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LOCAL DEVELOPMENT II
URBAN PROJECT

Submitted to

USAID / CAIRO

Submitted by

WILBUR SMITH ASSOCIATES

in association with

PUBLIC ADMINISTRATION SERVICE

DEVELOPMENT CONSULTING OFFICE

DELOITTE HASKINS AND SELLS

ENGINEERING AND GEOLOGICAL CONSULTING OFFICE

ROADS AND STREETS MAINTENANCE

PORT SAID GOVERNORATE

JUNE 1989

LOCAL DEVELOPMENT II
URBAN PROJECT

LOCAL DEVELOPMENT II URBAN PROJECT

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O&M - Port Said
LD-II/89/05
September 11, 1989

H. E. General Sami Khodeir
Governor
Port Said Governorate

Your Excellency,

It is with pleasure that I forward to you five copies of the Roads and Streets Maintenance plan for Port Said Governorate in English with an Arabic translation. The plan was developed with the assistance and cooperation of Engineer Gamal El Din Mahmoud Maatouk, Director of the Road Directorate, and other members of your staff. Copies of the plan are also being furnished to Mr. Gisiger, USAID, Cairo.

Should you wish to discuss any portion of the plan or have questions in regard to any recommendations or proposals, I will be most happy to meet with you at your convenience. As stated in the plan, Investment Plan Allocations provided from the USAID Local Development II Project may be used to fund the implementation of same of the recommendations or proposals.

Your continued support of and assistance to the LD-II Urban Program is appreciated.

With deepest respect,

WILBUR SMITH ASSOCIATES

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cc: Mr. John Gisiger
USAID, Cairo
Eng. Gamal El Din Mahmoud Maatouk
Director, Road Directorate
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Coordinator

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Acknowledgements

This Roads and Streets Maintenance Plan was made possible through the assistance and cooperation of HE Governor Sami Khodeir and the many officials of the Governorate of Port Said and the Districts comprising the Governorate. Engineer Gamal El Din Mahmoud Maatouk, Director of Port Said Road Directorate, made major contributions to the plan and was invaluable in assisting in obtaining data necessary to formulate the plan. Captain Yehia Khalil, TAC Coordinator for Port Said Governorate, helped greatly by arranging for meetings between the TAC representative and Governorate officials.

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INTRODUCTION

This report is prepared for Port Said Governorate and addresses the maintenance and repair of roads and streets. The objective of the report is to assist the Road Directorate in establishing a more effective and efficient road maintenance managment system. The report covers the following main topics:

- the current organization and staffing of the Road Directorate in the Governorate and Road Sections in districts;
- roads and streets inventory and their maintenance condition;
- personnel, equipment and financial resources available;
- proposal for developing the road maintenance management system including development of organization, staffing, training and budgeting;
- development of a five-year plan for effective road maintenance in Port Said, including introducing performance standards and indicators; and
- definition of maintenance levels and responsibilities.

The Technical Assistance Contractor appreciates the assistance and cooperation of Port Said Governorate officials who helped in obtaining data and contributed to the formulation of recommendations contained in the report.

The following reports were used as references in preparing the report:

- Egyptian Maintenance Study, July 1986, prepared for USAID by Wilbur Smith Associates in association with Engineering and Geological Consulting Office.
- Road and Street Maintenance - Suez Governorate, October 1987, prepared for USAID by Wilbur Smith and Associates in association with Engineering and Geological Consulting Office.

SECTION I

BACKGROUND ANALYSIS

1. ROAD DIRECTORATE AND DISTRICT ROAD SECTIONS

1.1 Functions and Responsibilities

- The Road Directorate is one of the "Services Agencies" which is controlled by the Governor as are the other directorates. The Directorate receives general policy guidance and technical advice from the National Road and Bridge Authority.

- The Road Directorate not only maintains existing paved roads and streets with the force account of Road Sections in districts, but also executes new paving projects and major overlays by contractors under its supervision. The directorate reviews requests for such work by districts, sets specifications, estimates cost and, after checking funding approvals, prepares the tender documents and develops programs for contracting the work.

- There is a Road Section headed by a road engineer in each of the five districts. The Road Section is under the direct supervision of the district chief but is technically advised by the Road Directorate. It is responsible for road maintenance work in the districts. By force account the Road Sections execute such work as; crackfilling, pothole repairs, levelling depressions, curbstone repair or replacement, repair of mastic or tile footpaths and repair of basalt brick paving.

- For the purpose of execution of some road maintenance work by force account, the Road Directorate and Road Sections in districts are provided with resources in the form of personnel, equipment and operating budget.

- A significant portion of the need for patching asphalt street surface results from cuts in the surface made to install or repair water pipe lines, sewer lines and other utilities. These trenches are made by agencies other than the Road Directorate and are due to the growth of the city and new building construction. Due to the long delay in getting utility work completed and cleaned up and lack of coordination between different directorates, problems and conflicts are added to programming the maintenance work. Painting of lane lines and maintenance of traffic signs and signals are done by the Traffic Department and not by the Road Directorate.

1.2 Organization and Staffing

- Current organization structure of Port Said Road Directorate and Road Sections in districts appear to be suitable for implementing road maintenance programs by contractors but not effective for executing road maintenance programs by force account of Road Directorate and Road Sections in districts due to the shortage in road equipment and skilled labor. Figure 1 shows the current organization chart.

- As the current organization of the Road Directorate and Road Sections in districts is not adequate, the Road Directorate proposed a modified organization structure to develop more effective execution for road maintenance programs by force account. Figure 2 shows the modified organization chart.

- Staffing of the Road Directorate and Road Sections in districts is inadequate. They are short of engineers, technicians, foremen, equipment operators and skilled labor. The current staff for the Road Directorate and Road Sections in districts is as shown in Table 1 (administrative staffs not included):

EXISTING ORGANIZATION

Port Said Road Directorate and Road Sections in Districts

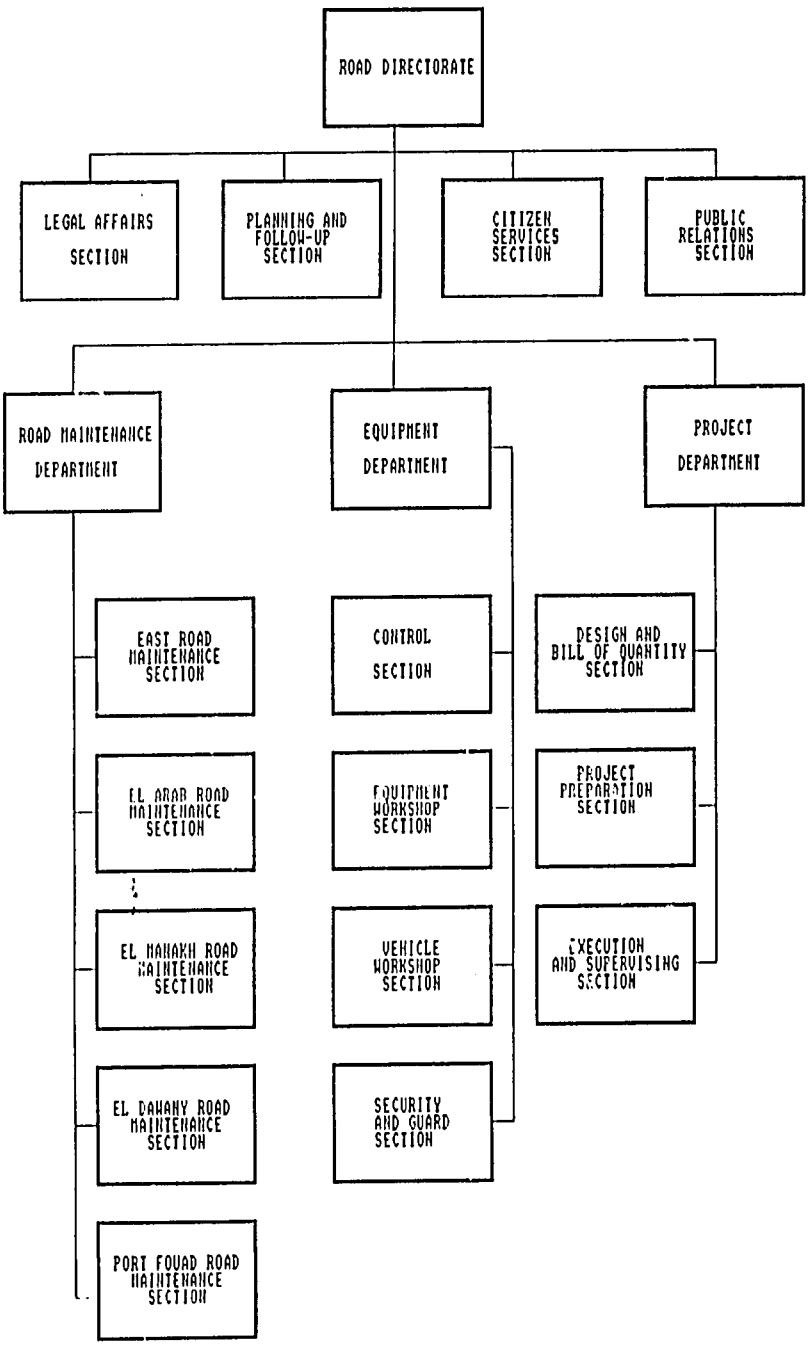

Fig. 1

nm/Figure1

MODIFIED ORGANIZATION
Port Said Road Directorate and Raod Sections In District
Proposed by the Road Directorate

