

ROAD AND TRANSPORTATION MASTERPLAN

PALESTINE

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X Investments Pipeline and Priority Actions

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1 Introduction

This chapter is aimed at providing a detailed overview of all Projects proposed by NTMP with a specific focus on the immediate and short term investment plan. Therefore, all analytical steps required to reach the displayed conclusion and findings hereafter will be illustrated in detail.

2 Methodology

Below is a quick summary of the main steps taken for a full-fledged study on priority actions and investments pipeline.

- Projects are considered in every phase in their life cycle, including investment (capital) cost, maintenance/ operation cost and potential revenues.
- Investment and maintenance/ operation costs will be analyzed in detail, whereas revenue and potential profit that can potentially be generated will be analyzed in the upcoming chapter dedicated to costs and benefits considerations and financial analysis.
- Every project is detailed as follows:
 - Serial number
 - Sub-Sector:Road, Rail, Maritime, Air, Public Transport, Border Crossing, Logistics
 - Location:West Bank, Gaza Strip, West Bank & Gaza Strip
 - Project Title
 - Category of Intervention:New infrastructure, Rehabilitation
 - Phase: Phase 1, 2, 3 and 4
 - Type of Intervention:Infrastructural improvement, Organizational, Institutional
 - Work Phase:Planning, Design, Construction
 - Quantity:Length (Roads and Rails), Surface Area (Logistics and Border Crossing Areas), etc.
 - Unit rate:(€ m per quantity unit)
 - Cost Estimate:(€ m)
 - Road Section Type:(applicable for Roads only)
 - Traffic Volumes:Traffic volumes per Project are either extracted from the multimodal traffic model, such as in the case of roads, rails and Public Transport or is based on the macroeconomic forecast model, mainly for freight transport
 - Priority (Ranking System):Ranking is associated to Projects further to a calculated index based on Traffic Model Volumes output data and construction complexity
 - Duration:(years)
- Based on the Project phase and expected construction duration, capital expenditure per Project (for all projects) is distributed on all reference years (2016-2045). Gaussian regression is used for distributing estimated investment cost on the different years reflecting realistically the resource distribution of medium to long term projects.
- Maintenance/ operation yearly costs are estimated based on a percentage of capital costs.
- Priority index is developed for each Project within every phase, where applicable, based on forecast traffic volumes and construction complexity. This provides a valid overall reading of the priority of different projects within a single network. This is particularly beneficial in the case of road network and Projects due to the interrelatedness among

projects and the practical and theoretical difficulty of treating components of the whole distinctly.

- Project Sheets are produced for most significant projects containing all the above mentioned project details in addition to plans and section types, where applicable.



3 Investments Cost Estimate

Cost indications and implications are mainly based on data available from PCBS including a detailed and updated analysis of yearly construction costs variances. Given the broad scale and variety of the interventions envisaged, the considerably differing time and culture provided scenarios as well as the limited technical details of projects, available at Master Plan level, the following methodology is adopted for the estimation of Capital Expenditures, associated with the planning, design and implementation of the Projects contained in the Master Program. The following steps are followed for cost estimation:

- Due to the very preliminary nature of the proposed projects in the Master Plan, at this stage Cost estimation can only follow the early cost estimation¹ approach
- Unit Cost references are based on:
 - Historic data base, where available;
 - Information provided by Local Experts;
 - Consultant's database;
 - Information provided by similar Projects in neighboring Countries, e.g. Jordan
 - Previous feasibility studies and projects;
 - Global construction cost estimates, provided by International Agencies, e.g. World Bank;
 - Most probable Unit Costs have been abstracted and adopted.
- As previously mentioned, the very preliminary infrastructure design stage provided by the Master Plan allow for an early cost estimate, with a potential error margin of +/- 30% approximation, mainly aimed at:
 - allowing a first level of technical and economic Feasibility;
 - structuring a phased expenditures program/ plan;
 - allowing a first level funding and financing plan;
 - appreciating priorities based on general utility and ridership indicators.

3.1 Investments Cost Estimate for Road Transport Sector

Below is the early cost estimate of all works required for achieving the proposed projects within the road transport sector.

Tab 1. Early Cost Estimate for the Road Transport Sector

Sn.	Sub-sector	Location	Project Title	Length (Km)	Cost Estimate (m. €)
1	Road	Gaza Strip	Road between Karem Abu-Salem BCP and Rafah BCP	3.30	3.30
2	Road	Gaza Strip	New Gaza Strip Eastern Corridor	0.00	1.63
3	Road	Gaza Strip	Salah Al Din Central Axis Road in Gaza Strip*	40.00	0.00
4	Road	Gaza Strip	Road Connection to Yasser Arafat Airport	2.25	4.50

¹Ibrahim Mahamid, "Early Cost Estimating for Road Construction Projects Using Multiple Regression Techniques", Hail University. Mahamid's study is taken as a reference since it is based on the 131 sets of data collected in the West Bank in Palestine. The concept of Early Cost Estimation was developed by Rose in 1982 and further by Sanders in 1992 and is considered to be an appropriate solution in similar conditions where cost estimation is required at very early design stages and/or in situations where a significant margin of error is expected due to unforeseen conditions that require detail analysis and diagnosis of the current situation.



5	Road	Gaza Strip	Road Connection to Gaza Fishery Port	3.80	3.80
6	Road	West Bank	New Eastern Road Network:Nabi Musa-Hebron-Bethlehem	0.00	2.40
7	Road	West Bank	Road Connection to Karama Bridge BCP	3.60	3.60
8	Road	West Bank	Road Connection between Ramallah and Nablus	36.60	36.60
9	Road	West Bank	Urban Ring-roads in West Bank Main Cities	0.00	1.92
10	Road	West Bank	Rural Roads Sealing - Stage 1 (40%)	162.40	20.30
11	Road	West Bank & Gaza Strip	Road Asset Management & Coordination Program	0.00	1.00
12	Road	West Bank & Gaza Strip	New West Bank - Gaza Strip Corridor	59.20	2.50
13	Road	West Bank & Gaza Strip	Detailed Road Inventory and Conditions Surveying	0.00	1.20
14	Road	West Bank & Gaza Strip	Roads Department Capacitation	0.00	1.00
15	Road	West Bank & Gaza Strip	Roads Total Quality (Planning, Design, Tendering, Construction, supervision, etc.)	0.00	0.80
			TOTAL ESTIMATED COST PHASE 1A (2-yr investment plan)	317.65	84.55
16	Road	Gaza Strip	Gaza Strip Coastal Road	31.90	31.90
17	Road	Gaza Strip	Gaza Strip Main Connections to N-S Central Axis	12.55	21.34
18	Road	Gaza Strip	New Gaza Strip Eastern Corridor	48.00	81.60
19	Road	Gaza Strip	Coastal Road to Bayt Hanoun Road Connection	6.50	6.50
20	Road	West Bank	New Connection from Bayt Ummar - Surif - ad-Dhahiriya	57.60	56.98
21	Road	West Bank	New Eastern Road Network: Nabi Musa to Bethlehem	26.00	31.04
22	Road	West Bank	New Connection "Wadi al-Nar"	9.50	44.44
23	Road	West Bank	New Ramallah Eastern By-pass Road	12.30	36.40
24	Road	West Bank	New Nablus/Huwara By-pass Road	5.70	34.70
25	Road	West Bank	West Bank N-S Backbone Reinforcement	173.30	136.37
26	Road	West Bank	Road Connecting Ramallah to Jericho (Road n.449)	24.50	24.50
27	Road	West Bank	West Bank Radial Road System	211.40	3.90
28	Road	West Bank	New Eastern Road Network: Nabi Musa-Hebron-Bethlehem	60.00	88.74
29	Road	West Bank	New Western Connection: Tulkarm to Ramallah	58.70	4.23
30	Road	West Bank	Rural Roads Sealing - Stage 2 (80%)	162.40	20.30
31	Road	West Bank & Gaza Strip	Urban Ring-roads in West Bank Main Cities - Stage 1	42.25	96.12
32	Road	West Bank & Gaza Strip	New West Bank - Gaza Strip Corridor - Stage 1	19.00	57.00
			TOTAL ESTIMATED COST PHASE 1	961.60	776.06
33	Road	Gaza Strip	New Gaza East-West Road Connections	14.90	29.80
34	Road	West Bank	New Western Connection: Tulkarm to Ramallah	58.70	141.00
35	Road	West Bank	West Bank Radial Road System - Stage 1	102.80	195.20
36	Road	West Bank	Road Connecting Ramallah to Jericho (Road n.457/458)	20.00	31.94
37	Road	West Bank	West-East Road Connecting Majdal to Road n°90	27.40	31.18
38	Road	West Bank	Rural Roads Sealing - Stage 3 (100%)	81.20	10.15
39	Road	West Bank & Gaza Strip	New West Bank - Gaza Strip Corridor - Stage 2 (100%)	40.20	64.26
40	Road	West Bank & Gaza Strip	Urban Ring-roads in West Bank Main Cities - Stage 2 (100%)	39.93	180.92



			TOTAL ESTIMATED COST PHASE 2	385.13	684.45
41	Road	West Bank	West Bank Radial Road System - Stage 2 (100%)	108.60	130.32
			TOTAL ESTIMATED COST PHASE 3	108.60	130.32
42	Road	West Bank	West Bank Perimeter Road System	174.90	297.33
			TOTAL ESTIMATED COST PHASE 4	174.90	297.33
	Road		ROADWAY NETWORK GRAND TOTAL	1941.38	1972.71

* The project of Salah Al Din Central Axis Road in Gaza Strip is already financed.

