidents in Jordan 2011. Jordan Traffic Institute.

Qualitative assessment of the compliance of each alternative with the policy pillars has been rated with **High, Medium, Low** and **None** and then converted into numeric score in order to be comparable with quantitative values.

Economic and financial criteria

The evaluation of alternative transport strategies cannot prescind from analysing the economic and financial soundness of proposed interventions.
The economic evaluation considers the benefits and costs the alternative scenario generates for the society as a whole, while the financial evaluation just focuses on the income and monetary costs associated with the option.

Both approaches address two different but highly interrelated questions. The economic evaluation attempts to provide an answer to whether the scenario should be carried out from the perspective of society as a whole and with reference to the plan's contribution to social welfare. The financial evaluation is related to the alternative scenario's viability and ability to generate income flows that will cover its costs, thereby implicitly wondering on its potential to attract private investors, whose decisions are assumed to be guided by the objective of maximum (private) benefit.

The economic and financial criteria considered in the multi-criteria assessment are related to:

- **Costs & Benefits** computed through the CBA of alternative scenarios and evaluated in terms of **economic performance indicator NPV (Net Present Value)** and of **financial performance indicator NPV (Net Present Value)** expressed in Million JOD at 2012.
- **Timing** of the alternative scenarios evaluated in terms of **distribution of investments over time.** The indicator here considered is the ratio between total discounted investments and total not-discounted investments.
- **Readiness** which judges the overall level of 'maturity' of the alternative from an **institutional** and **financial** point of view. The **institutional readiness** considers whether the option has already established responsibility for actions development, administrative/institutional steps for measures' implementation already defined, pre and/ or feasibility studies already available etc; the financial readiness is evaluated in terms of financial plans already developed, allocation of budget, estimated investment volumes for mature projects included in the option etc. These are qualitative indicators rated as **High, Medium, Low** and **None** and then converted into numeric score in order to be comparable with quantitative values.
- **Attractiveness for private-sector participation** which measures the overall **attractiveness** of the option for **private sector participation** (e.g. on the basis of expected revenues or other potential profits). It is a qualitative indicator rated as **Yes, Possible** and **No** then converted into numeric score in order to be comparable with quantitative values.

Environmental criteria

Sustainable mobility of people and freight is a widely shared goal amongst policy makers. The evaluation of **environmental sustainability** of Jordan's alternative transport strategies is focused on three main aspects:

- **Emissions**. In this context it is important to analyse the capability of the option to reduce all **emissions from transport** sector (i.e. CO2, CO, PMx, NOx expressed in tons per day).
- **Energy consumption** which measures the potential reduction of **fuel consumption** (in tons per day) that might be achieved through the implementation of the transport strategy.
- **Traffic reduction** measured in terms of **V-km reduction** at **national level** and in **densely populated areas** by type of vehicle (i.e. car, HGV, LGV and expressed in 1000v-km per day).

All the above mentioned indicators are a direct output of model's link statistics.

A4.1.2 Setting the relative importance of criteria, sub-criteria and indicators

An important element in multi-criteria evaluation is the identification of the relative importance of different criteria, sub-criteria and indicators (weighting process).

Three levels of weights have been used in the MCA assessment:

- A **first level** of weights which combines all indicators belonging to the same subcriterion in order to have a final score for each sub-criterion; this first level of weights is set by the project team on the basis of its expertise and professional judgment

- A **second level** of weights which combines all sub-criteria belonging to the same criterion in order to have a final score for each criterion; also this second level of weights is set by the project team

- A **third level** of weights which combines all criteria in order to have a final score for each alternative scenario. This top level of weights has been derived from the participatory stakeholders' web consultation on the relative importance of criteria held in June 2013.

A4.1.3 Evaluating the alternatives and determining the final ranking

The evaluation of different alternatives encompassed at first the computation of all indicators for each alternative. In a second step indicators and sub-criteria were weighted through the already defined weights in order to derive one value for each criterion. Then all criteria values were weighted by means of the weights derived from the stakeholders' consultation in order to compute the final score of each option whose ranking allowed for the identification of the most promising one.

A4.2 Results of MCA assessment

The multi-criteria assessment has lead to the following ranking of the different transport strategies:

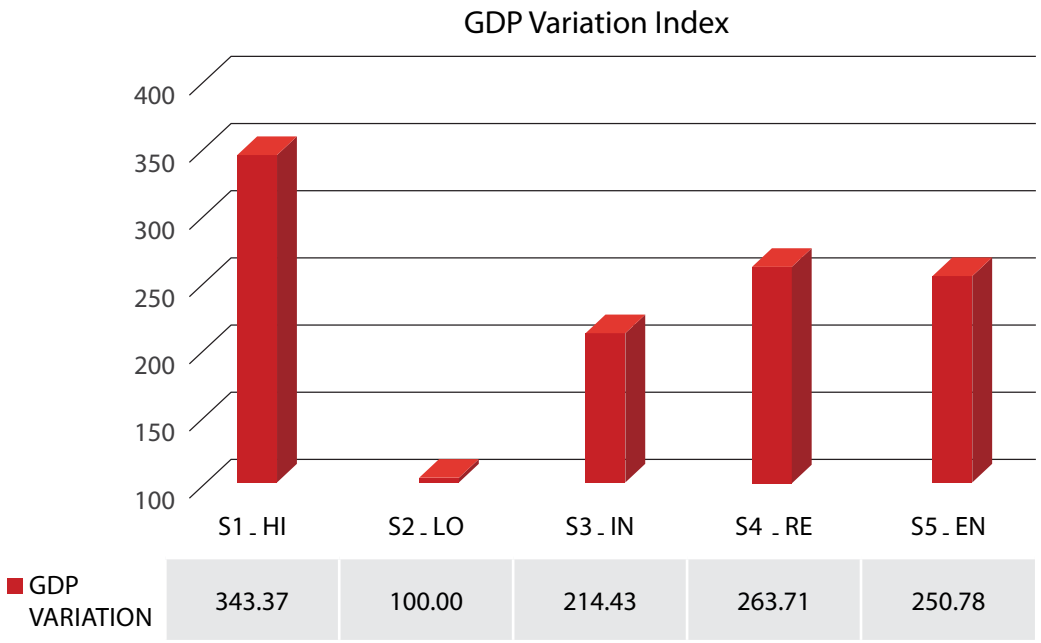
Table 2: Ranking of alternative scenarios