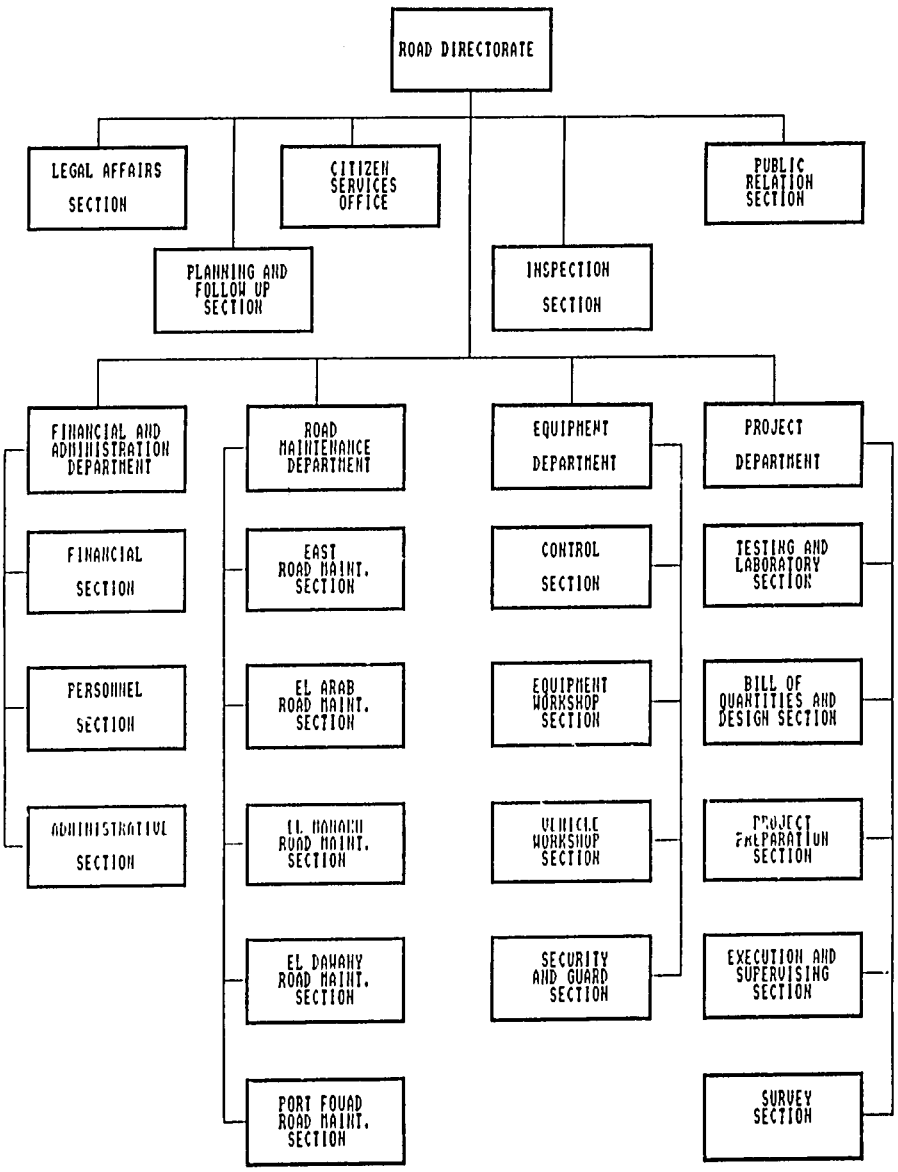

Fig. 2

nm/Figure2

TABLE 1
EXISTING STAFFING - ROAD DIRECTORATE AND DISTRICT ROAD SECTIONS

	Engineers	Technicians	Foremen	Equipment Operators	Laborers
Road Directorate	5	3	1	20	20
East District	1	1	1	8	10
El Arab District	1	1	1	8	10
El Manakh District	1	1	1	8	20
El Dawahy District	1	1	1	5	5
Port Fouad District	1	1	1	5	5
Total	10	8	6	54	70

Source: Port Said Road Directorate

- Training of road engineers, technicians, equipment operators and other trades is badly needed. Training needs are covered in Section III.

2. ROADS, STREETS AND FOOTPATHS, INVENTORY AND CONDITIONS

2.1 General

- There are three types of surfacing in Port Said City streets; asphalt concrete (AC) streets, basalt bricks (BB) streets in El Arab District, natural soil (unpaved) streets which exist in El Arab, El Manakh and Port Fouad Districts. The asphalt concrete pavements are constructed of hot-mix asphaltic concrete surfacing produced by local plants owned by paving contractors and three mobile 10 TPH batch plants owned by districts. The basalt bricks pavement is constructed of basalt brick surfacing which is no longer used for maintenance and repair work in streets paved with this type brick. The unpaved streets of Port Said are built of local soil surfaced with selected materials from Ismailia or Tenth of Ramadan areas as sub-base course.

- Most of the streets of Port Said are two, three or four lanes, double carriage way with or without median areas. They have curbings of precast concrete units defining the footpaths. Footpaths are paved with "steelcrete" colored tiles, asphalt mastic, cement concrete squares, or are unpaved. There are streets without curbings or defined footpaths.

- The main roads which connect Port Said Governorate with other governorates are Port Said-Ismailia and Port Said-Damietta road. They are constructed and maintained by the National Road and Bridge Authority.

2.2 Inventory and Conditions

Inventory and condition of Port Said roads and streets were obtained from the Port Said Road Directorate. Random inspections were made to check these data. Tables 2, 3, 4 and 5 show the inventory including surface type, condition, length and area of streets and footpaths.

TABLE 2

Road Inventory and Condition
Roadway Length in Kilometers

District	Paved									Unpaved			Total No. of Streets	Total Length (KM)	Percent of Total
	Good			Medium			Poor								
	No. of Streets	Length (KM)	Percent	No. of Streets	Length (KM)	Percent	No. of Streets	Length (KM)	Percent	No. of Streets	Length (KM)	Percent			
East District	61	25.55	82.1	4	1.36	4.4	2	4.20	13.5	-	-	-	67	31.11	19.6
El Arab District	20	6.6	24.0	33	11.32	41.0	28	9.43	35.0	-	-	-	81	27.35	17.3
El Manakh District	44	20.57	37.2	18	27.64	50.0	2	2.57	4.6	10	4.59	8.2	74	55.37	34.9
El Dawahy District	27	8.10	38.3	5	5.65	26.7	-	-	-	8	7.41	35.0	40	21.16	13.4
Port Fouad District	16	7.16	30.5	14	9.07	38.7	-	-	-	15	7.21	30.8	45	23.44	14.8
Total	168	67.98	42.9	74	55.04	34.7	32	16.2	10.2	33	19.21	12.2	307	158.43	100

Source: Port Said Road Directorate and TAC calculation

nm/table1ps

Governorate: Port Said

TABLE 3

Road Inventory and Condition
Road Area in Square Meters

District	Paved									Unpaved			Total No. of Streets	Total Area (m2)	Percent of Total
	Good			Medium			Poor								
	No. of Streets	Area (m2)	Percent	No. of Streets	Area (m2)	Percent	No. of Streets	Area (m2)	Percent	No. of Streets	Area (m2)	Percent			
East District	61	272,357	76.9	4	2,778	0.8	2	79,200	22.3	-	-	-	67	354,335	18.5
El Arab District	20	53,940	27.7	33	103,042	52.8	28	37,996	19.5	-	-	-	81	194,978	10.2
El Manakh District	44	657,622	68.9	18	244,644	25.6	2	5,600	0.6	10	46,540	4.9	74	954,406	49.8
El Dawahy District	27	101,829	54.5	5	47,250	25.3	-	-	-	8	37,670	20.2	40	186,749	9.7
Port Fouad District	16	22,280	9.9	14	51,100	22.7	-	-	-	15	151,925	67.4	45	225,305	11.8
Total	168	1108,028	57.8	74	448,814	23.4	32	122,796	6.5	33	236,135	12.3	307	1915,773	100

Source: Port Said Road Directorate and TAC calculation

nm/table2ps

Governorate: Port Said

TABLE 4

Curbstone Inventory and Condition
Road Curb Length in Linear Meters

District	Paved									Unpaved			Total Linear Meters	Total No. of Streets	Percent of Total
	Good			Medium			Poor								
	No. of Streets	Length (m)	Percent	No. of Streets	Length (m)	Percent	No. of Streets	Length (m)	Percent	No. of Streets	Length (m)	Percent			
East District	62	58,994	97.7	5	1,390	2.3	-	-	-	-	-	-	67	60,384	21.3
El Arab District	-	-	-	81	49,498	100	-	-	-	-	-	-	81	49,498	17.4
El Manakh District	24	27,800	29.5	23	36,010	38.3	5	4,430	4.7	22	25,920	27.5	74	94,160	33.1
El Dawahy District	3	2,300	6.9	13	7,000	20.9	-	-	-	24	24,166	72.2	40	33,466	11.8
Port Fouad District	8	10,320	22.1	22	22,480	48.1	-	-	-	15	13,960	29.8	45	46,760	16.4
Total	97	99,414	35.0	144	116,378	40.9	5	4,430	1.6	61	64,046	22.5	307	284,268	100