Estimate of sub components of the various projects is based on the following breakdown:

Tab 2. Early Cost Estimate Breakdown for Road Network

Road Type	Unit rate (m Euro)
New Road at grade road	1.5-2.5 per km
Rehabilitation of an existing road	0.5-1.0 per km
New viaduct	5.0-7.0 per km
New Tunnel	14.00-18.00 per km

3.2 Investments Cost Estimate for Rail Transport Sector

Below is the early cost estimate of all works required for achieving the proposed projects within the rail transport sector.

Tab 3. Early Cost Estimate for the Rail Transport Sector

Sn.	Sub-sector	Location	Project Title	Length (Km)	Cost Estimate (m. €)
1	Rail	West Bank & Gaza Strip	Capacitation of Railway Management & Operations Unit		2.00
2	Rail	West Bank & Gaza Strip	International Railway Network Feasibility Study		4.00
3	Rail	West Bank	National Railway Network Feasibility Study		3.00
4	Rail	West Bank	Ramallah-Nablus Rail Connection Planning and Design	30.80	4.93
	Rail		TOTAL ESTIMATED COST PHASE 1A (2-yr investment plan)		13.93
5	Rail	West Bank	Ramallah-Nablus Rail Connection Construction	30.80	246.40
6	Rail	West Bank	Nablus-Jenin Rail Connection Planning and Design	44.70	5.36
7	Rail	West Bank	Ramallah-Hebron Rail Connection Planning and Design	49.20	7.87
	Rail		TOTAL ESTIMATED COST PHASE 1	30.80	259.64
8	Rail	Gaza Strip	Gaza Strip International Railway Planning and Design	47.40	7.11
9	Rail	West Bank	West Bank Northern Rail Connection Design and Construction	13.80	85.28
10	Rail	West Bank	Nablus-Jenin Rail Connection Construction	44.70	268.20
11	Rail	West Bank	Ramallah-Hebron Rail Connection Construction	49.20	393.60
	Rail		TOTAL ESTIMATED COST PHASE 2	107.70	754.19
12	Rail	Gaza Strip	Gaza Strip International Railway Construction	47.40	237.00
13	Rail	Gaza Strip	Rail Connection to New Gaza Commercial Seaport Design and Construction	5.78	28.90



14	Rail	West Bank	West Bank International Rail Connection Design and Construction	138.00	1126.08
15	Rail	West Bank	Western West Bank rail system Planning and Design	91.56	13.73
16	Rail	West Bank	Tubas - Damyeh Rail Connection Planning and Design	26.80	3.62
	Rail		TOTAL ESTIMATED COST PHASE 3	191.18	1409.33
17	Rail	West Bank	Western West Bank rail system Construction	91.56	732.48
18	Rail	West Bank	Tubas - Damyeh Rail Connection Construction	26.80	214.40
	Rail		TOTAL ESTIMATED COST PHASE 4	118.36	946.88
	Rail		RAILWAY NETWORK GRAND TOTAL	448.04	3383.97

A range of Euro 6m to 10m is considered to be the infrastructure cost per km of railway. This is based on reference to Railway Feasibility study on a Regional scale.

3.3 Investments Cost Estimate for Maritime Transport Sector

Below is the early cost estimate of all works required for achieving the proposed projects within the maritime transport sector.

Tab 4. Early Cost Estimate for the Maritime Transport Sector

Sn.	Sub-sector	Location	Project Title	Cost Estimate (m. €)
1	Port	Gaza Strip	Existing Gaza Fishery Port Restructuring - Stage 1	29.00
2	Port	Gaza Strip	New Gaza Strip Commercial port	3.00
			TOTAL ESTIMATED COST PHASE 1A (2-yr investment plan)	32.00
3	Port	Gaza Strip	Existing Gaza Fishery Port Restructuring - Stage 2	39.00
4	Port	Gaza Strip	New Gaza Strip Commercial port	182.00
			TOTAL ESTIMATED COST PHASE 1	221.00
	Maritime		PORTS GRAND TOTAL	253.00

Cost breakdown for ports infrastructure is based on the following port components:

- Harbor mouth width (m)
- Harbor basin area (sqm)
- Operation forecourts (sqm)
- Quay length (m)
- Number of fishing boat moorings (n.)
- Occupied coast length (m)

3.4 Investments Cost Estimate for Air Transport Sector

Below is the early cost estimate of all works required for achieving the proposed projects within the air transport sector.



Tab 5. Early Cost Estimate for the Air Transport Sector

Sn.	Sub-sector	Location	Project Title	Cost Estimate (m. €)
1	Airport	West Bank & Gaza Strip	Capacitation of Air Transport Administration and Operations	1.00
2	Airport	Gaza Strip	Yasser Arafat Regional Airport Rehabilitation in Gaza Strip - Stage 1 (60%)	35.49
3	Airport	West Bank	New West Bank International Airport	4.00
			TOTAL ESTIMATED COST PHASE 1A (2-yr investment plan)	40.49
4	Airport	Gaza Strip	Yasser Arafat Regional Airport Rehabilitation in Gaza Strip - Stage 2 (100%)	23.67
5	Airport	West Bank	New West Bank International Airport - Phase 1 (40%)	79.26
			TOTAL ESTIMATED COST PHASE 1	102.93
6	Airport	West Bank	New West Bank International Airport - Phase 2 (100%)	118.90
			TOTAL ESTIMATED COST PHASE 2	118.90
	Airports		AIRPORTS GRAND TOTAL	262.32

Cost breakdown for airports infrastructure is based on the following port components:

Airside

- Site preparation: Surveying, Investigations geognostic, airport fence, earthwork for runway strip/ pavement, etc.
- Runway: Pavement, shoulders, clearways and blast pads, drainage and surface water drains, etc.
- Apron: Apron grid pavement, drainage, etc.
- Taxiways: Exit taxiways pavement, rapid exit taxiways, shoulders, drainage, etc.
- Visual Aids: Runway edges lighting system, taxi axes/ edges, visual aids apron, threshold and runway ends, ALS system, PAPI systems, D-VOR-DME, NDB, power supply, cable ducts, etc.
- ATC: Control tower and control tower apparatus (Radio ARO AFIS METEO), power, supply, etc.
- Service Yard: Waste Water treatment, Fuel farm, fire-fighting station, fire brigade, etc.

Terminals

- Passenger Terminal
- Electric Power
- Civil Work: Lighting System
- Central Cooling
- Terminal Mechanical Equipment
- Landside: external drop off areas, external parking areas, connecting roads and road infrastructure, etc.

3.5 Investment Cost Estimate for Public Transport Sector

Below is the early cost estimate of all works required for achieving the proposed projects within the public transport sector.



Tab 6. Early Cost Estimate for the Public Transport Sector

Sn.	Sub-sector	Location	Project Title	Length (Km)	Cost Estimate (m. €)
1	Public Transport	West Bank & Gaza Strip	Administrative Structuring of Public Transport Sector		1.50
2	Public Transport	West Bank & Gaza Strip	Public Transport Network Detailed Study		1.00
3	Public Transport	West Bank & Gaza Strip	Public Transport Design for New hubs, Stations and Stops		1.00
4	Public Transport	West Bank & Gaza Strip	Temporary Refurbishment of Major hubs and stations	10.00	0.40
			TOTAL ESTIMATED COST PHASE 1A (2-yr investment plan)		3.90
5	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors		1.00
6	Public Transport	West Bank & Gaza Strip	Intercity Bus Fleet Acquisition - Stage 1	50.00	13.00
7	Public Transport	West Bank & Gaza Strip	Rehabilitation and Upgrade of Major Hubs	5.00	2.03
8	Public Transport	West Bank & Gaza Strip	Rehabilitation and Upgrade of Major Stations	18.00	3.42
9	Public Transport	West Bank & Gaza Strip	Rehabilitation and Upgrade of Bus Stops	593.00	7.12
			TOTAL ESTIMATED COST PHASE 1		26.57
10	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors - Stage 1	36.00	160.20
11	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors - Fleet Acquisition	30.00	9.60
12	Public Transport	West Bank & Gaza Strip	Intercity Bus Fleet Acquisition - Stage 2	50.00	13.00
			TOTAL ESTIMATED COST PHASE 2		182.80
13	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors - Stage 2	36.00	160.20
14	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors - Fleet Acquisition	30.00	9.60
			TOTAL ESTIMATED COST PHASE 3		169.80
15	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors - Stage 3	18.00	80.10
16	Public Transport	West Bank & Gaza Strip	Bus Rapid Transit Urban Corridors - Fleet Acquisition	30.00	9.60
			TOTAL ESTIMATED COST PHASE 4		89.70
	Public Transport		PUBLIC TRANSPORT GRAND TOTAL		472.77

Cost breakdown for public transport infrastructure is based on the following components and unit rates:

Tab 7. Cost Estimate Breakdown for Public Transport Infrastructure and Fleet Investments

Component	Unit rate (Euro)
Infrastructure Investments	
BRT infrastructure	m 4.45 per km
Temporary rehabilitation of stations and hubs	40,000 per station/ hub
New Stations (or major Rehabilitation) of hubs	400,000 per hub
New Stations (or major Rehabilitation) of stations	190,000 per station
New Bus Stops	12,000 per bus stop
Fleet Investments	
BRT	320,000 per bus
Intercity Bus	260,000 per bus



3.6 Investments Cost Estimate for Border Crossing Facilities

Below is the early cost estimate of all works required for achieving the proposed projects for the improvement of border crossing facilities and infrastructure.