Position	Scenario	Score
1	Environmental (S5)	156.60
2	Integrated (S3)	153.80
3	Regional (S4)	141.93
4	High Investment (S1)	136.26
5	Low Cost (S2)	106.88

When looking at the performance of each scenario within the six evaluation criteria (see Figure 1 and Table 3) it can be seen that the Environmental Scenario (S5) performs at the top in two criteria (Economic and Financial and Policy); it is second best placed in other two criteria (Social and Environmental); and it is third placed in the remaining criteria (Regional macro-economic and Technical).

Figure 3 shows that, High Investment scenario (S1) is expected to impact more on the increase of national GDP than the other scenarios given the higher amount of construction component of the investments.

Figure 3: GDP variation index



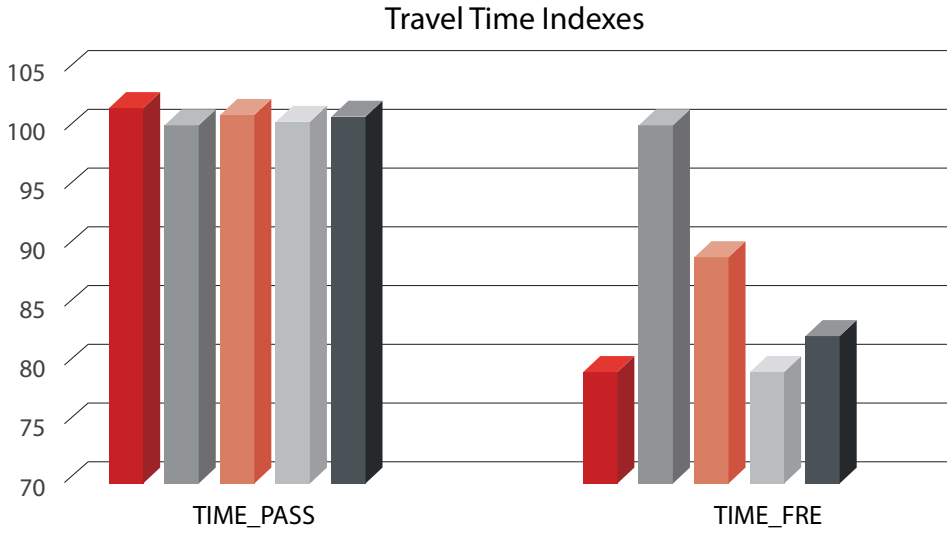
	S1 _ HI	S2 _ LO	S3 _ IN	S4 _ RE	S5 _ EN
GDP VARIATION	343.37	100.00	214.43	263.71	250.78

A4.2.2 Performance against technical criteria

When looking at travel time for the passenger sector, Figure 4 shows that High Investment scenario (S1) performs better than the other scenarios mainly due to: i) several improvements on the existing road network (i.e. widening of narrow road);ii) the construction of all planned ring-roads; and iii) to the high modal shift of freight transport from road to rail with a consequent increase of average road speed (see also Figure 5).

For the freight sector it can be seen that the modal shift from road to rail leads, as expected, to an increase of travel time of freights in comparison with the reference scenario. This increase is obviously higher in High Investment scenario (S1) and in Regional (S4) scenario where there is a stronger shift of freights to rail (due to the higher completeness of the rail network) and lower in remaining scenarios.

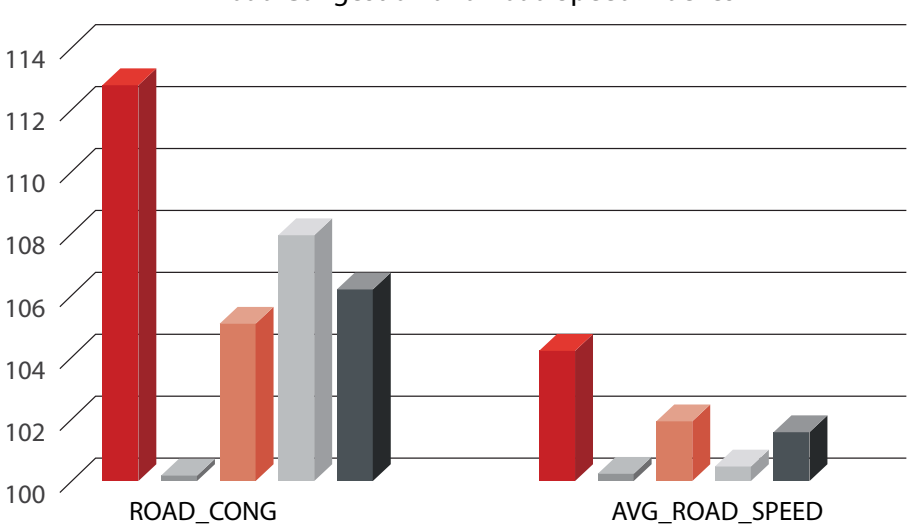
Figure 4: Travel time indexes



	TIME_PASS	TIME_FRE
S 1 _ HI	101.35	78.73
S2 _ LO	100.00	100.00
S3 _ IN	100.97	88.36
S4 _ RE	100.21	78.57
S5 _ EN	101.08	81.91

With a focus on road network, Figure 5 below shows that High Investment (S1) and Regional (S4) scenarios are more relieved from road congestion (due to the higher freight modal shift to rail). In terms of speed improvement, High Investment scenario (S1) performs better than the others since it combines the effect of the highest freight flow reduction with the effect of all the planned ring-roads (which are not included into Regional scenario (S5).