Source: Port Said Road Directorate and TAC calculation

nm/table3ps

Governorate: Port Said

TABLE 5

Sidewalk Inventory and Condition
Sidewalk Area in Square Meters

District	Sidewalk Type - With Curbstone									Unpaved Without Curbstone			Total No. of Walks	Total Area (m2)	Percent of Total
	Tiles			Mastic			Unpaved								
	No. of Walks	Area (m)	Percent	No. of Walks	Area (m2)	Percent	No. of Walks	Area (m2)	Percent	No. of Walks	Area (m2)	Percent			
East District	61	72,571	39.3	29	61,284	33.1	44	49,443	26.7	8	1,500	0.8	142	184,798	23.2
El Arab District	4	306	0.5	28	17,980	29.4	14	20,776	33.9	100	22,192	36.2	146	61,254	7.7
El Manakh District	5	5,500	1.9	75	195,400	67.3	23	29,660	10.3	52	59,580	20.5	155	290,140	36.3
El Dawahy District	-	-	-	18	10,450	15.9	30	24,249	36.8	34	31,160	47.3	82	65,859	8.2
Port Fouad District	-	-	-	68	153,390	78.0	-	-	-	30	43,260	22.0	98	196,650	24.6
Total	70	78,377	9.8	218	438,504	54.9	111	124,128	15.6	224	157,692	19.7	623	798,701	100

Source: Port Said Road Directorate and TAC calculation

nm/table4ps

3. AVAILABLE RESOURCES

3.1 Personnel

Port Said Road Maintenance Units have an inadequate number of personnel. Existing personnel (other than administrative staff) are shown in Table 1.

3.2 Vehicles and Equipment

Port Said has only a small number of vehicles and equipment. Although these pieces are in good condition, they are not enough to carry out needed maintenance. Table 6 shows the inventory and condition of these vehicles and equipment.

TABLE 6
INVENTORY AND CONDITION
OF
VEHICLES AND EQUIPMENT

Vehicles/Equipment	Origin	No. of Pieces In Operation	Faulty	Total
Buldozer	American	2	-	2
Loader	American	2	-	2
Vibrating Roller 3/4 t Ingersol	American	2	-	2
Vibrating Roller 2-3 t Ingersol	American	2	-	2
Vibrating Roller 6 t Ingersol	American	2	-	2
Vibrating Roller 9 t Ingersol	American	2	-	2
Vibrating Roller 3-5 t Elma	Italian	1	-	1
Vibrating Roller 8 t Smiza	German	1	-	1
Mobile Asphalt Patch Plant 10 TPH	American	2	1	3
Agriculture Truck 65 HP	Romanian	2	-	2
Asphalt Grouting Truck (Fiat)	Italian	2	-	2
Dump Truck 8-10 t (Ford)	Brazilian	2	-	2
Dump Truck 12 t International	American	4	-	4
Water Tank Vehicle	American	2	-	2
Pickup Vehicle Isuzu	Japanese	2	-	2
Pickup Vehicle 1/2 t Chevrolet	American	1	-	1
Crane Vehicle		1	-	1

Source: Port Said Road Directorate and TAC inspection

3.3 Annual Budget Resources

Annual road maintenance and road construction are funded by BAB II and BAB III, Governorate Service Treasury and Gasoline Revenues. The approximate current budget for FY 88/89 is as follows:

From BAB II

Equipment Maintenance	LE	30,000 approx.
Road Maintenance		500,000 approx.

From BAB III Investment

Road Construction	LE	3,000,000 approx. from free zone revenues

From Governorate Service Treasury

Road Maintenance and Paving Projects	LE	440,000 approx.

From Gasoline Revenues

Road Maintenance and Paving Projects	LE	200,000 to 500,000 depending on revenues
Total Funds	LE	4,170,000-4,470,000

The above mentioned amounts of money is inadequate to cover maintenance and new paving needs.

3.4 Port Said Road Maintenance Plans for FY 88/89

The road maintenance plan and programed work for FY 88/89 cover some of the streets in each district to be maintained or paved. The work plan is as shown in Table 7.

TABLE 7

FY 88/89 WORK PLAN

DISTRICT	NO. OF STREETS	AREA (M^2)
East	10	35,000
El Arab	8	20,000
El Manakh	9	40,000
El Dawahy	2	5,000
Port Fouad	4	30,000
Total	33	130,000

Source: Port Said Road Directorate

SECTION II
ROAD MAINTENANCE PLANNING

1. JUSTIFICATION OF MAINTENANCE

Roads and streets are always subjected to wear, damage, weathering and excavation for some utilities. These deteriorative forces begin as soon as the pavements are completely constructed and continue indefinitely. Some of the defects which occur in street pavements are due to breaks, cuts or similar damage which are either unpatched or poorly patched. Poorly set manhole covers also handicaps pavement repair. Ineffective maintenance is due to absence of maintenance plans, lack of cooperation between agencies and lack of funds and facilities necessary for maintenance. Neglecting street maintenance allows accumulations of refuse and soil which significantly reduce the capacity and utilization of the streets and sometimes reaches such a state that several blocks of streets can be inventoried as unpaved while there is pavement underneath the debris.

The decline in road surface quality over time is most apparent in the gradual loss of smoothness. This results from settlement in soil over which the road is built, incidental damages, need to disturb the surface to repair buried utilities, traffic wear, overloading, and faulty initial construction. Other roadway elements such as curbstones, drains and signs also deteriorate. The safety of travel is sometimes reduced by these defects. The most significant effect is the increasing roughness of the running surfaces and loss of pavement strength to withstand loads. Maintenance and renewal then becomes necessary. Maintenance can slow the deterioration of what was built and preserve the roads and streets at a high standard. Regular simple maintenance can do much to avoid these negative effects and to preserve the integrity and utility of streets which have been constructed at public expense. Routine road maintenance saves money and minimizes vehicle accidents.

To establish an effective road maintenance program the following must be done:

- Define the network of roads and streets to be maintained.
- Collect detailed information on streets by districts or sections.
- Identify the kind of maintenance work which is needed.
- Decide the best way of doing each activity, then develop performance standards.
- Determine how many crew-days of each activity will be needed annually.
- Calculate the resources needed for each crew-day.
- Review the calculated resources needed to decide on staffing and budget.
- Convert the previous crew-day calculation into a work program.
- Schedule the work according to resources and priorities.
- Execute, inspect and control performance, standards and production.

2. MAINTENANCE LEVELS AND ACTIVITIES

Port Said streets and footpaths were inventoried and inspected to define the kinds of maintenance activities needed to keep the streets and footpaths in good usable condition.

2.1 Maintenance Classification

- Casual Maintenance which needs prompt repair, such as sudden depression, potholes, upheavals and bleeding of asphalt, any of which require short asphalt overlays or small asphalt repairs according to the size of each defect.

- Periodic Maintenance which is done each three or four months, such as grading unpaved streets of five meters or more width with grader or shaping unpaved streets of less than five meters width with laborers.

- Annual Maintenance which is done annually such as major overlays and rehabilitation, surface dressing, footpaths repair and curbstone replacement. The overlay should be done for approximately 10% of the streets annually.

2.2 Road Maintenance Responsibilities

Table 8 shows types of road maintenance activities and for each type the responsible agency for executing the needed maintenance work.

TABLE 8
ROAD MAINTENANCE RESPONSIBILITIES

CODE	WORK TYPE	RESPONSIBILITY
01	Major overlays and rehabilitation	By contractor
02	Short asphalt overlays	Road Sections in districts
03	Small pavement repairs	Road Sections in districts
04	Curb repair or replacement	Road Sections in districts
05	Basalt bricks pavement repairs	Road Sections in districts
06	Footpaths repair (tile surface)	Road Sections in districts
07	Footpaths repair (mastic asphalt surface)	Road Sections in districts
08	Grading unpaved streets (grader)	Road Sections in districts
09	Shaping unpaved streets (labor)	Road Sections in districts
10	Surface dressing	Contractor
11	Traffic service (signs, signals, striping)	Traffic Department
12	Draining maintenance	Utility Department

Source: Port Said Road Directorate

2.3 Annual Maintenance Requirements

To estimate the annual maintenance requirements needed for each work type, it is necessary to set quality standards. By these quality standards the number of annual crew-days necessary to keept up the maintenance program can be estimated. From observation and experience a percentage of pavement areas that have to be patched each year has been determined. Table 9 reflects these percentages.