Tab 8. Early Cost Estimate for Border Crossing facilities and infrastructure

Sn.	Sub-sector	Location	Project Title	Cost Estimate (m. €)
1	Border Crossing	West Bank	Tulkarm-Faroun Border Crossing	3.97
2	Border Crossing	West Bank	Damyeh Border Crossing	4.58
3	Border Crossing	West Bank	Karama Bridge Border Crossing	4.65
4	Border Crossing	West Bank	Tarqumiya Border Crossing	2.65
5	Border Crossing	West Bank	Beitunia Border Crossing	4.83
6	Border Crossing	Gaza Strip	Rafah Border Crossing	4.57
			TOTAL ESTIMATED COST PHASE 1 (2-yr investment plan)	25.25
7	Border Crossing	West Bank	Al Jalameh Border Crossing	5.58
8	Border Crossing	West Bank	Tell Al Bayda Border Crossing	4.24
9	Border Crossing	West Bank	Damyeh Border Crossing	11.51
10	Border Crossing	West Bank	Karama Bridge Border Crossing	3.49
11	Border Crossing	West Bank	Bayt Hanoun Border Crossing	4.15
12	Border Crossing	West Bank	King Abdallah Border Crossing	5.41
13	Border Crossing	West Bank	Bayt Jala Border Crossing	4.41
14	Border Crossing	West Bank	Freijjat (Al Dahriya) Border Crossing	3.00
15	Border Crossing	Gaza Strip	Karm Abu Salem Border Crossing	14.03
			TOTAL ESTIMATED COST PHASE 1	55.82
16	Border Crossing	West Bank	Al Jalameh Border Crossing	6.64
17	Border Crossing	West Bank	Tell Al Bayda Border Crossing	8.53
18	Border Crossing	West Bank	Tulkarm-Faroun Border Crossing	6.06
19	Border Crossing	West Bank	Tarqumiya Border Crossing	7.50
20	Border Crossing	West Bank	Bayt Hanoun Border Crossing	8.94
21	Border Crossing	West Bank	King Abdallah Border Crossing	8.59
22	Border Crossing	West Bank	Bayt Jala Border Crossing	8.13
23	Border Crossing	Gaza Strip	Rafah Border Crossing	4.80
			TOTAL ESTIMATED COST PHASE 2	59.21
	Border Crossing		BORDER CROSSING SYSTEM GRAND TOTAL	140.27

Cost breakdown for Border Crossing facilities and infrastructure is based on the following components and unit rates:

Tab 9. Cost Estimate Breakdown for Border Crossing Facilities and Infrastructure

Component	Unit rate (Euro)
Open Space	100 per sqm
Open Space Rehabilitation	50 per sqm
New buildings	600 per sqm
Covered Platforms	600 per sqm
Fences	90 per lm
Mark up on construction cost for equipment	10%-20%



3.7 Investments Costs for Logistics Areas

Below is the early cost estimate of all works required for achieving the proposed projects for the improvement of logistics areas facilities and infrastructure

Tab 10. Early Cost Estimate for Logistics Facilities and Infrastructure

Sn.	Sub-sector	Location	Project Title	Cost Estimate (m. €)
1	Logistics	West Bank & Gaza Strip	Detailed Feasibility Study of Logistics Network	1.50
2	Logistics	West Bank	Damyeh National Logistics Area - Stage 1 (50%)	10.15
			TOTAL ESTIMATED COST PHASE 1A (2-yr investment plan)	11.65
3	Logistics	West Bank	Jenin District Logistics Area	14.60
4	Logistics	West Bank	Tulkarm District Logistics Area	9.90
5	Logistics	West Bank	Jericho District Logistics Area	13.60
6	Logistics	West Bank	Bethlehem District Logistics Area	14.60
7	Logistics	West Bank	Hebron District Logistics Area	9.90
8	Logistics	Gaza Strip	Gaza District Logistics Area	14.60
9	Logistics	West Bank	Damyeh National Logistics Area - Stage 2 (100%)	10.15
10	Logistics	Gaza Strip	New Gaza Commercial Port National Logistics Area	20.30
			TOTAL ESTIMATED COST PHASE 1	107.65
11	Logistics	West Bank	Jenin District Logistics Area	15.70
12	Logistics	West Bank	Tulkarm District Logistics Area	10.30
13	Logistics	West Bank	Jericho District Logistics Area	15.70
14	Logistics	West Bank	Bethlehem District Logistics Area	15.70
15	Logistics	West Bank	Hebron District Logistics Area	10.30
16	Logistics	Gaza Strip	Gaza District Logistics Area	16.70
17	Logistics	West Bank	Damyeh National Logistics Area	30.90
18	Logistics	Gaza Strip	New Gaza Commercial Port National Logistics Area	30.90
			TOTAL ESTIMATED COST PHASE 2	146.20
	Logistics		LOGISTICS NETWORK GRAND TOTAL	265.50

Cost breakdown for logistics areas and infrastructure is based on unit rates used for the border crossing infrastructure. Equipment mark-up percent to construction is higher due to complexity of equipment required in logistics area; mark up is calculated to be 20%-40%.

4 Investment Plan

A preliminary Investment Plan is prepared with the aim to determine:

- Investment Needs per Transport Mode
- Maximum amount of resources required per year per transport mode
- Average amount of resources required per year per transport mode
- Investment Peak year during the 30-year investment plan
- Investment distribution West Bank and Gaza Strip (per capita and per sq-km)

Tab 11. Investment Cost Summary (Euro)

	Phase 1	Phase 2	Phase 3	Phase 4	
Road	860.6	684.5	130.3	297.3	1,972.7
Rail	273.6	754.2	1,409.3	946.9	3,384.0
Maritime	253.0	-	-	-	253.0
Air	143.4	118.9	-	-	262.3
Public Transport	30.5	182.8	169.8	89.7	472.8
Border Crossing	81.1	59.2	-	-	140.3
Logistics	119.3	146.2	-	-	265.5
	1,761.5	1,945.7	1,709.4	1,333.9	6,750.5

€6,750.54m is the total cost of all proposed project for projects in all modes to be phased and planned throughout 30 years in 4 different phases (including the sub-phase 1A).

4.1 Investment by Region

Projects are distributed in both West Bank and Gaza Strip. While apparently investment in West Bank is much higher, investment per capita and per sq-km justifies this apparently imbalanced distribution.

Figure 1. Expenditure per Region (West Bank/ Gaza Strip)

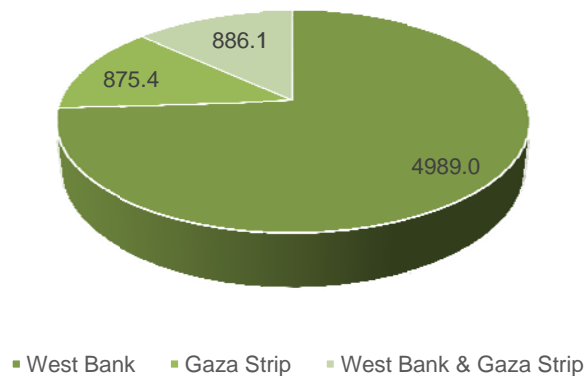


Figure 2. Expenditure per capita (€)

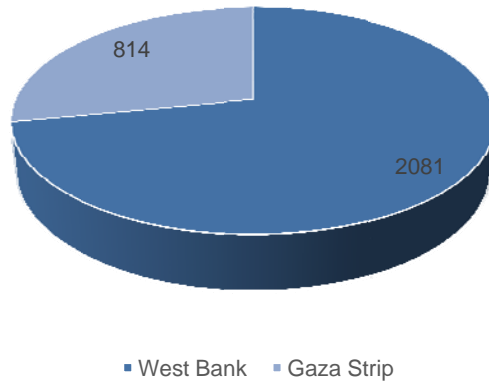
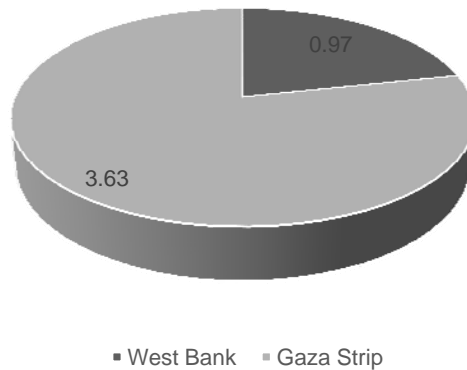


Figure 3. Expenditure per sq-km (m €)