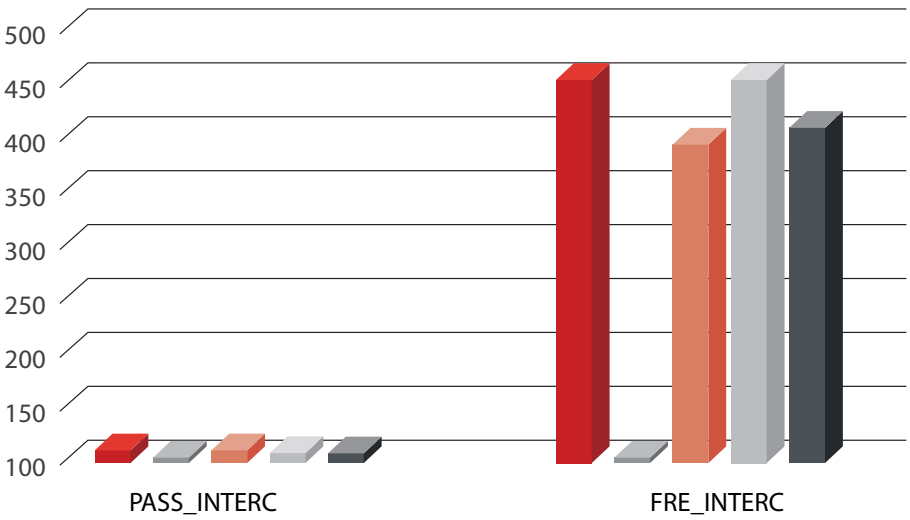
Figure 5: Road congestion and speed indexes



S 1 _ HI	112.23	103.94
S2 _ LO	99.96	100.00
S3 _ IN	104.78	101.66
S4 _ RE	107.74	100.43
S5 _ EN	106.01	101.36

Finally, when looking at interconnectivity indexes it can be seen that High Investment scenario (S1) performs better than the other ones in improving the connectivity of the public transport network for passengers; in the freight sector, High Investment (S1) and Regional (S4) scenarios performs well above the others due to the higher attractiveness of the rail network.

Figure 6: Interconnectivity indexes



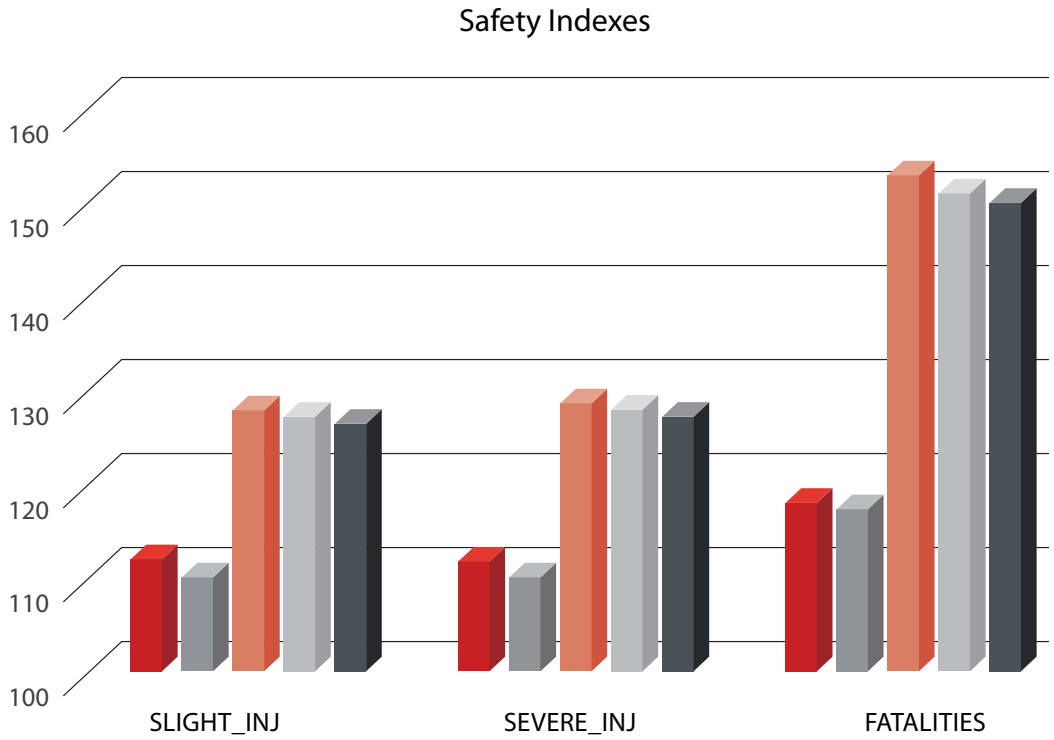
S 1 _ HI	111.53	450.13
S2 _ LO	100.00	100.00
S3 _ IN	110.61	385.19
S4 _ RE	109.15	450.13
S5 _ EN	110.10	407.11

A4.2.3 Performance against social criteria

Figure 7 shows that, when looking at safety indexes, Integrated scenario (S3) performs better than the others in terms of road injuries and fatalities reduction mainly due to the implementation of a more comprehensive and better balanced set of safety measures, addressing infrastructures, drivers (both private and professional ones) and vehicles. Compared to the other scenarios that in some cases deploy the same sub-set of measures, Integrated scenario (S3) often benefits from the introduction of safety measures at an early stage.