2.4 Performance Standards

- After identifying maintenance work needed, it is necessary to decide on: how the job should be done; work procedure on site, tasks and sub-tasks; size of crew needed to do the work; equipment and materials needed; and how to control quality. Performance Standards must be developed for the various tasks. Developed Performance Standards should be adjusted periodically to reflect actual performance. Figures 3 thru 10 are initial performance standards sheets for executing different maintenance work. They should be adjusted after being tested in the field.

PERFORMANCE STANDARD

ACTIVITY	CODE
Short Asphalt Overlays	02

DESCRIPTION & PURPOSE

Placing new hot-mix asphalt surfacing over existing pavement which is in poor condition due to wear, settlement or damage, to restore smoothness and strength.

PERFORMANCE GUIDELINE

This work is Limited to repair of short sections of unusual damage or failure, normally not more than 100 m in Length. Long sections or generalized failure should receive engineering study and control. Short overlays are generally placed over the full width of lane, carriageway or two-lane roadway

TEAM OF WORK	WORK METHOD
1 Foreman 1 Grader operator 1 Roller operator 3 Truck Drivers 8 Labourers	1. Place flagmen or warning signs for safety 2. Remove Loose or damaged surface 3. Repair and compact base and patch old pavement as necessary 4. Prime new base, lightly tack old surface to be overlaid 5. Place overlay with laydown machine or dump new hot-mix and spread with grader 6. Compact new overlay 7. Clean up area
EQUIPMENT	
1 Motor Grader 1 Roller 3 Dump Trucks	
MATERIAL PER DAY	ESTIMATED DAILY PRODUCTION
12 m3 Hot-mix-Asphalt 75 KG tack coat 6 m3 Crushed stone for base	150 m2

NOTES:

The standard assumes that spreading with grader will be the normal method. Material quantities are loose volume, based on 8 cm average surface thickness and 15 cm base before compaction. Base repair is assumed to be 25% of overaly area.

Source: Road and Street Maintenance, Suez Governorate

Fig. 3

nm/perform

PERFORMANCE STANDARD

ACTIVITY	CODE
Small Pavement Repairs	03

DESCRIPTION & PURPOSE

Repairing potholes, utility cuts and other damage or failure in existing asphalt pavement, by placing hot-mix patching to restore smoothness and uniform surface.

PERFORMANCE GUIDELINE

Patching to be done as soon as potholes, damage or edge breakage occur, before failure is enlarged by traffic. If the cause is evident, such as water seepage, the cause must be corrected without delay, before patching the surface. Avoid excessive primary and tack coat which might cause instability in the patch.

TEAM OF WORK	WORK METHOD
1 Foreman 1 Roller Operator 2 Truck Drivers 6 Labourers	1. Place flagmen or warning signs for safety 2. Trim pothole or damaged areas back to sound edges Remove Loose or weak materials 3. Repair and compact base as necessary 4. Prime new base, lightly tack sides and bottom of areas to be patched 5. Place patching hot-mix 6. Compact throughly, to same level as adjacent pavement or slightly higher (one to two cm) 7. Clean up area
EQUIPMENT	
1 Roller 2 Dump trucks	
MATERIAL PER DAY	ESTIMATED DAILY PRODUCTION
8 m3 Hot mix Asphalt 20 KG Tack Coat 4 m3 Crushed stone for base	100 m2

NOTES:

Materials are loose, based on 8 cm average thickness of asphalt patches and 15 cm base, before compaction. Base repair is assumed to be necessary for under 15% of patches.

Source: Road and Street Maintenance, Suez Governorate

Fig. 4

nm/perform2

PERFORMANCE STANDARD

ACTIVITY	CODE
Curbstone Repair or Replacement	04

DESCRIPTION & PURPOSE

Re-set or replace curbstone sections which are loose, tilted, broken or missing to restore previously - existing curbing

PERFORMANCE GUIDELINE

This work is intended to be the maintenance of lines of precast or cutstone sectional curbs constructed earlier

TEAM OF WORK	WORK METHOD
1 Foreman 1 Truck Driver 3 Masons 6 Labourers	1. Place flagmen or warning signs for safety 2. Remove and dispose of broken curbstone sections and other unusable materials 3. Excavate to correct line and grade, compacting underlaying soil and new bedding material as necessary 4. Re-set existing usable sections and add new curbstone section as necessary, with mortared base and joint. Check for finish line and grade 5. Clean up area
EQUIPMENT	
1 Dump Truck	

MATERIAL PER DAY	ESTIMATED DAILY PRODUCTION
50 Pre-Cast Curbstones (0.5 m Length each) 1.0 m3 Bedding Sand 0.5 m3 Mortor	50 m Length

NOTES:

The standard assumes that in maintaining existing lines of curbs which have been damaged or disturbed, half of the old sections can be re-used.

Source: Road and Street Maintenance, Suez Governorate

Fig. 5

nm/perform3

PERFORMANCE STANDARD

ACTIVITY	CODE
Basalt Bricks Pavement Repair	05

DESCRIPTION & PURPOSE

Replacing and leveling the broken basalt bricks which are in poor condition due to settlement or damage to restore smoothness and strength.

PERFORMANCE GUIDELINE

This work is limited to repair of short sections of unusual damage or failure, normally not more than 50 m in length

TEAM OF WORK	WORK METHOD
1 Foreman 2 Masons 1 Truck Driver 6 Laborers	1. Place flagmen or warning signs for safety 2. Remove loose or damaged surface 3. Repair and compact base course under basalt bricks 4. Place mortar under basalt bricks 5. Place basalt bricks and grout after checking for level 6. Clean up the surface after finishing
EQUIPMENT	
1 Dump Truck	

MATERIAL PER DAY	ESTIMATED DAILY PRODUCTION
50 m2 Basalt bricks 5 m3 Sand 0.5 m3 Mortar	50 m2

NOTES:

Source: Port Said Road Directorate and TAC

Fig. 6

nm/perform4

PERFORMANCE STANDARD

ACTIVITY	CODE
Footpaths Repair (Tile Surface)	06

DESCRIPTION & PURPOSE

Replacing loose and broken tiles which are in poor condition due to settlement or damage to restore smoothness and strength.

PERFORMANCE GUIDELINE

This work is limited to repair of short sections of unusual damage or failure, normally not more than 100 m in length

TEAM OF WORK	WORK METHOD
1 Foreman 2 Masons 2 Truck Driver 6 Laborers	1. Place flagmen or warning signs for safety 2. Remove loose or damaged surface 3. Repair and compact base course under tiles 4. Overlay mortar under tiles 5. Place tiles and grout after checking levelling 6. Clean up the surface after finishing
EQUIPMENT	
2 Dump Truck	
MATERIAL PER DAY	**ESTIMATED DAILY PRODUCTION**
100 m2 Tiles 10 m3 Sand 2 m3 Mortar	100 m2

NOTES:

Source: Port Said Road Directorate and TAC

Fig. 7

nm/perform5

PERFORMANCE STANDARD

ACTIVITY	CODE
Footpaths Repair (Mastic Asphalt Surface)	07

DESCRIPTION & PURPOSE

Placing new mastic asphalt to restore smoothness and strength

PERFORMANCE GUIDELINE

This work is Limited of short sections of unusual damage or failure, normally not more than 100 m in length

TEAM OF WORK	WORK METHOD
1 Foreman 2 Plasters 1 Roller operator 2 Truck Drivers 8 Laborers	1. Place flagmen or warning signs for safety 2. Remove loose or damaged surface 3. Repair and compact base course 4. Place new mastic asphalt and spread it with shovels 5. Compact new overlay 6. Clean up area
EQUIPMENT	
1 Roller 0.5 - 1.0 t 2 Dump Truck	
MATERIAL PER DAY	**ESTIMATED DAILY PRODUCTION**
5 m3 Mastic asphalt 10 m3 Sand	100 m2

NOTES:

Source: Port Said Road Directorate and TAC

Fig. 8

nm/perform6

PERFORMANCE STANDARD

ACTIVITY	CODE
Grading Unpaved Streets (Grader)	08

DESCRIPTION & PURPOSE

The re-shaping of unpaved streets previously constructed for vehicular use, by machine, to restore a reasonably uniform grade and cross-section

PERFORMANCE GUIDELINE

This work is required at intervals of about four months, on unpaved streets in regular use, when they have developed holes, corrugation, traffic ruts, uneven settlement, or accumulations of debris which obstruct vehicular use.

TEAM OF WORK	WORK METHOD
1 Grader Operator	1. With motor grader, cut high places and fill low areas on travelway of unpaved street. Starting outside edges and blading usable material toward center 2. Blade off large stones, trash and other unusable material, disposing of it beyond the travelway or windrowing the material for later collection and disposal. 3. Strike off and spread evenly any excess usable material bladed toward the center of the street, obtain a firm, even grade and cross-section
EQUIPMENT	
1 Grader	

MATERIAL PER DAY	ESTIMATED DAILY PRODUCTION
None	1.5 KM of street length

NOTES:

Source: Road and Street Maintenance, Suez Governorate

Fig. 9

nm/perform7

PERFORMANCE STANDARD

ACTIVITY	CODE
Shaping Unpaved Streets (Labor)	09

DESCRIPTION & PURPOSE

Reshaping unpaved streets to restore grade, width and riding surface

PERFORMANCE GUIDELINE

Reshaping unpaved streets previously constructed and in use, to restore an adequate grade and width, using hand methods assisted by a loader

TEAM OF WORK	WORK METHOD
1 Foreman 1 Loader Operator 2 Truck Drivers 8 Laborers	1. Cut down high places in street surface. Use suitable material to fill low places. Use pick shovel, assisted by loader when feasible, to cut and move material, and to compact filled area 2. Load and dispose of trash, debris and other unsuitable material
EQUIPMENT	
1 Loader 2 Dump Truck	
MATERIAL PER DAY	ESTIMATED DAILY PRODUCTION
None	0.5 KM of street length

NOTES:

This work is needed to maintain public access streets too narrow for general vehicular use, normaly less than five meters wide.