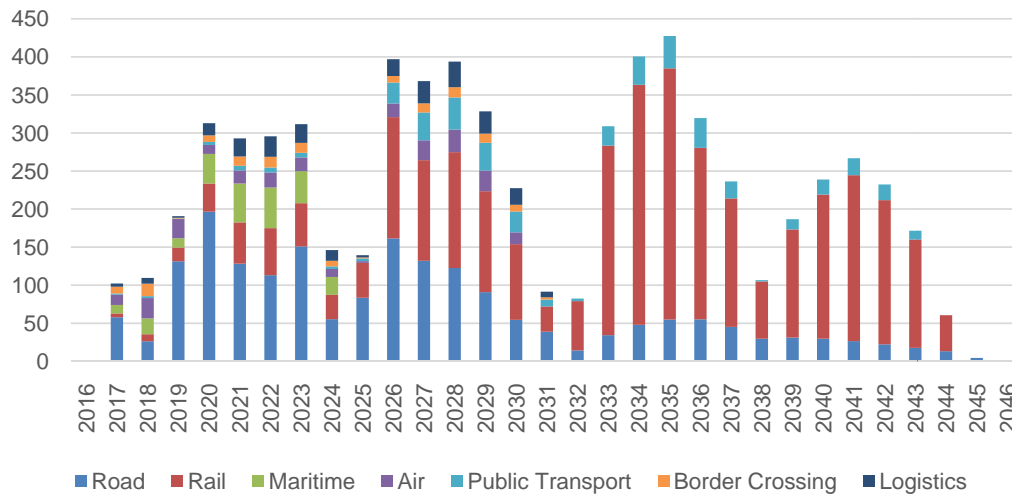
4.2 Investment by Transport Mode/ Sector

Based on a preset order and phasing of projects, discussed and refined through a number of technical meetings and seminars with multiple stakeholders, a preliminary investment plan is obtained indicating investment per year and per mode with an:

- Average annual expenditure = € 217.8m
- Maximum annual expenditure (year 2035) = € 427.4m



Figure 4. Investment by Transport Mode/ Sector



As regards investment distribution in the different phases, it is noteworthy that roads and rails, the two major components, are distributed alternately. Expenditure in the road sub sector reaches its peak in Phase 2 and gradually decreases in Phases 3 and 4, whereas expenditure in the Rail sub sector reaches its peak in Phase 4, hence maintaining a constant expenditure in Phases 1, 2 and 3; said phases are considered to be the most intense phases during the implementation of the Master Plan, whereas Phase 1A is a 2-year investment plan, which will bear a number of studies that require time and less resources while Phase 4 is also characterized by a significant decrease in investments since the major system components of all sub sectors will be in place.

Figure 5. Expenditure per Phase per Transport Mode/ Sector

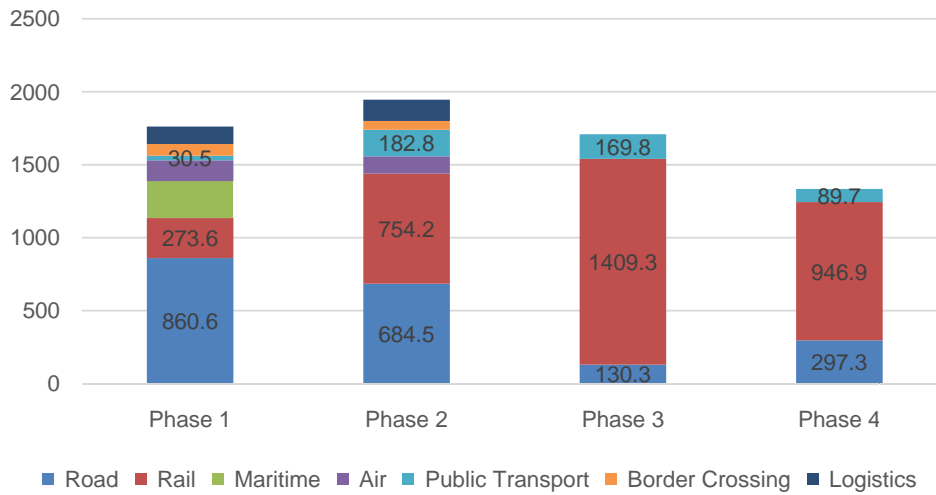
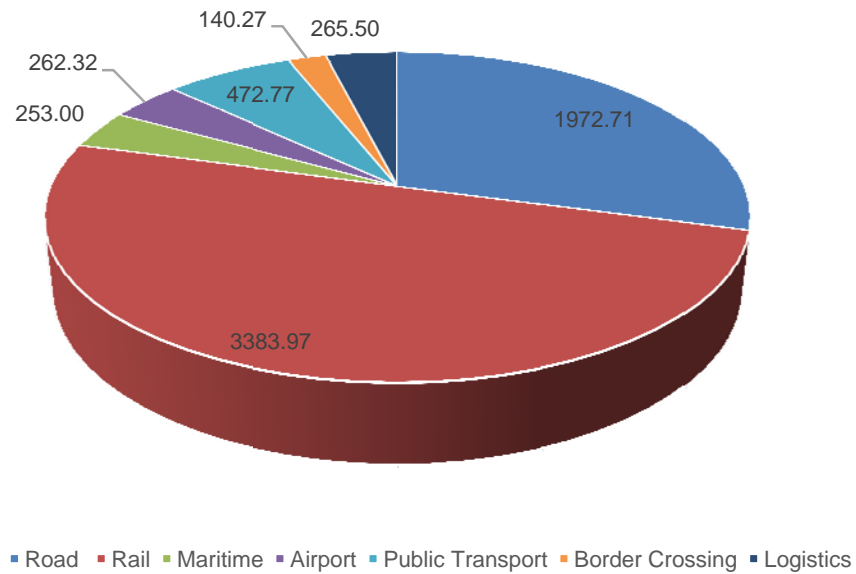


Figure 6. Expenditure Plan





5 Maintenance Cost Estimate

Maintenance costs are based on a percentage of construction cost for all sub-sectors with the exception of Public Transport which is based on vehicle*km as shown below

5.1 Maintenance Cost Estimate for Road Transport Sector

Yearly maintenance costs for **Roads** is considered to be **1%** of construction cost.

5.2 Maintenance Cost Estimate for Rail Transport Sector

Yearly maintenance costs for **Rails** is considered to be **2%** of construction cost.

5.3 Maintenance Cost Estimate for Air Transport Sector

Yearly maintenance costs for **Airports** is considered to be **0.5%** of construction cost.

5.4 Maintenance Cost Estimate for Maritime Transport Sector

Yearly maintenance costs for **Ports** is based on the following figures:

Tab 12. Average Maintenance Cost (Thoresen, 2014)

Part of the PORT STRUCTURE and Type of Equipment	Average Economical Design Life in Years	Annual Average Maintenance Cost as a Percentage of Investment Costs
Breakwater	100	2
Reinforced open berth structure	50	1-2
Steel sheet-pile berth structure	60	1-2
Rubber fenders	10	1
Concrete aprons and roads	20	1-2
Asphalt surfacing	10	2
Container gantry cranes	20	4
Mobile container cranes	15	10
Fork-lift and reach stackers	10	10
Straddle carriers	5-10	10-15
Road tractors	10	10
Warehouses and sheds	40	5

Management costs, including personnel, commercial and administrative and energy cost, are based on freight traffic (TEU). Undoubtedly, such costs are prevalent with respect to those associated with other cargos (such as Ro-Ro, bulk carrier, etc.). Management costs are evaluated for container traffic of 500,000 TEU/year. Although Gaza Commercial Port is expected to reach higher traffic volumes in Year 2045, the figures shown below are considered to contain an adequate margin of error.



Tab 13. Management Cost

Cost	€/TEU
Personnel	15
Commercial and Administrative	6
Energies	5

5.5 Maintenance Costs for Public Transport Sector

Maintenance and administrative costs for Public Transport are considered as follows:

Tab 14. Maintenance Cost Estimate for Public Transport Sector

Maintenance cost	1,760	Euro/km/year
<u>Administrative cost</u>	<u>710,000</u>	<u>Euro/year</u>
29 employees in West Bank		
18 employees in Gaza Strip		
Average salary Euro 10,560 (yearly)		
Salaries constitute 70% of admin. costs		
<u>Operational Cost</u>	<u>7,300,000</u>	
West Bank	5,300,000	Euro/year
Gaza Strip	2,000,000	Euro/year
Estimated subsidy (included in the above figures)	19%	

5.6 Maintenance Cost Estimate for Border Crossing Facilities

Yearly maintenance costs for **Border Crossings Facilities** is considered to be **0.2%** of construction cost.

5.7 Maintenance Cost Estimate for Logistics Areas

Yearly maintenance costs for **Logistic Areas** is considered to be **1%** of construction cost.

5.8 Total Maintenance cost Estimate

The following table shows the overall maintenance cost estimate for each sector.

Tab 15. Overall Maintenance Cost Estimate for Each Sector

Sector	Maintenance Cost € m
Roads	574.20
Rail	1711.21
Maritime	375.00



European
Investment
Bank



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Air	34.60
Public Transport	140.48
Border Crossing	8.42
Logistics	104.05

6 Expenditure Plan

Expenditure Plan takes into account all previous considerations regarding investments in addition to resources required for maintenance, operation and management.