The performance of the Regional Scenario (S4) and the Environmental one (S5) from this point of view is slightly worse, mainly because of a different timing (postponed) of the road safety measures, while High Investment (S1) and Low Cost (S2) scenarios perform significantly worse having a more limited set of measures, mainly related to the basic maintenance recovery of road infrastructure.

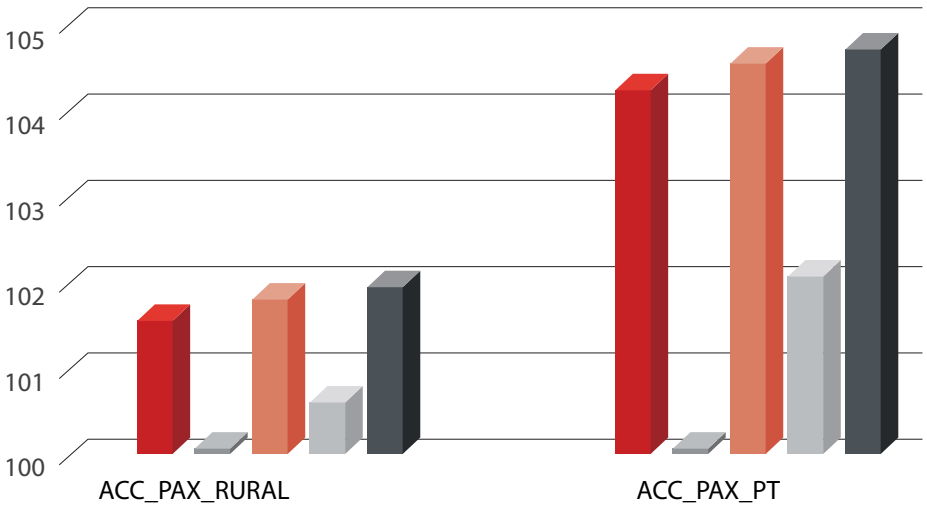
Figure 7: Safety indexes



	SLIGHT_INJ	SEVERE_INJ	FATALITIES
S 1 _ HI	110.22	109.75	116.28
S2 _ LO	108.04	108.03	116.11
S3 _ IN	126.06	125.86	149.87
S4 _ RE	124.98	124.85	148.30
S5 _ EN	124.75	124.49	148.05

In terms of accessibility, as shown in Figure 8, Environmental scenario (S5) performs slightly better than the others due to improvements in private and public transport sectors.
New roads and road upgrades result in reduced car travel times. Improvements in bus services and especially the reduction of transfer times between line routes result in better accessibility due to decreasing travel times for passengers in public transport.