Source: Road and Street Maintenance, Suez Governorate

Fig. 10

nm/perform8

TABLE 9

ANNUAL MAINTENANCE REQUIREMENTS
BY PERCENTAGE

CODE	ACTIVITY DESCRIPTION	SURFACE	CONDITION	YEARLY % OF AREA OR LENGTH	FREQUENCY
02	Short Overlay	Paved surface	Good	1.0 % Area	Continuous
			Medium	1.1 % Area	Continuous
			Poor	1.2 % Area	Continuous
03	Small Pavement Repairs	Paved Surface	Good	0.1 % Area	Continuous
			Medium	0.15 % Area	Continuous
			Poor	0.2 % Area	Continuous
04	Curbstone Repair or Replacement	Sectional Curb	Good	4.0 % Length	Continuous
			Medium	5.0 % Length	Continuous
			Poor	6.0 % Length	Continuous
05	Basalt Bricks Pavement Repairs	Paved Surface		2.0 % Area	Continuous
06	Footpaths Repair	Tile Surface		1.0 % Area	Continuous
07	Footpaths Repair	Mastic Surface		1.0 % Area	Continuous
08	Grading Unpaved Streets (Grader)	Unpaved Surface		100 % Length	4 month
09	Shaping Unpaved Streets (Laborers)	Unpaved Surface		100 % Length	Annual

Source: Port Said Road Directorate and TAC

2.5 Work Quantities and Crew Days

Calculations are made separately for the streets of the five districts of Port Said City to determine the work quantities and crew-days for each activity. The results of these estimates are shown in tables 10 through 15.

3. FIVE YEARS MAINTENANCE PLAN

Based on the study of Port Said Road Directorate and District Road Sections, a five year master plan and two year maintenance plan are outlined.

3.1 Required Work for a five year period is as shown in Table 16.

TABLE 10

DERIVATION OF WORK QUANTITIES AND CREW-DAYS
EAST DISTRICT

CODE	ACTIVITY		CONDITION RATING	ANNUAL % * OF AREA OR LENGTH	INVENTORY QUANTITIES	ANNUAL** WORK QUANTITY	DAILY PRODUCTION RATE	CREW-DAYS	CREW-DAYS
	DESCRIPTION	SURFACE							
02	Short Overlay	Paved Surface	Good	1.0 %	272,357	2,724	150	18.2	
			Medium	1.1 %	2,778	31	150	0.2	25
			Poor	1.2 %	79,200	950	150	6.3	
03	Small Pavement Repairs	Paved Surface	Good	0.1 %	272,357	272	100	2.7	
			Medium	0.15 %	2,778	4.2	100	0.04	5
			Poor	0.2 %	79,200	158	100	1.6	
04	Curbstone Repair	Sectional Curb	Good	4.0 %	58,994	2,360	50	47	
			Medium	5.0 %	1,390	70	50	1.4	49
			Poor	6.0 %	-	-	50	-	
05	Basalt Bricks Repairs	Paved Surface		2.0 %	-	-	50	-	
06	Footpath Repair	Tile Surface		1.0 %	72,571	726	100	7.6	8
07	Footpaths Repair	Mastic Surface		1.0 %	61,284	613	100	6.1	7
08	Grading Unpaved Streets	(Grader)		100 %	-	-	1.5	-	
09	Shaping Unpaved Streets	(Laborers)		100 %	-	-	0.5	-	

Source: TAC calculation

* From Table 9

** From Tables 2 though 5

nm/table14

TABLE 11

DERIVATION OF WORK QUANTITIES AND CREW-DAYS
EL ARAB DISTRICT

CODE	ACTIVITY		CONDITION RATING	ANNUAL % * OF AREA OR LENGTH	INVENTORY QUANTITIES	ANNUAL WORK QUANTITY	DAILY ** PRODUCTION RATE	CREW-DAYS	CREW-DAYS
	DESCRIPTION	SURFACE							
02	Short Overlay	Paved Surface	Good	1.0 %	53,940	539	150	3.6	
			Medium	1.1 %	103,042	1,133	150	7.6	13
			Poor	1.2 %	13,114	157	150	1.05	
03	Small Pavement Repairs	Paved Surface	Good	0.1 %	53,940	54	100	0.54	
			Medium	0.15 %	103,042	155	100	1.55	3
			Poor	0.2 %	13,114	26	100	0.26	
04	Curbstone Repair	Sectional Curb	Good	4.0 %	-	-	50	-	
			Medium	5.0 %	49,498	2,475	50	49.5	50
			Poor	6.0 %	-	-	50	-	
05	Basalt Bricks Repairs	Paved Surface		2.0 %	24,882	498	50	9.96	10
06	Footpaths Repair	Tile Surface		1.0 %	306	3.06	100	0.03	1
07	Footpaths Repair	Mastic Surface		1.0 %	17,980	180	100	1.8	2
08	Grading Unpaved Streets	(Grader)		100 %	-	-	1.5	-	
09	Shaping Unpaved Streets	(Laborers)		100 %	-	-	0.5	-	

Source: TAC calculation

* From Table 9

** From Table 2 through 5

nm/table15

TABLE 12

DERIVATION OF WORK QUANTITIES AND CREW-DAYS
EL MANAKH DISTRICT

CODE	ACTIVITY		CONDITION RATING	ANNUAL % * OF AREA OR LENGTH	INVENTORY QUANTITIES	ANNUAL WORK QUANTITY	DAILY** PRODUCTION RATE	CREW-DAYS	CREW-DAYS
	DESCRIPTION	SURFACE							
02	Short Overlay	Paved Surface	Good	1.0 %	657,622	6,576	150	43.8	
			Medium	1.1 %	244,644	2,691	150	17.9	62
			Poor	1.2 %	5,600	67	150	0.4	
03	Small Pavement Repairs	Paved Surface	Good	0.1 %	657,622	658	100	6.6	
			Medium	0.15 %	244,644	367	100	3.7	11
			Poor	0.2 %	5,600	11	100	0.1	
04	Curbstone Repair	Sectional Curb	Good	4.0 %	27,800	1,112	50	22.2	
			Medium	5.0 %	36,010	1,801	50	36.02	64
			Poor	6.0 %	4,430	266	50	5.3	
05	Basalt Bricks Repairs	Paved Surface		2.0 %	-	-	50	-	
06	Footpaths Repair	Tile Surface		1.0 %	5,500	55	100	0.55	1
07	Footpaths Repair	Mastic Surface		1.0 %	195,400	1,954	100	19.54	20
08	Grading Unpaved Streets	(Grader)		100 %	3.5	3.5	1.5	2.3	3
09	Shaping Unpaved Streets	(Laborers)		100 %	1.09	1.09	0.5	2.18	3

Source: TAC calculation

* From Table 9

** From Tables 2 through 5

nm/table16

TABLE 13

DERIVATION OF WORK QUANTITIES AND CREW-DAYS
EL DAWAHI DISTRICT

CODE	ACTIVITY		CONDITION RATING	ANNUAL % * OF AREA OR LENGTH	INVENTORY QUANTITIES	ANNUAL WORK QUANTITY	DAILY** PRODUCTION RATE	CREW-DAYS	CREW-DAYS
	DESCRIPTION	SURFACE							
02	Short Overlay	Paved Surface	Good	1.0 %	101,829	1018	150	6.8	
			Medium	1.1 %	47,250	520	150	3.5	11
			Poor	1.2 %	-	-	150	-	
03	Small Pavement Repairs	Paved Surface	Good	0.1 %	101,829	102	100	1.02	
			Medium	0.15 %	47,250	71	100	0.71	2
			Poor	0.2 %	-	-	100	-	
04	Curbstone Repair	Sectional Curb	Good	4.0 %	2,300	92	50	1.84	
			Medium	5.0 %	7,000	350	50	7.0	9
			Poor	6.0 %	-	-	50	-	
05	Basalt Bricks Repairs	Paved Surface		2.0 %	-	-	50	-	-
06	Footpaths Repairs	Tile Surface		1.0 %	-	-	100	-	-
07	Footpaths Repair	Mastic Surface		1.0 %	10,450	105	100	1.05	2
08	Grading Unpaved Streets	(Grader)		100 %	4.2	4.2	1.5	2.8	3
09	Shaping Unpaved Streets	(Laborers)		100 %	3.21	3.21	0.5	6.4	7