Figure 7. Funding Requirements for Road Transport Sector

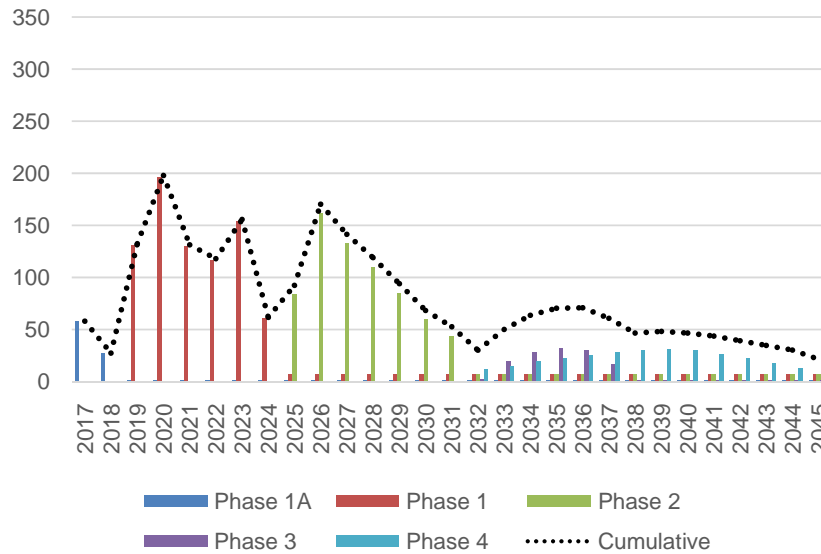


Figure 8. Funding Requirements for Rail Transport Sector

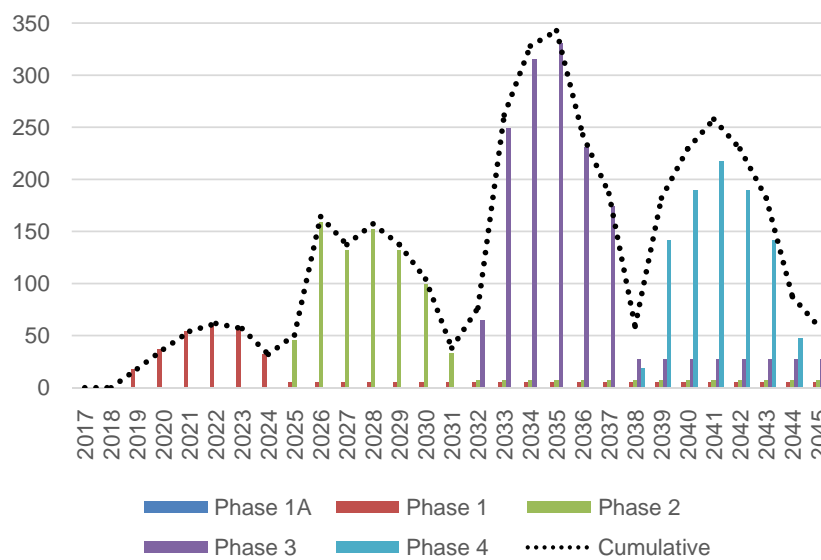


Figure 9. Funding Requirements for Air Transport Sector

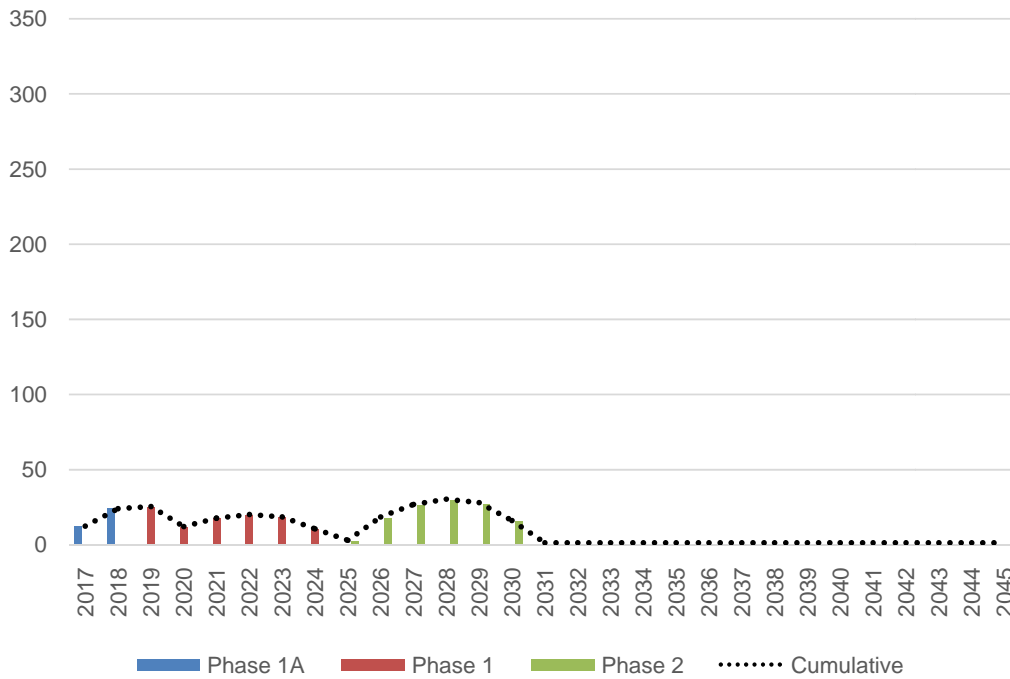


Figure 10. Funding Requirements for Maritime Transport Sector

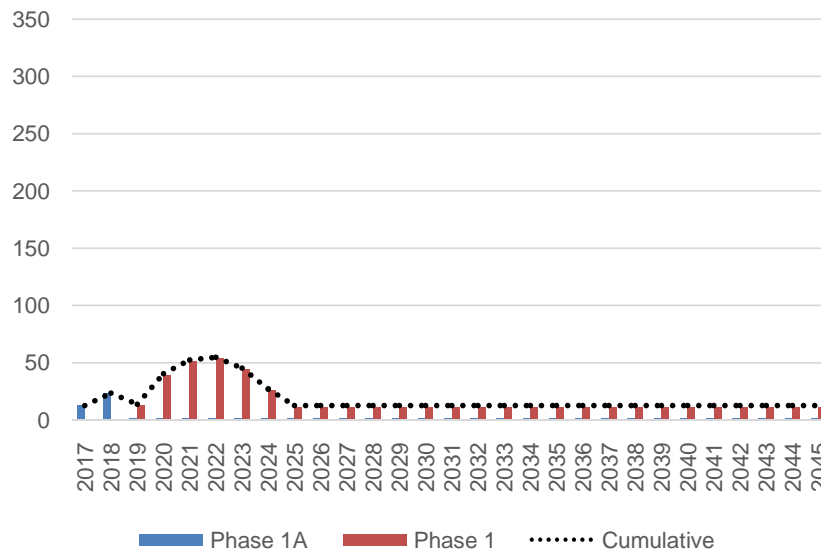
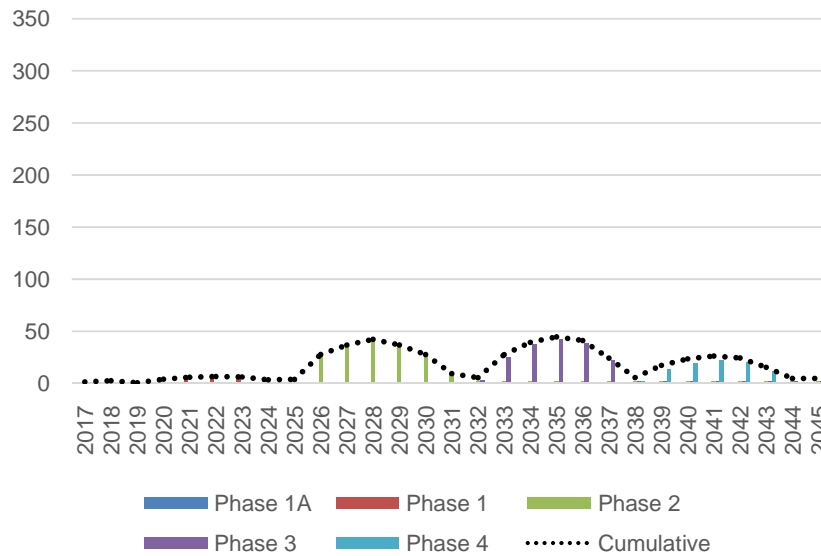




Figure 11. Funding Requirements for Public Transport Sector



The following table shows the detail investment and maintenance costs for each sector in different phases of the development of the master plan.