Figure 8: Accessibility indexes

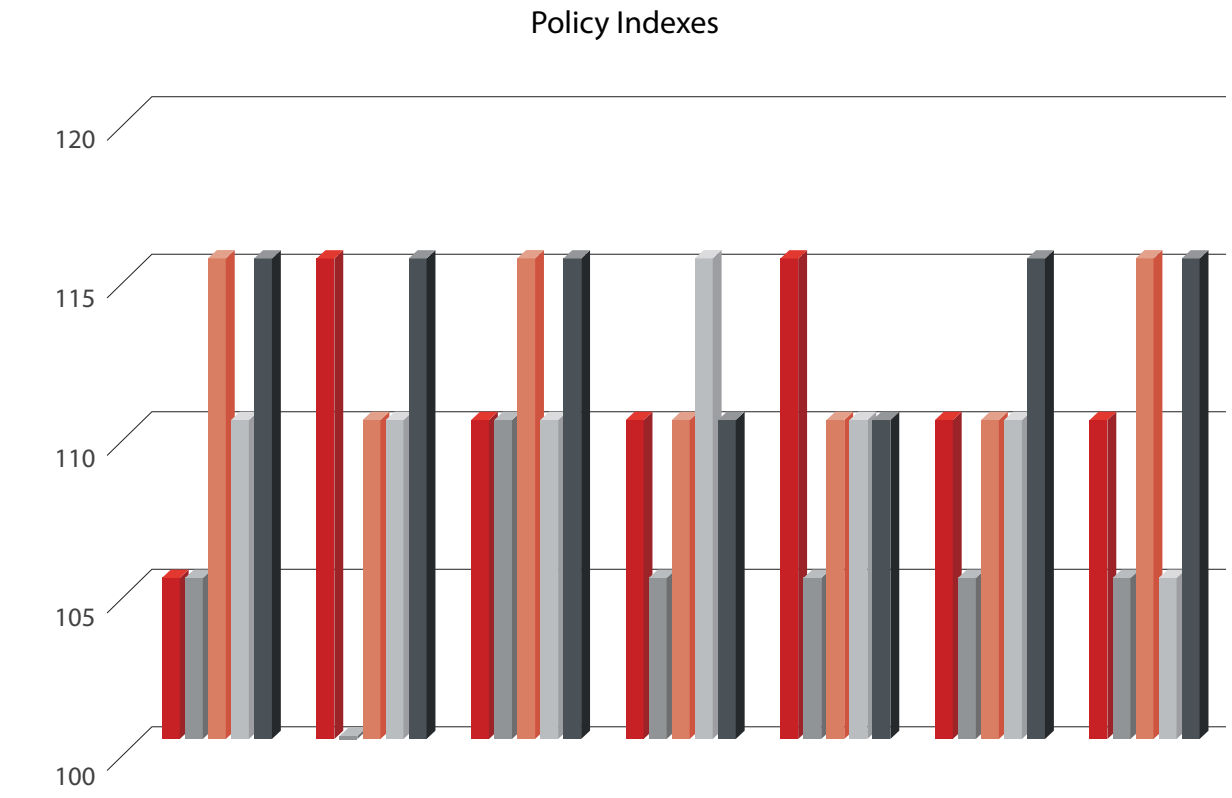


S 1 _ HI	101.45	104.28
S2 _ LO	100.00	100.00
S3 _ IN	101.69	104.44
S4 _ RE	100.48	102.02
S5 _ EN	101.84	104.59

A4.2.4 Performance against policy criteria

The evaluation of the compliance of alternative scenarios to the policy principles of the Jordan Long Term Transport Strategy shows that Environmental scenario (S5) performs at the top against five policy pillars over seven and Integrated scenario (S3) against three over seven.

Figure 9: Policy indexes



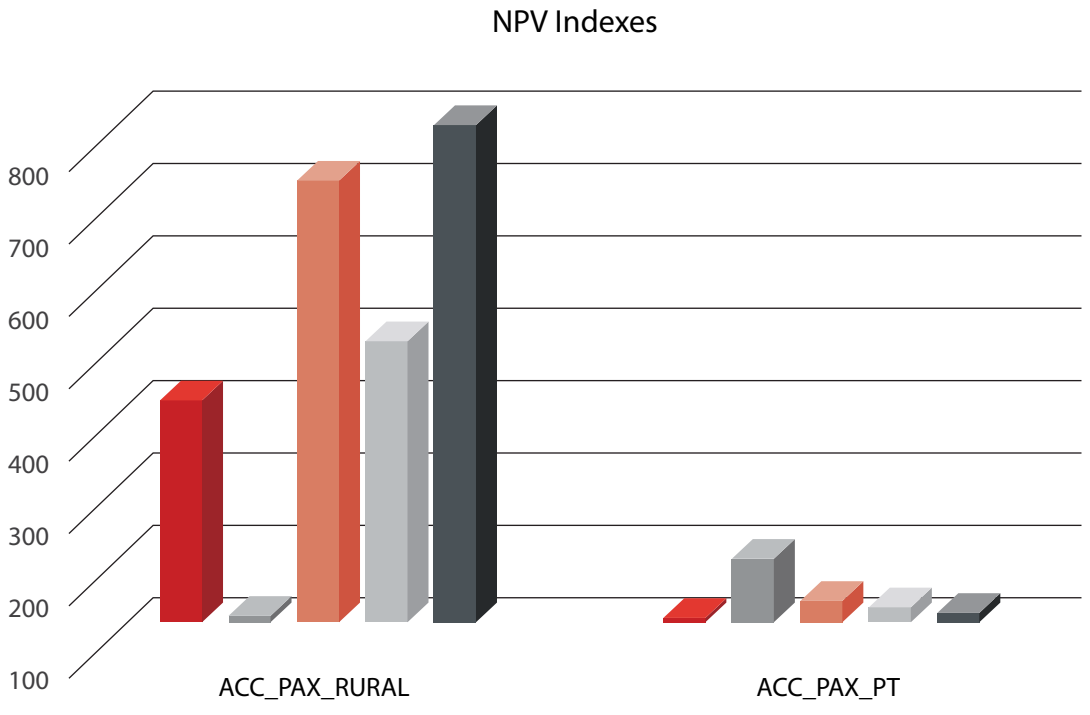
	P_PILLAR_1	P_PILLAR_2	P_PILLAR_3	P_PILLAR_4	P_PILLAR_5	P_PILLAR_6	P_PILLAR_7
S 1 _ HI	105.00	115.00	110.00	110.00	115.00	110.00	110.00
S2 _ LO	105.00	100.00	110.00	105.00	105.00	105.00	105.00
S3 _ IN	115.00	110.00	115.00	110.00	110.00	110.00	115.00
S4 _ RE	110.00	110.00	110.00	115.00	110.00	110.00	105.00
S5 _ EN	115.00	115.00	115.00	110.00	110.00	115.00	115.00

A4.2.5 Performance against economic and financial criteria

As shown in Figure 10 when looking at cost-benefit indicators, Environmental scenario (S5) has the highest index than the other scenarios with respect to the economic Net Present Value. This evidence is explained by considering that, while investment costs position this scenario at the third place (after High Investment (S1) and Regional (S4) ones), it shows the highest values for consumer and producer surplus and it is second best placed (after Integrated (S3)) in terms of environmental and safety costs reduction.

In the analysed alternative scenarios, revenues generation is substantially limited to the new railway services and tolled highways and the ranking of scenarios is largely determined by the entity of investment and operational costs. Therefore, when looking at the financial Net Present Value, not surprisingly the Low Cost scenario (S2) performs better than the others given the lowest investments required for its implementation.