Source: TAC calculation

* From Table 9
** From Tables 2 through 5

nm/table17

TABLE 14

DERIVATION OF WORK QUANTITIES AND CREW-DAYS
PORT FOUAD DISTRICT

CODE	ACTIVITY		CONDITION RATING	ANNUAL % * OF AREA OR LENGTH	INVENTORY QUANTITIES	ANNUAL WORK QUANTITY	DAILY** PRODUCTION RATE	CREW-DAYS	CREW-DAYS
	DESCRIPTION	SURFACE							
02	Short Overlay	Paved Surface	Good	1.0 %	22,280	223	150	1.5	
			Medium	1.1 %	51,100	562	150	3.7	6
			Poor	1.2 %	-	-	150	-	
03	Small Pavement Repairs	Paved Surface	Good	0.1 %	22,280	22	100	0.22	
			Medium	0.15 %	51,100	77	100	0.77	1
			Poor	0.2	-	-	100	-	
04	Curbstone Repair	Sectional Curb	Good	4.0 %	10,320	412	50	8.2	
			Medium	5.0 %	22,480	1,124	50	22.5	31
			Poor	6.0 %	-	-	50	-	
05	Basalt Bricks Repairs	Paved Surface		2.0 %	-	-	50	-	
06	Footpaths Repair	Tile Surface		1.0 %	-	-	100	-	
07	Footpaths Repair	Mastic Surface		1.0 %	153,390	1,534	100	15.3	16
08	Grading Unpaved Streets	(Grader)		100 %	6.1	6.1	1.5	4.06	5
09	Shaping Unpaved Streets	(Laborers)		100 %	1.11	1.11	0.5	2.22	3

Source: TAC calculation

* From Table 9

** From Tables 2 through 5

nm/table18

TABLE 15

Summary of Crew Days

Activity	District					Total
	East	El Arab	El Manakh	El Dawahi	Port Fouad	
02	25	13	62	11	6	117
03	5	3	11	2	1	22
04	49	50	64	9	31	203
05	-	10	-	-	-	10
06	8	1	1	-	-	10
07	7	2	20	2	16	47
08	-	-	3	3	5	11
09	-	-	3	7	3	13

Source: Tables 10-14 and TAC Calculation

ia/table19

TABLE 16

QUANTITIES OF REQUIRED WORK
Five Year Period

Execution	Activities		Districts					Total
			East	Al Arab	Al Manakh	Al Dawahy	Port Fouad	
By Sections in Districts	Short asphalt overlay	(m2)	18,525	4,145	46,670	7,690	3,925	80,955
	Small pavement repairs	(m2)	2,170	1,175	5,180	865	495	9,885
	Curb repair	(m.l)	12,150	12,375	15,895	2,210	7,680	50,310
	Basalt brick repair	(m2)	-	2,490	-	-	-	2,490
	Footpaths repair (tile)	(m2)	3,630	200	275	-	-	3,925
	Footpaths repair (mastic)	(m2)	3,065	900	9,770	525	7,670	21,930
	Grading unpaved streets	(km)	-	-	17.5	21	3,0.5	69
	Shaping unpaved streets	(km)	-	-	5.45	16.05	5.55	27.05
By Contractors Under Road Directorate Supervision	Major overlay	(m2)	177,165	85,050	453,930	74,540	36,690	827,375
	Curbstone replacement	(m.l)	30,190	24,750	34,120	4,650	16,400	110,110
	Footpaths overlay	(m2)	67,015	9,140	100,450	5,225	76,695	258,525
	Provision of road materials		Five time the materials in table (26)					

Source: TAC calculation

nm/table4-2

3.2 **Required Labor Hours:**

Foreman	12,660 hrs
Grader operator	3,840 hrs
Loader operator	390 hrs
Roller operator	5,580 hrs
Truck operator	20,940 hrs
Mason	22,290 hrs
Laborer	80,940 hrs

3.3 **Equipment Operating Hours**

Grader	3,840 hrs
Roller	5,580 hrs
Loader	390 hrs
Dump Truck	20,940 hrs

3.4 Required Materials

Table 17 shows the materials required and estimated cost at 1989 prices.

TABLE 17
ESTIMATED MATERIALS AND COST

Materials	Unit	Quantities	Quantities + 10% Losses	Estimated Unit Cost (LE)	Total Cost LE
Hot-Mix Asphalt	m^3	7,900	8,690	60	521,400
Tack Coat	kg	46,075	50,682	0.05	2,535
Crushed Base	m^3	3,950	4,345	20	86,900
Curbstone	l.m	50,750	55,825	8	446,600
Sand	m^3	4,115	4,525	8	36,200
Mortar	m^3	635	700	50	35,000
Basalt Brick	m^2	2,500	2,750	15	41,250
Tiles	m^2	5,000	5,500	8	44,000
Mastic Asphalt	m^3	1,175	1,295	50	64,750
Total					LE 1,278,635

Source: TAC Calculation

3.5 Equipment Services and Repair Cost

Equipment Services and Repairs	LE 250,000
Spare Parts	LE 150,000
Total	LE 400,000

3.6 Estimated Fuel Cost For Equipment Operating Hours

Total operating hours = 30,750 hrs

Total Fuel Cost = 30,750 hrsx100 avg.hp x 0.2 kg.fuel/hp/hr x LE 0.15/kg	= LE 92,250
Oil and Grease = 30,750 hrsx100 avg.hp x 0.5 kg.oil/hp/hr x LE 1.20/kg	= LE 36,900
	LE 129,150

3.7 Estimated Cost for Work by Contractors

Major overlay with 4 cm hot-mix asphalt	= 82,375 m^2 x LE 3.4 per m^2	= LE 2,813,075
Curbstone replacement	= 110,110 l.m x LE 10 per l.m	= LE 1,101,100
Footpath overlay	= 258,525 m^2 x LE 3 per m^2	LE 775,575
Adjusting level of manhole covers		LE 50,000
Total		LE 4,739,750

3.8 Road Materials and Soil Testing Laboratory

A small asphalt, materials and soil testing laboratory is required for quality control of hot-mix asphalt, road materials and soil testing. A proposed list of test equipment which is required for the Road Directorate is shown in Table 18. The estimated cost for the laboratory equipment and furnishing is as follows:

Laboratory equipment and apparatus	LE 40,815
Furnishing the laboratory	LE 7,000

	LE 47,815

3.9 Equipment Purchase

Existing equipment in the Road Directorate and Road Sections in districts is listed in Table 6. The list indicates the type and number of equipment. The existing equipment is suitable in size and configuration for road maintenance and is in good condition with respect to function. Due to the lack of some types of equipment in districts, it is necessary to provide the Road Directorate and Road Sections with new types of equipment to fulfill the road maintenance plan and program by the force account. The required equipment, types, number and estimated cost are as shown in Table 19.

TABLE 18

List Of Required Test Equipment For Road Directovate Laboratory

Item	Description	Number Required	Expected Unit Price	Estimated Total Price
1	Sets of Sieves 203 mm diameter including the following sieve sizes: 75 mm 63 mm 50 mm 37 1/2 mm 25 mm 19 mm 12 1/2 mm 9 1/2 mm 4.75 mm 2.36 mm 1.18 mm 0.425 mm 0.6 mm 0.15 mm 0.075 mm Pan & cover	1	2,220 (185 for each sieve)	2,220
2	Motorized Dynamic Sieve Shaker for 203 mm Sieves (Electrical)	1	4,500	4,500
3	Laboratory Oven 50x50x50 cm minimum, 110 c min.	1	2,200	2,200
4	Balance capacity 20 kg with sensitivity 1 gm.	1	4,200	4,200
5	Balance Capcity 2.610 kg with sensitivity 0.1 gm.	1	1,400	1,400
6	Liquid Limit Devices, complete	1	980	980
7	Complete Proctor Apparatus with four moulds, hammer and sample extruder	1	650	650
8	Mould, CBR, with plate, collar, Penetration piston and expansion device.	1	1,395	1,395
9	Sand Cone Density Apparatus	1	550	550
10	Test Set For Penetration of Bituminous Materials.	1	2,600	2,600
11	Complete Bituminous Extraction Apparatus (elect.)	1	7,000	7,000
12	Core Drilling Apparatus with bits	1	12,500	12,500
13	Cubic Moulds 150x150x150 mm	6	70	420
14	Drying Pans 60x90x10	4		
15	Beaker glass 250 ml, 500 ml, 100 ml	2 From each	200	200
16	Thermometer, General Lab 0-200 c +0.5 c	2		
17	Some Brushes, Plates, Trades	4 From each		
	Total Estimated Price	L.E.		40,815

Source: Port Said Road Directorate and TAC

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ie/table27

TABLE 19
NEW EQUIPMENT REQUIREMENTS

Equipment Type	Required Number	Unit Cost	Total Cost (LE)
Loader	3	150,000	450,000
Dump Truck 10 t	6	150,000	900,000
Water Tank Vehicle $3m^3$	4	50,000	200,000
Asphalt Cutter 80 HP	5	30,000	150,000
Air Compressor	5	30,000	150,000
Transport Vehicle	5	60,000	300,000
Grader	5	180,000	900,000
Mobile Asphalt Boiler and Distributor Tank	5	40,000	200,000
Survey tools and apparatus	2 levels + 2 theodlites and survey tools		30,000
	Sub-total		LE 3,280,000
	Spare Parts 10%		LE 328,000
	Total		LE 3,608,000

Source: Port Said Road Directorate and TAC

3.10 Required Budget For Five Year Maintenance Plan

Five year maintenance plan budget requirements except manpower, are as shown in Table 20.