Tab 16. Investment, Maintenance, Operational and Management Costs

Phase / Sector	Investment Cost €m	Maintenance Cost €m
Phase 1A	84.55	34.03
Phase 1	776.06	230.38
Phase 2	684.45	181.50
Phase 3	130.32	39.10
Phase 4	297.33	89.20
Roads	1,972.71	574.20
Phase 1A	13.93	0.00
Phase 1	259.64	147.84
Phase 2	754.19	216.36
Phase 3	1,409.33	778.88
Phase 4	946.88	568.13
Rail	3,383.97	1,711.21
Phase 1A	32.00	43.50
Phase 1	221.00	331.50
Maritime	253.00	375.00
Phase 1A	40.49	1.32
Phase 1	102.93	15.44
Phase 2	118.90	17.83
Air	262.32	34.60



Phase 1A	3.90	0.12
Phase 1	26.57	7.67
Phase 2	182.80	54.84
Phase 3	169.80	50.94
Phase 4	89.70	26.91
Public Transport	472.77	140.48
Phase 1A	25.25	1.51
Phase 1	55.82	3.35
Phase 2	59.21	3.55
Border Crossing	140.27	8.42
Phase 1A	11.65	3.04
Phase 1	107.65	60.19
Phase 2	146.20	43.86
Logistics	265.50	104.05
Total	6,750.54	2,947.96



7 Ranking System

The main objective of the ranking system is to attribute numerically a rank for every project. This is applicable for networks that consist of a series of sub projects, such as the Road Network. The ranking system is mainly based on two factors:

- Traffic volumes*km (veh*km);
- Total Construction Cost (€).

Therefore, the index is based on the following formula:

$$\text{Priority Index} = \text{Traffic volumes*km (veh*km)} / \text{Total Construction Cost (€)}$$

Traffic volumes are retrieved from two main sources.

- Output traffic data extracted from the multimodal macroscopic traffic gravity model for the following sector:
 - Road (veh*km);
 - Rail (pax*km);
 - Public Transport (pax*km);
 - Border Crossing (veh).
- Macroeconomic model for travel forecast for the following sectors:
 - Airport (pax);
 - Ports (TEU).

7.1 Ranking System for Road Network

Ranking system for Road Network Projects is based on the priority index defined above. Traffic volumes expressed in vehicle*km are based on the average volume of each Project during all phases, where cost estimates refer to the cost estimate per project shown earlier and on construction complexity reflected in the cost per kilometer. Ranking results reveal to be essential in setting priority actions within each Phase, where Projects are selected and phased based on several factors in addition to expected traffic volumes. It is noteworthy that the ranking system proposed is indicative and should support, without prescribing the order of Projects, the decision making process.

7.1.1 Road Network Ranking for Phase 1

Proposed Road Projects in Phase 1 are listed and ordered according to ranking outcome.

Tab 17. Road Network Project Ranking – Phase 1

Sn.	Location	Project Title	Av. Traffic Vol. - (annual)Veh*km	Index (Volume/Cost)	Ranking
3	Gaza Strip	Salah Al Din Central Axis Road in Gaza Strip	721,428,726	18,035,718	1
8	West Bank	Road Connection between Ramallah and Nablus	297,830,183	8,137,437	2
25	West Bank	West Bank N-S Backbone Reinforcement	556,278,957	4,079,189	3



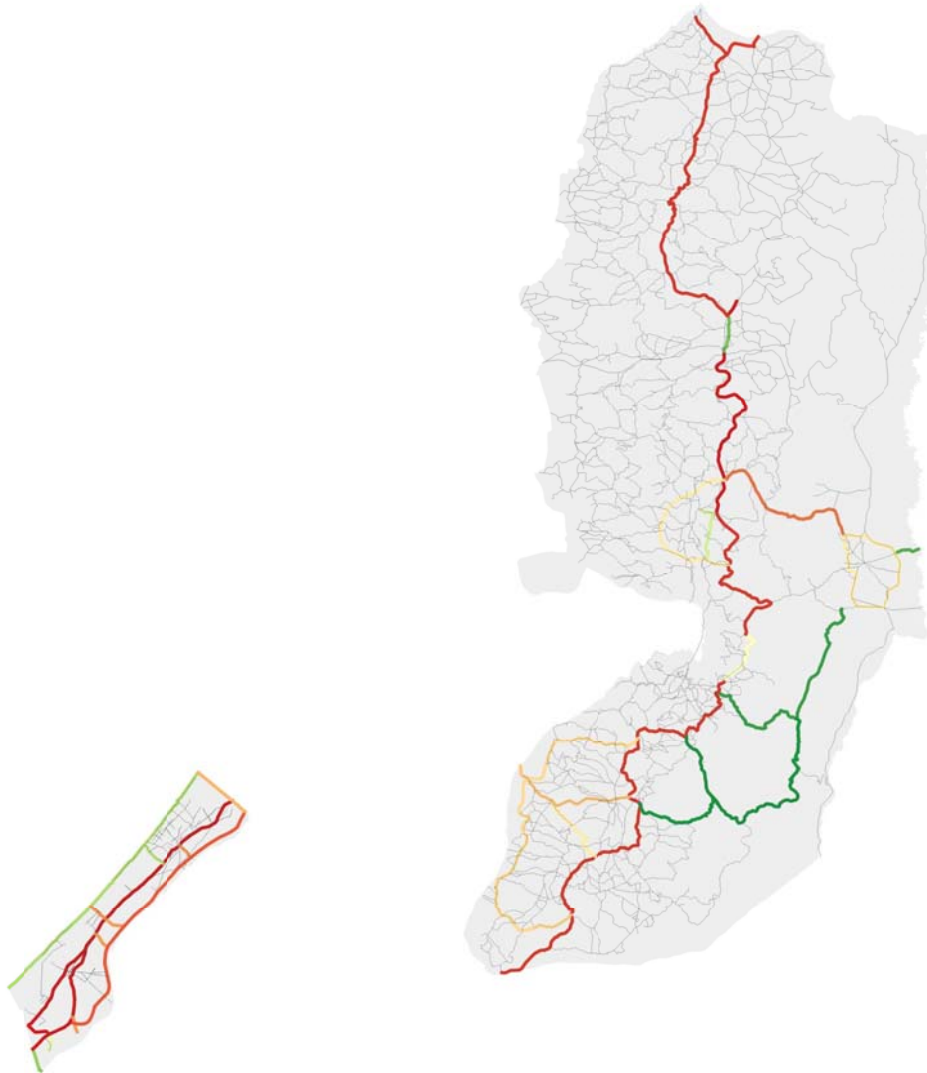
18	Gaza Strip	New Gaza Strip Eastern Corridor	203,653,956	2,495,759	4
26	West Bank	Road Connecting Ramallah to Jericho (Road n.449)	50,375,014	2,056,123	5
17	Gaza Strip	Gaza Strip Main Connections to N-S Central Axis	40,519,746	1,899,215	6
19	Gaza Strip	Coastal Road to Bayt Hanoun Road Connection	8,315,018	1,279,233	7
32	West Bank & Gaza Strip	New West Bank - Gaza Strip Corridor - Stage 1	65,113,770	1,142,347	8
20	West Bank	New Connection from Bayt Ummar - Surif - ad-Dhahiriya	60,356,413	1,059,256	9
31	West Bank & Gaza Strip	Urban Ring-roads in West Bank Main Cities - Stage 1	82,230,553	855,499	10
22	West Bank	New Connection "Wadi al-Nar"	27,489,846	618,583	11
4	Gaza Strip	Road Connection to Yasser Arafat Airport	2,586,561	574,791	12
23	West Bank	New Ramallah Eastern By-pass Road	12,724,588	349,577	13
5	Gaza Strip	Road Connection to Gaza Fishery Port	1,054,254	277,435	14
16	Gaza Strip	Gaza Strip Coastal Road	8,518,048	267,023	15
1	Gaza Strip	Road between Karem Abu-Salem BCP and Rahaf BCP	867,139	262,770	16
24	West Bank	New Nablus/Huwwara By-pass Road	7,362,680	212,181	17
7	West Bank	Road Connection to Karama Bridge BCP	394,532	109,592	18
21	West Bank	New Eastern Road Network: Nabi Musa to Bethlehem	3,069,641	98,893	19
28	West Bank	New Eastern Road Network: Nabi Musa-Hebron-Bethlehem	1,688,099	19,023	20



Figure 12. Priority Ranking – Phase 1

Priority

- proposed new roads with maximum priority
- proposed new roads with high priority
- proposed new roads with medium priority
- proposed new roads with low priority
- proposed new roads with minimum priority
- existing roads





7.1.2 Road Network Ranking for Phase 2

Proposed Road Projects in Phase 2 are listed and ordered according to ranking outcome.