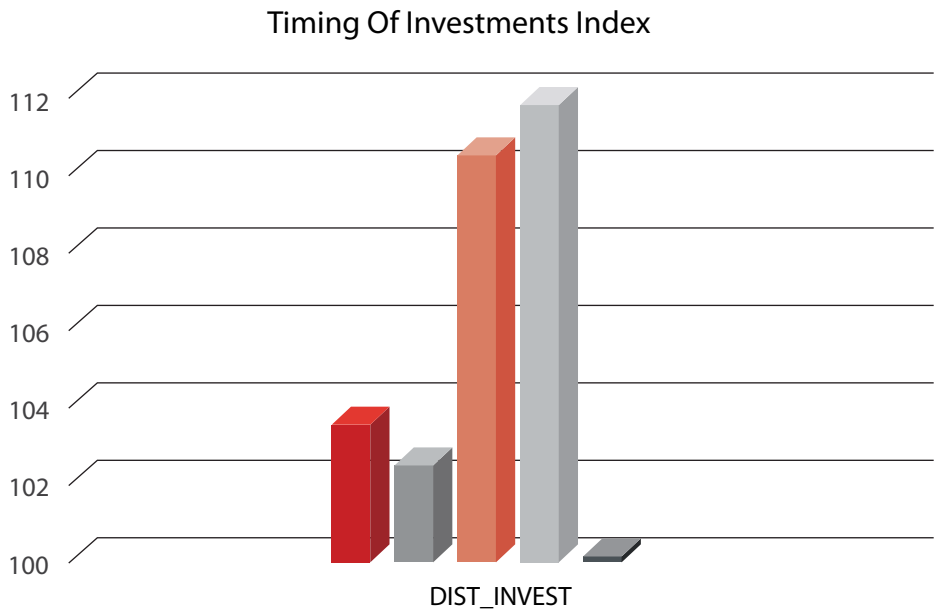
Figure 10: NPV indexes



	ACC_PAX_RURAL	ACC_PAX_PT
S 1 _ HI	396.80	100.00
S2 _ LO	100.00	173.75
S3 _ IN	702.28	132.01
S4 _ RE	463.49	128.93
S5 _ EN	757.31	106.70

When considering the distribution of investments over time, Regional scenario performs at the top, as shown in Figure 11.

Figure 11: Timing of investments index

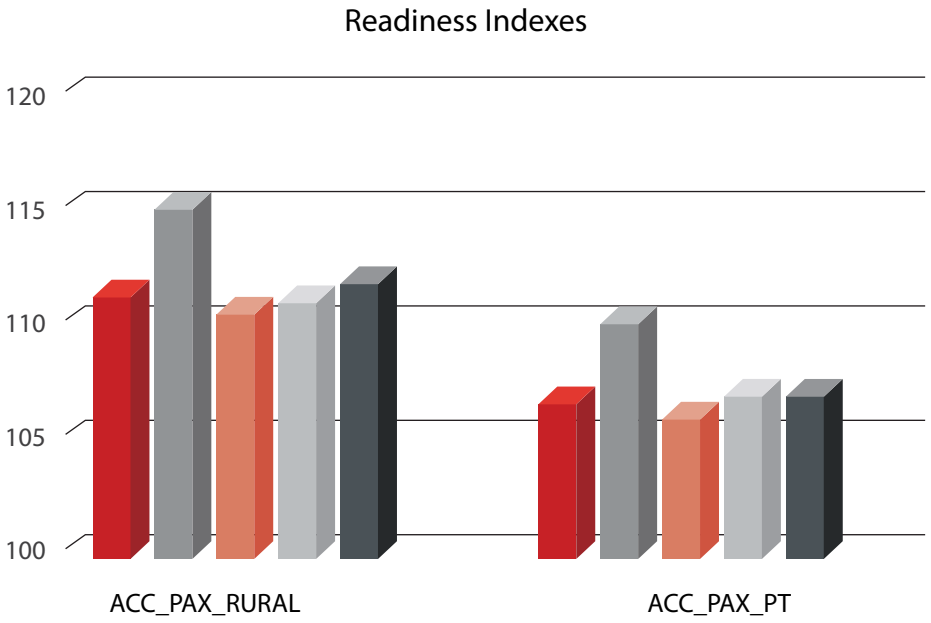


S 1 _ HI	103.24
S2 _ LO	102.36
S3 _ IN	110.35
S4 _ RE	111.39
S5 _ EN	100.00

When looking at institutional and financial readiness (Figure 12), as expected Low Cost scenario (S2) is the one with the highest score due to the few measures composing it.
From the institutional point of view, the second best placed scenario is the High Investment (S1) which performs slightly better than the Environmental (S5).

From the financial readiness perspective, both Environmental (S5) and Regional (S4) appear equally as the second best scenarios.

Figure 12: Institutional and financial readiness indexes



	ACC_PAX_RURAL	ACC_PAX_PT
S 1 _ HI	111.82	106.14
S2 _ LO	115.00	110.00
S3 _ IN	110.45	105.91
S4 _ RE	110.68	106.62
S5 _ EN	111.76	106.62