TABLE 20

FIVE YEAR MAINTENANCE PLAN BUDGET

No.	Items	Estimated Cost L.E	Executing Agent
1	Cost of materials	1,278,635	By force account of Road
2	Equipment services and repair	400,000	Directorate and Road
3	Fuel cost	129,150	Sections in districts
	Sub-total	1,807,785	
4	Road maintenance cost of major overlay, curbstone replacement and footpaths overlay	4,739,750	By contractors
5	Materials and soil testing Laboratory	47,815	BAB III and/or USAID LD-II Investment Plan Grant.
6	Equipment purchase:		BAB III and/or USAID LD-II Investment Plan Grant.
	3 Loader	450,000	
	6 Dump Truck	900,000	
	4 Water Tank Vehicle	200,000	
	5 Transport Vehicle	300,000	
	5 Air Compressor	150,000	
	5 Asphalt Cutter	150,000	
	5 Grader	900,000	
	5 Mobile Asphalt Boiler and Distribution Tank	200,000	
	Survey Tools and Apparatus	30,000	
	Spare Parts	328,000	
	Sub-total	3,608,000	
	Total	10,203,350	

Source: Port Said Road Directorate and TAC

4. YEARLY MAINTENANCE PLAN

4.1 Quantity of Required Work are as shown in Table 21

TABLE 21

Required Work

Execution	Activities		Districts					Total
			East	El Arab	El Manakh	El Dawahy	Port Fouad	
By Sections in Districts	Short asphalt overlay	(m2)	3,705	1,829	9,334	1,538	785	17,191
	Small pavement repairs	(m2)	434	235	1,036	173	99	1,977
	Curb repair	(m.l)	2,430	2,475	3,179	442	1,536	10,062
	Basalt brick repair	(m2)	-	498	-	-	-	498
	Footpaths repair (tile)	(m2)	726	4.0	55	-	-	785
	Footpaths repair (mastic)	(m2)	613	180	1,954	105	1,534	4,386
	Grading unpaved streets	(km)	-	-	3.5	4.2	6.1	13.8
	Shaping unpaved streets	(km)	-	-	1.09	3.21	1.11	5.41
By Contractors Under Road Directorate Supervision	Major overlay	(m2)	35,433	17,010	90,786	14,908	7,338	165,475
	Curbstone replacement	(m.l)	6,038	4,950	6,824	930	3,289	22,022
	Footpaths overlay	(m2)	13,403	1,828	20,090	1,045	15,339	51,705
	Provision of road materials		all materials denoted in table (24)					

Source: Tables 10 through 14
TAC calculation

nm/table5-1

4.2 **Required Labor Hours** are as shown in Table 22

TABLE 22

REQUIRED LABOR HOURS

Code	Total Crew Days	Foreman		Grader Operator		Roller Operator		Loader Operator		Truck Driver		Mason		Laborer	
		Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs
02	117	6	702	6	702	6	702	0	0	18	2,106	0	0	48	5,616
03	22	6	132	0	0	6	132	0	0	12	264	0	0	36	792
04	203	6	1,218	0	0	0	0	0	0	6	1,218	18	3,654	36	7,308
05	10	6	60	0	0	0	0	0	0	6	60	12	120	36	360
06	10	6	60	0	0	0	0	0	0	12	120	12	120	36	360
07	47	6	282	0	0	6	282	0	0	12	564	12	564	24	1,128
08	11	0	0	6	66	0	0	0	0	0	0	0	0	0	0
09	13	6	78	0	0	0	0	6	78	12	156	0	0	48	624
10															
Total			2,532		768		1,116		78		4,488		4,458		16,188

Source: From Table 15, Performance Standard and TAC calculation

4.3 **Staff Requirements** are as shown in Table 23

TABLE 23

STAFF REQUIREMENTS

Personnel Class	Annual Hours Needed Each Class	Available Annual Hours	Number of Personnel Needed	Number Rounded up
Foreman	2,532	1,560	1.62	2
Grader Operator	768	1,560	0.49	1
Roller Operator	1,116	1,560	0.72	1
Loader Operator	78	1,560	0.05	1
Truck Driver	4,188	1,560	2.68	3
Mason	4,458	1,560	2.86	3
Laborer	16,188	1,560	10.38	11

N.B.:

Work Hours/Day = 6 Hours

Casual Leave = 7 Days

Sick Leave = 30 Days

Annual Leave = 21 Days

Vacation/Year = 48 Days

Total 106

Work Days/Year = 366 - 106 = 260 Days

Available Annual Hours = 260x6 = 1560 Hour

Source: Directorate of Organization & Administration Instruction (DOA) and TAC calculation

ia/table22

4.4 <u>Required Equipment Operating Hours</u> are as shown in Table 24.

TABLE 24

REQUIRED EQUIPMENT OPERATING HOURS

Code	Total Crew Days	Grader		Roller		Loader		Dump Truck	
		Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs	Per C-D	Total Hrs
02	117	6	702	6	702	0	0	18	2,106
03	22	0	0	6	132	0	0	12	264
04	203	0	0	0	0	0	0	6	1,218
05	10	0	0	0	0	0	0	6	60
06	10	0	0	0	0	0	0	12	120
07	47	0	0	6	282	0	0	12	564
08	11	6	66	0	0			0	0
09	13	0		0	0	6	78	12	156
Total			768		1,116		78		4,188

Source: From Table 15, Performance Standard and TAC calculation

ia/table21

4.5 Required Equipment are as shown in Table 25.

TABLE 25

REQUIRED EQUIPMENT

Machine Type	Annual Hours Needed Each Type	Available Machine Hours	No.of Machines Needed	Rounded No. of Machines Needed
Grader	768	1,350	0.57	1
Loader	78	1,350	0.06	1
Roller	1,116	1,350	0.83	1
Dump Truck	4,188	1,350	3.1	4

Available Machine Hours = 300 dayx0.75 availabityx6 hours =1350 hours

Source: From Table 24 and IAC calculation

4.6 Required Materials

Required materials are as shown in Table 26.

Table 27 reflects the cost of the materials.

TABLE 26

REQUIRED MATERIALS

Code	Total Crew Days	Hot-mix Asphlt m3		Tack coat Kg		Crushed Base m3		Curb Stone		Sand		Mortar		Basalt Brick m2		Tile or Mastic m2	
		Per C-D	Total	Per C-D	Total	Per C-D	Total	Per C-D	Total	Per C-D	Total	Per C-D	Total	Per C-D	Total	Per C-D	Total
02	117	12	1,404	75	8,775	6	702										
03	22	8	176	20	440	4	88										
04	203							50	10,150	1	203	0.5	102				
05	10									5	50	0.5	5	50	500		
06	10									10	100	2.0	20			100 T	1,000
07	47									10	470					5 M	235
08	11																
09	13																
Total			1,580		9,215		790		10,150		823		127		500		1,000 m2 Tile 235 m2 Mastic

Source: From Table 15, Performance Standard and TAC calculation

ia/table24

TABLE 27

COST OF MATERIALS

Materials	Unit	* Quantities	Quantities** + 10 % Losses	Estimated Unit Cost L.E	Total Cost L.E
Hot-Mix Asphalt	m3	1,580	1,738	60	104280
Tack Coat	kg	9,215	10,137	0.05	507
Crushed Base	m3	790	869	20	17,380
Curbstone	Linear m	10,150	11,165	8	89,320
Sand	m3	823	905	8	7,240
Mortor	m3	127	140	50	7,000
Basalt Brick	m2	500	550	15	8,250
Tiles	m2	1,000	1,100	8	8,800
Mastic Asphalt	m3	235	259	50	12,950
Total					255,727

Source: * From Table 26 for quantities
** Road Directorate Tenders FY 89/90 for Price
TAC Calculation

4.7 **Equipment Service and Repair Cost**

Equipment service and repair	LE 50,000
Spare Parts	LE 30,000
Total	LE 80,000

4.8 **Estimated Fuel Cost For Equipment Operating Hours**

Total operating hours	6150 hrs	
Total fuel cost = 6,150 hrsx100 avg.hpx0.2kg.fuel/hp/hrxLE 0.15/kg =		LE 18,450
Oil and grease = 6,150 hrsx100avg.hpx0.05xkg.oil/hp/hrxLE 1.2/kg =		LE 7,380
	Total	LE 25,830

4.9 **Estimated Cost For Work By Contractors**

Major overlay with 4 cm hot-mix asphalt	=	165,475 m^2x3.4LE/m^2 =	LE 562,615
Curbstone replacement	=	22,022 l.mx10LE/lm =	LE 220,220
Footpath overlay	=	51,705 m^2x3LE/m^2 =	LE 155,115
Adjustment of manhole covers	=		LE 10,000
Total			LE 947,950

4.10 **Required Budget For Year 90/91** is as shown in Table 28.