Tab 18. Road Network Project Ranking – Phase 2

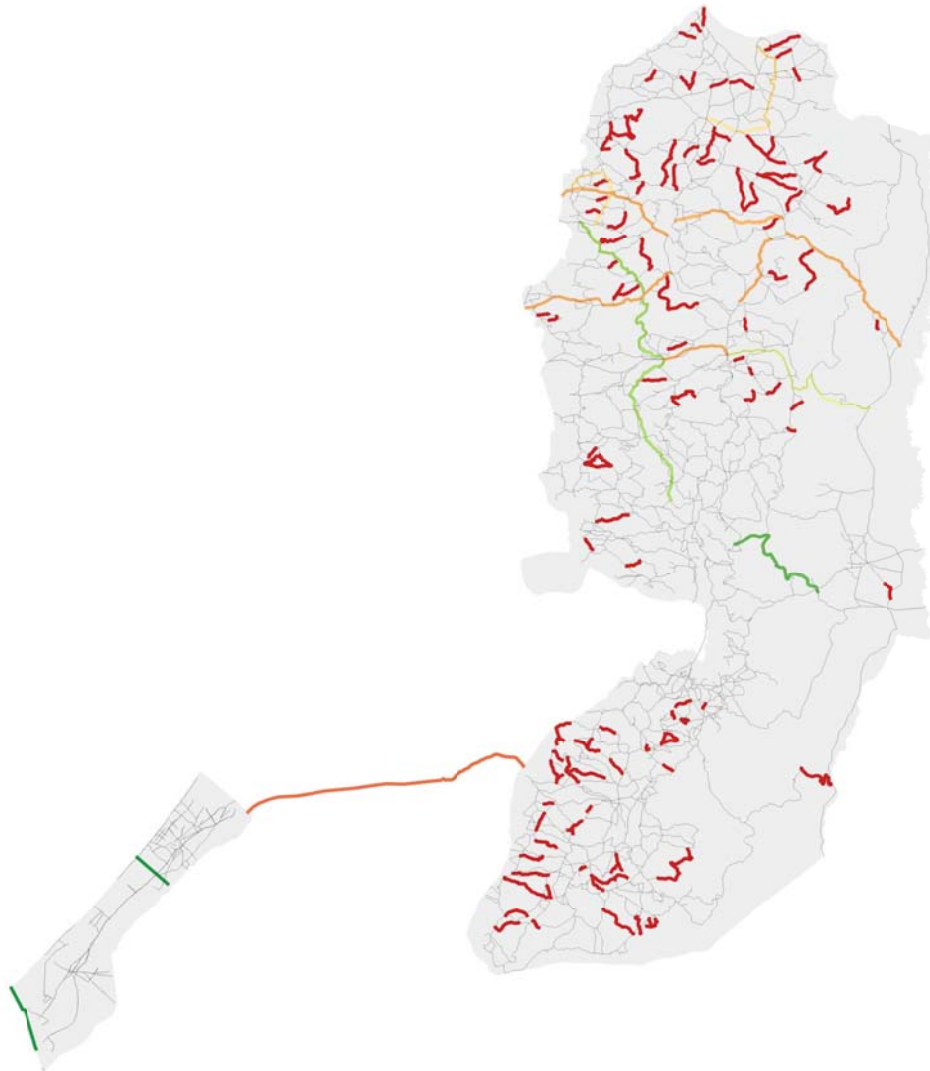
Sn.	Location	Project Title	Av. Traffic Vol. - (annual) Veh*km	Index (Volume/Cost)	Ranking
38	West Bank	Rural Roads Sealing - Stage 3 (100%)	79,948,519	7,876,701	1
39	West Bank & Gaza Strip	New West Bank - Gaza Strip Corridor - Stage 2 (100%)	228,652,854	3,558,245	2
35	West Bank	West Bank Radial Road System - Stage 1	308,721,329	1,581,564	3
40	West Bank & Gaza Strip	Urban Ring-roads in West Bank Main Cities - Stage 2 (100%)	254,282,747	1,405,498	4
37	West Bank	West-East Road Connecting Majdal to Road n°90	40,363,708	1,294,538	5
34	West Bank	New Western Connection: Tulkarm to Ramallah	133,265,623	945,146	6
36	West Bank	Road Connecting Ramallah to Jericho (Road n.457/458)	15,427,612	483,019	7
33	Gaza Strip	New Gaza Strip East-West Road Connections	4,155,966	139,462	8



Figure 13. Priority Ranking – Phase 2

Priority

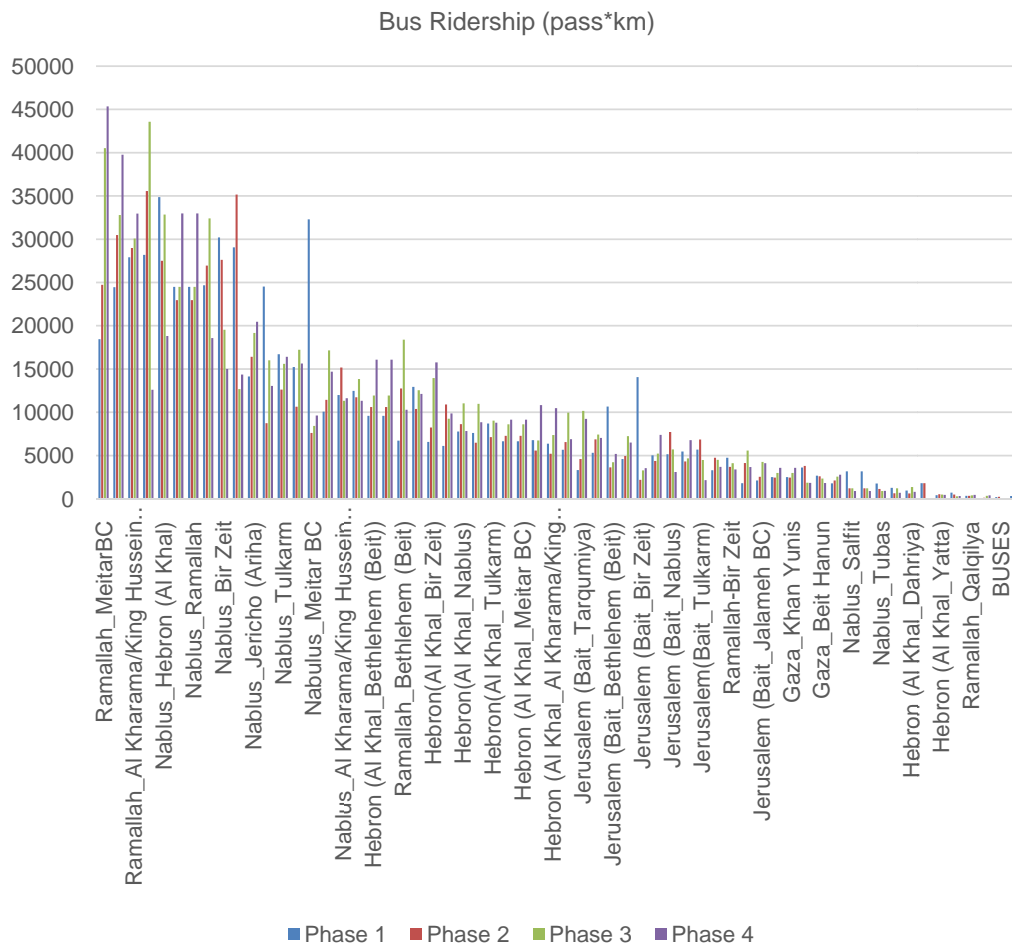
- proposed new roads with maximum priority
- proposed new roads with high priority
- proposed new roads with medium priority
- proposed new roads with low priority
- proposed new roads with minimum priority
- existing roads



7.2 Ranking System for Public Transport Network

Furthermore, due to the complexity in certain sectors to separate systems into disaggregated components such in the case of Public Transport (rail and road) the ranking system is not applied. Nevertheless, ridership data is utilized for establishing a different ranking system based on the potential utility of a given Public Transport line. As shown below proposed bus lines show different ridership results, indicative of the importance, utility, needs and requirements of every line.

Figure 14. Ridership Ranking Data for Proposed Bus lines – pax*km





8 Priority Actions

Priority actions are included in the Phase 1A (2-Year Investment Plan) and are defined on the basis of the parameters below:

- Strategic connections/ investments capable of boosting other sectors and connecting West Bank and Gaza Strip with international networks through the rehabilitation and implementation of new airport, port, border crossing points;
- Institutional and organizational improvement through establishing new agencies, units, departments, programs, etc;
- Developing ongoing/under development/ financed projects resulting from local needs and consensus between local and national governing levels.
- Response to forecast traffic volumes, passengers, freight and vehicles.

8.1 Summary of Priority Actions

8.1.1 Priority Actions for Road Transport

- Conduct a Road Re-habilitation and Up-grading Program review, within a renewed National Roads Asset Management Scheme;
- Run Regional and City Planning Conferences for National Roads – City Links shared Master Planning;
- Open Palestine – Israel joint Road Asset Management and Development Committee;
- Discuss the Opportunity for the institution of a National Road Development and Management Authority, Agency or Department;
- Launch planning and design of ring and by-pass roads of major cities in West Bank and Gaza Strip;
- Rehabilitate and upgrade existing roads connecting Ramallah-Nabulus;
- Complete and implement partially (40%) rural roads currently on the MoPWH's program;
- Launch planning and design activities for the Gaza Strip Eastern Expressway;
- Rehabilitate and upgrade road connecting to Yasser Arafat Airport in Gaza Strip;
- Rehabilitate and upgrade road/s linking to the Gaza Fishery Port;
- Launch detailed feasibility study, planning and design for a full technical, economical, financial, environmental, legal, juridical and operational assessment on the road-rail-utilities dedicated West Bank – Gaza Strip Corridor;
- Procure and install warning and guidance signs, as well as installing road safety barriers, reflectors, traffic lights and road marks;²
- Rehabilitate and upgrade the road between Karem Abu-Salem BCP and Rahaf BCP;
- Rehabilitate and upgrade of the Salah Al Din central axis road in Gaza Strip;
- Launch planning and design for new eastern road network connecting Nabi Musa-Hebron-Bethlehem;
- Rehabilitate and upgrade the road connection to Karama Bridge BCP;
- Conduct detailed surveys of road inventory and conditions;
- Restructure, organize and capacitate Roads Departments for planning and development, administration and management;

²All the sentences indicated with the symbol “*” are taken from the document *MoT, Transport Vision Master Plan, 2015*

- Conduct studies and organize activities to collect information regarding Roads Total Quality.