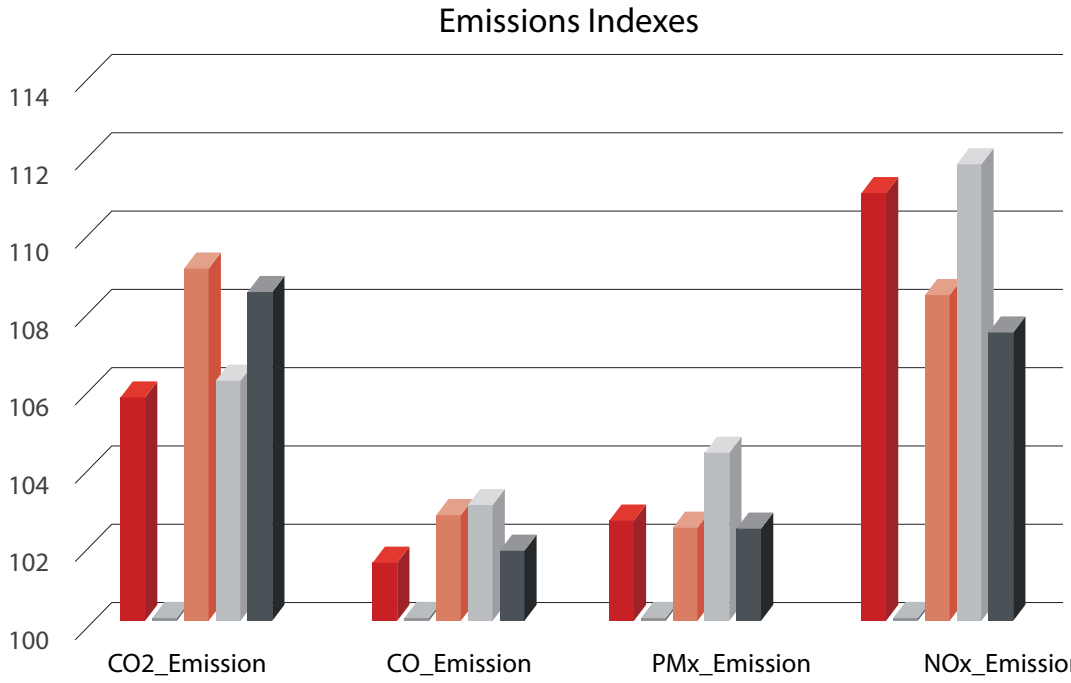
A4.2.6 Performance against environmental criteria

When looking at pollutant emissions indexes shown in Figure 13 it can be seen that scenarios perform differently with respect to diverse pollutants. When considering PMx and NOx pollutants, Regional scenario (S4) performs at the top followed by High Investment scenario (S1). This evidence is explained by considering that these scenarios are the ones determining the highest freight modal shift from road to rail which implies a sensible reduction of HGV vehicles on the road network (see also Figure 15).

Regional scenario (S4) performs also at the top with respect to CO emissions – followed by the Integrated (S3) one - and the best ranked scenario with respect to CO2 reduction is the Integrated (S3) one, followed by the Environmental (S5).

It should be also noted that both Integrated (S3) and Environmental (S5) scenarios assume the implementation of road tolls (for trucks only in S3 and for all traffic in S5) on selected highways. In such cases a diversion from tolled highways to un-tolled roads might occur with a consequent potential increase of environmental emissions (e.g. due to increased travel time and distances on roads in comparison with highways). Additional policy measures (e.g. extension of road charging to parallel roads or the introduction of specific restrictions) could prevent such a diversion effect.

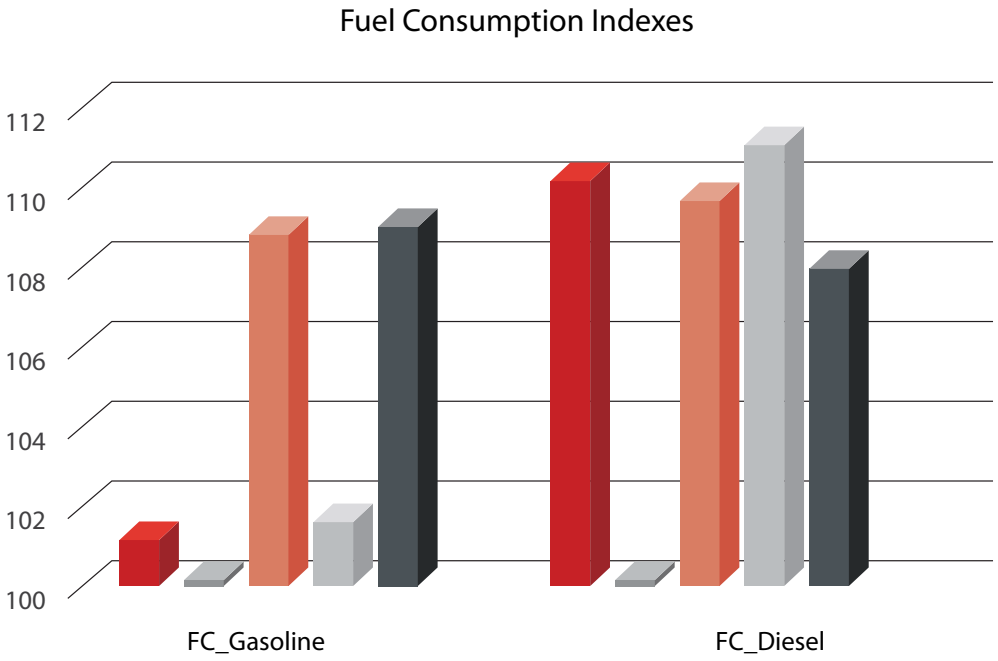
Figure 13: Emissions indexes



	CO2_Emission	CO_Emission	PMx_Emission	NOx_Emission
S 1 _ HI	105.55	101.25	102.57	110.85
S2 _ LO	100.00	100.00	100.00	100.00
S3 _ IN	108.86	102.59	102.20	108.44
S4 _ RE	106.07	102.70	104.05	111.49
S5 _ EN	108.21	101.71	102.06	107.14

The highest impact of Regional (S4) and High Investment (S1) scenarios on freight mode shift is confirmed by the trend of diesel fuel consumption indexes shown in Figure 14. For gasoline fuel consumption, the best performing scenario is the Environmental (S5) one followed by the Integrated (S3).