8.1.2 Priority Actions for Rail Transport

- Conduct Feasibility Studies and Preliminary Design on the Master Plan proposed National and International Railway Project Network;
- Launch planning and design for the for the Implementation of Nablus to Ramallah Rail Link as first stage of the North-South Rail Backbone connection;
- Open and conduct Consensus Building bi-lateral Meetings, with the diplomatic supports of the EC and the Quartet, in order to negotiate the Gaza Strip– West Bank Link and the Gaza Strip – Egypt re-opening;
- Restructure, organize and capacitate a Palestine Rail Department;
- Launch detailed feasibility study, planning and design for a full technical, economical, financial, environmental, legal, juridical and operational assessment on the road-rail-utilities dedicated Link, Gaza Strip–West Bank.

8.1.3 Priority Actions for Maritime Transport

- Negotiate Increased Fishing Mileage, together with reopening of Light Commercial port and Emergency Passenger Port, on current Fishing Harbor location;
- Develop relevant Fishing Port, with Facilities, e.g. Cold Stores, Fish Market, enhancing and fortifying the Harbor on sound foundation, ensuring safety of users³;
- Deepen the Harbor Basin, fortifying the Breakwater Structures and repairing the Northern Coast, in order to cease erosion of Ash Shati' Refugee Camp*;
- Launch planning and design activities of New Commercial Port, including RoRo, Bulk Terminal and relevant Logistics (1st Level), on current Fishing Harbor location;
- Develop Operation for a Passenger Terminal (1st Level) on current Fishing Harbor location;
- Improve the Shore area, within the Port, for City Leisure;
- Study Potentiality and Effects of Natural Gas Exploitation on Port needs;
- Launch detailed feasibility study, planning and design for the New Gaza Commercial Port;
- Structure Project Financing for Private or PPP for New Commercial Port;
- Renegotiate Foreign Trade Bilateral and Multilateral Agreements;
- Restructure, organize and capacitate Ports Authority for ports planning and development, administration and management.

8.1.4 Priority Actions for Air Transport

- Consider and negotiate Qalandiya to be re-developed and operated* for Emergency Airport, Heliport and/or Aero Club purposes;
- Reconstruct and reopen to operations Gaza Yasser Arafat Airport – Category: ICAO-C;
- Launch detailed feasibility, planning and design for the implementation of the New West Bank International Airport – Category: ICAO-F;
- Carry out and submit new international airport financing structure;
- Collect Finance, Build, Operate and Transfer program proposals on the new West Bank International Airport for government's approval;

³All the sentences indicated with the symbol “*” are taken from the document *MoT, Transport Vision Master Plan, 2015*.

- Restructure the civil aviation department for planning, administration and management of proposed airports;
- Consider Amman as an interim and temporary continued External Base International Airport.

8.1.5 Priority Actions for Public Transport

- Run Regional and City Planning Conferences for Regional and National Public Transport reorganization;
- Establish new entity for the planning, administration and management of National Public Transport Services;
- Launch planning and detailed design of the proposed Public Transport Network including design of new hubs, stations and stops;
- Temporary refurbishment of existing major hubs and stations.

8.1.6 Priority Actions for West Bank – Gaza Strip Corridor

- National road network planning, to include West Bank - Gaza Strip Corridor;
- National railways network planning and preliminary in-depth assessment to include West Bank - Gaza Strip Corridor;
- International rail links planning and preliminary in-depth assessment to include West Bank - Gaza Strip Corridor;
- First stage consensus gained on West Bank - Gaza Strip Corridor;
- West Bank - Gaza Strip Rail Link negotiation progress based on 1993 agreement stage;
- International plans/priorities re-discussed;
- Financial/operational options evaluated;
- Conduct full technical, economical, financial, environmental, legal, juridical and operational assessment on dedicated rail and utilities link, from Gaza Strip to West Bank.

8.1.7 Priority Actions for Border Crossing Points and Logistics Area

- Increase Door to Door Tonnage through Karama Bridge BCP as well as Rafah BCP;
- Negotiate additional BCP Agreements and Tonnage, also through Bulk Handling;
- Implement Security and Capacity logistics, in cooperation with Neighboring States;
- Rehabilitate and upgrade Tulkarm-Faroun, Karama Bridge, Tarqumiya, Beitunia, Damyeh and Rafah BCPs;
- Design, Approve and Launch a National Logistics Implementation Program,
- Launch negotiations with Jordanian Authorities to plan, design and implement Damyeh National Logistics Area stage 1 (50%).

8.1.8 General and Economical Priority Actions

- Plan and Launch a Communication Campaign, including Internal and International Conferences on Palestine and Regional Development, based on factual, objective and realistic Information on Programs and Action;
- Promote Internal and International debates on the positive outcomes of a regional sustainable economic and social development;
- Study and negotiate projects and programs of public utility financing avenues;
- Launch registration of interest for PPP on public utility projects;
- Participate to Donor's Conferences;



- Plan, promote and facilitate private investment in agricultural, industrial, touristic and service markets;
- Launch strategic planning projects for metropolitan growth in consideration of land and resources constraints and expected migratory in-flows, including the study of new urban areas development potentials along future infrastructural networks.

8.2 Two-Year Investment Plan(End of 2016 – 2018)

Priority actions for all sub-sector are then defined based on the previous analysis where all projects that are currently financed or that can be potentially to later stages are not considered in order to define a clear set of actions for Phase 1A, 2-Year Investment Plan that responds adequately to the immediate needs and requirements. A total of **€211.8m** is estimated for all projects for all sectors in Phase 1A, as shown below.

Tab 19. 2-Year Investment Plan Summary

Location	Cost Estimate (m. €)
West Bank	107.57
Gaza Strip	85.30
West Bank & Gaza Strip	18.90
Total – Phase 1A	211.8

Tab 20. West Bank – 2-Year Investment Plan

Sn.	Sub-sector	Project Title	Cost Estimate (m. €)
6	Road	New Eastern Road Network:Nabi Musa-Hebron-Bethlehem	2.40
7	Road	Road Connection to Karama Bridge BCP	3.60
8	Road	Road Connection between Ramallah and Nablus	36.60
9	Road	Urban Ring-roads in West Bank Main Cities	1.92
10	Road	Rural Roads Sealing - Stage 1 (40%)	20.30
3	Rail	National Railway Network Feasibility Study	3.00
4	Rail	Ramallah-Nablus Rail Connection Planning and Design	4.93
3	Airport	New West Bank International Airport	4.00
1	Border Crossing	Tulkarm-Faroun Border Crossing	3.97
2	Border Crossing	Damyeh Border Crossing	4.58
3	Border Crossing	Karama Bridge Border Crossing	4.65
4	Border Crossing	Tarqumiya Border Crossing	2.65
5	Border Crossing	Beitunia Border Crossing	4.83
2	logistics	Damyeh National Logistics Area - Stage 1 (50%)	10.15
		TOTAL	107.57

Tab 21. Gaza Strip – 2-Year Investment Plan



Sn.	Sub-sector	Project Title	Cost Estimate (m. €)
1	Road	Road between Karem Abu-Salem BCP and Rahaf BCP	3.30
2	Road	New Gaza Strip Eastern Corridor	1.63
3	Road	Salah Al Din Central Axis Road in Gaza Strip*	0.00
4	Road	Road Connection to Yasser Arafat Airport	4.50
5	Road	Road Connection to Gaza Fishery Port	3.80
1	Port	Existing Gaza Fishery Port Restructuring - Stage 1	29.00
2	Port	New Gaza Strip Commercial Port	3.00
2	Airport	Yasser Arafat Regional Airport Rehabilitation in Gaza Strip - Stage 1 (60%)	35.49
6	Border Crossing	Rafah Border Crossing	4.57
		TOTAL	85.30

* The project of Salah Al Din Central Axis Road in Gaza Strip is already financed.

Tab 22. West Bank + Gaza Strip – 2-Year Investment Plan

Sn.	Sub-sector	Project Title	Cost Estimate (m. €)
11	Road	Road Asset Management & Coordination Program	1.00
12	Road	New West Bank - Gaza Strip Corridor	2.50
13	Road	Detailed Road Inventory and Conditions Surveying	1.20
14	Road	Roads Department Capacitation	1.00
15	Road	Roads Total Quality (Planning, Design, Tendering, Construction, etc.)	0.80
1	Rail	Capacitation of Railway Management & Operations Unit	2.00
2	Rail	International Railway Network Feasibility Study	4.00
1	Airport	Capacitation of Air Transport Administration and Operations	1.00
1	Public Transport	Administrative Structuring of Public Transport Sector	1.50
2	Public Transport	Public Transport Network Detailed Study	1.00
3	Public Transport	Public Transport Design for New hubs, Stations and Stops	1.00
4	Public Transport	Temporary Refurbishment of Major hubs and stations	0.40
1	Logistics	Detailed Feasibility Study of Logistics Network	1.50
		TOTAL	18.90

For more details, refer to [Annex A.18: Priority Actions Project Sheets](#).