Figure 14: Fuel consumption indexes



	FC_Gasoline	FC_Diesel
S 1 _ HI	100.96	109.90
S2 _ LO	100.00	100.00
S3 _ IN	108.66	109.05
S4 _ RE	101.23	110.67
S5 _ EN	108.73	107.73

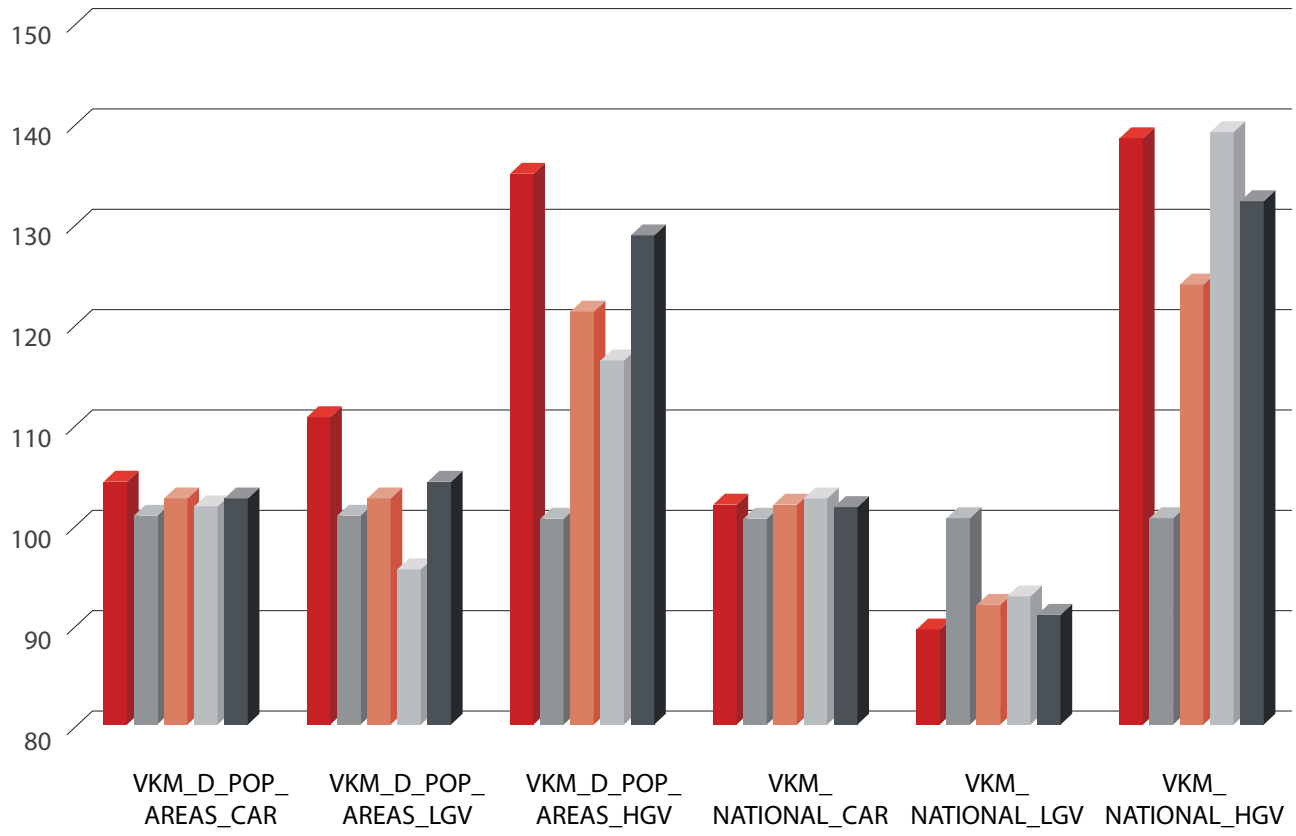
When looking at traffic indexes, it can be noted that all scenarios observe an increase of LGV traffic on the national territory with respect to the reference situation; this is the effect of the implementation of the dry ports and logistics centres which determine a general increase of LGV vehicles-kilometres and of transport distances and as consequence of the peripheral geographical location of the dry ports (compared to the custom centres).

This increase is highest in High Investment scenario (S1) since in this scenario the number of new road bypasses is the highest than in the other scenarios, providing faster connections for certain relations on the one hand, but resulting in longer distances and more LGV kilometres on the other hand.

As far as concerns HGV traffic, the effect of the development of the rail network and the implementation of dry ports and logistics centres lead to a sensible reduction of traffic in all scenarios, being the Regional (S4) one the best performing in this respect and followed the High Investment (S1) scenario.

When looking at traffic in densely populated areas, it can be observed that, as expected, High Investment scenario (S1) performs always at the top - for all vehicle types - given the implementation of all planned ring-roads of main urban areas.

Figure 15: Traffic indexes



	VKM_D_POP_ AREAS_CAR	VKM_D_POP_ AREAS_LGV	VKM_D_POP_ AREAS_HGV	VKM_ NATIONAL_CAR	VKM_ NATIONAL_LGV	VKM_ NATIONAL_HGV
S 1 _ HI	103.32	110.17	134.56	101.01	88.81	136.79
S2 _ LO	100.00	100.00	100.00	100.00	100.00	100.00
S3 _ IN	101.89	101.65	120.35	100.91	91.85	124.19
S4 _ RE	100.87	94.84	114.15	101.28	92.95	137.21
S5 _ EN	101.70	103.67	126.87	100.62	90.61	130.71