4.11 **Time Schedule for Yearly Maintenance is as shown in Table 29.**

TABLE 28

FY 90/91 Budget Requirements

Item	Subject	Estimated Cost L.E	Executing Agent
1	Cost of materials	255,727	By force account of
2	Equipment service and repair	80,000	Road Directorate and
3	Fuel cost	25,830	Road sections in districts
	Sub-total	361,557	
4	Road maintenance cost of major overlay, curbstone replacement and footpaths overlay	947,950	By contractors
	Sub-total	947,950	
5	Materials and soil testing laboratory	47,815	
	Sub-total	47,815	
6	Equipment purchase 4 water tank vehicle 5 asphalt cutter 5 mobile asphalt boiler and distributor tank	 200,000 300,000 200,000	
	Sub-total	700,000	
	Total	2,057,322	

Source: TAC calculation

nm/table5.8

TABLE 29

TIME SCHEDULE FOR YEARLY MAINTENANCE PLAN

Item	Activities	Unit	Estimated Quantities	Months												Executing Agent
				1	2	3	4	5	6	7	8	9	10	11	12	
1	Inspection to estimate needed repairs and location															Road Directorate and Road Section in district
2	Preparation of specification, bill of quantity and documents for needed works and materials															
3	Contracting for providing materials of works															
4	Short asphalt overlay	m2	1691													
5	Small pavement repairs	m2	1986													
6	Curb repair	m.l	10060													
7	Basalt bricks repair	m2	478													
8	Footpaths repair (tile)	m2	778													
9	Footpaths repair (mastic)	m2	4386													
10	Grading unpaved streets	km	13.8													
11	Shaping unpaved streets	km	5.41													
12	Major overlays	m2	165475													Contractors under Supervision of Road Directorate
13	Curbstone replacement	m.l	83527													
14	Footpaths overlay	m2	79888													
15	Provision of road materials	needed	material													

Source: Port Said Road Directorate and TAC

SECTION III
CONCLUSIONS AND RECOMMENDATIONS

Sections I & II discussed the present status of the Port Said Road Directorate and Sections in in the Port Said five districts, and developed a road maintenance plan for the Governorate. The essentials of the plan are presented in this Sections.

1. ORGANIZATION

The current organization is not adequate. The TAC staff in cooperation with the Port Said Road Directorate developed a more effective organization as shown in figure 2. This modified organization will allow for effective road maintenance planning, programming and implementation, either by contractors or by road sections and teams. Supervision and control on maintenance activities will be more effective and efficient. The new organization, after being reviewed in the Governorate, should be sent to DOA for formal approval.

2. STAFFING

The existing staff is deficient in engineers, technicians, foremen, equipment operators and laborers. Table 30 shows a comparison between the existing staff and the staff proposed in the new organization.

TABLE 30

EXISTING AND PROPOSED STAFF

Road Section	Engineer		Technicians		Foreman		Eq. Operator		Labor	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Road Directorate	5	12	3	18	1	2	20	1	20	10
East District	1	1	1	3	1	2	8	10	10	14
Al Arab District	1	1	1	3	1	2	8	10	10	14
Al Manakh District	1	1	1	3	1	2	8	10	20	14
Al Dawahy District	1	1	1	3	1	2	5	10	5	14
Port Fouad District	1	1	1	3	1	2	5	10	5	14
Total	10	17	7	33	6	12	54	51	70	80

Source: Port Said Road Directorate and TAC

3. TRAINING

All road maintenance staff in Port Said would benefit by training to develop their knowledge and skills. A training program should be developed and implemented. Suitable courses are available in the National Road Authority Training Center in Cairo.

3.1 For Engineer and Technicians

A 15 day course on road maintenance and repair of asphalt concrete pavements. This course should cover the following topics:

- Different types of failures for embankment and base course.
- Different types of cracks, causes and required remedies.
- Surface corrugation, potholes, bleeding, rutting, depressions, upheavals and disintegration of flexible pavement.
- Curbs and footpaths repairs.

3.2 For Road Equipment Operators

A 15 day course to train operators on the correct use of road equipment is desirable. Practical training is most important to upgrade operators skills. Operator equipment maintenance should be a major topic in the training.

3.3 Laborer Training

On the job training should take place on work sites. Road engineers should be responsible for planning and implementing the training.

4. EQUIPMENT NEEDS

- Road maintenance equipment in Port Said are not sufficient to carry out road maintenance by force account. Table 6 shows the inventory and status of road equipment. Table 31 indicates needed equipment.

- It is recommended that Port Said be supplied with a test laboratory to control different road materials and asphalt mixtures. A list of proposed laboratory equipment and apparatus and approximate cost estimate is shown in Table 18.

- At Appendix A are guide specifications for main road materials and mixtures.

5. BUDGETING

5.1 Five Year Maintenance Plan

To implement the five years maintenance plan the following amount of funding is needed. The Investment Plan Allocations provided from the USAID Local Development II Project may be used to fund some requirements.

TABLE 31

Required Equipment For Road Directorate And Sections

Equipment Type	Road Directorate		East District		El Arab District		El Manakh District		El Dawahy District		Port Fouad District		Total	
	Exist	Requ.	Exist	Requ.	Exist	Requ.	Exist	Requ.	Exist	Requ.	Exist	Requ.	Exist	Requ.
Bulldozer	1										1		2	
Loader		1		1	1	-	1	-		1		1	2	3
Roller	10												10	
Asphalt Plant 10t			1		1		1						3	2
Agriculture Truck	2												2	
Dump Truck	2		1	1	1	1	1	1		2	1	1	6	6
Asphalt Grouting Vehicle	2												2	
Water Tank Vehicle	1			1	1			1		1		1	2	4
Crane Vehicle	1												1	
Transport Vehicle	3			1		1		1		1		1		5
Asphalt Cutter				1		1		1		1		1		5
Air Compressor				1		1		1		1		1		5
Grader	-	1	-	1	-	1	-	1	-	1	-	1	-	5
Mobile Asphalt Boiler and Distributor Tank	-	1	-	1	-	1	-	1	-	1	-	1	-	5
Total														

Source: Port Said Road Directorate and TAC

ia/table26

o	Cost of materials	LE 1,278,635	From BAB II
o	Equipment service and repair	LE 400,000	From BAB II
o	Fuel cost	LE 129,150	From BAB II
o	Road maintenance by contractor for major overlay	LE 4,739,750	From BAB II
o	Material and Soil Testing Laboratory	LE 47,815	From BAB III
o	Equipment purchase	LE 3,608,000	From BAB III
	Total	LE 10,203,350	

5.2 Annual Maintenance Plan

Based on the Five Year Maintenance Plan, an annual budget requirement would be:

o	Cost of materials	LE 255,727	From BAB II
o	Equipment service and repair	80,000	From BAB II
o	Fuel cost	25,830	From BAB II
o	Road maintenance by contractor for major overlay	947,950	From BAB II
o	Material and soil testing laboratory	47,815	From BAB III
o	Equipment purchase	700,000	From BAB III
	Total	LE 2,057,322	

The budget for each of the other four years is the same as the first year without the cost of the laboratory.

5.3 Comparison of Available Funding and Requirements

Table 32 shows a comparison between available funds, the needed funds yearly and the deficit in funding to fulfill the yearly maintenance plan.

TABLE 32

AVAILABLE BUDGET AND REQUIREMENTS

Budget	Available (LE)	Needed (LE)	Deficit (LE)
From BAB II	530,000	1,309,507	(779,507)
From BAB III	-	547,815	(547,815)
From the Governorate service treasury	440,000	440,000	
From Benzine Revenues	200,000	200,000	
Total	1,170,000	2,497,322	(1,327,322)

Source: Port Said Road Directorate and TAC

APPENDIX A
MATERIALS SPECIFICATIONS

1. ASPHALTIC CONCRETE (AC) HOT-MIX

This is the most important maintenance material. It is intended to be a high-quality paving material, of controlled characteristics, placed and compacted while hot. It is used in large quantities for new paving, levelling and overlays in the restoration of older existing pavements. It is preferred material for patching defects in pavements. AC hot-mix usually consists of two or more uniform aggregate materials combined to obtain a designed gradation. Heated asphalt is added in controlled quantities and mixed with aggregate. This mixture must be discharged, placed, shaped and compacted while still hot. The asphalt concrete hot-mix and aggregate must meet the following standard specifications and comply with the required gradation.

Stability, lb(kg) min	1000 (454)
Flow, 1/100 inch	20
Voids Ratio, %	3-5
Voids filled with bitumen, %	80-90
Los Angeles abraision test for aggregate, % max	40
Water absorption value for aggregate, % max	5
Disintegration of aggregate in water	None
Penetration grade for bitumen	60/70

The coarse and fine aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coating and other foreign materials.

The asphalt hot-mix is produced for small repairs or patching by the available three batch plants existing in the Road Sections. For major repairs and new pavement the asphalt hot-mix is supplied by contractors according to an annual tender.

2. BITUMEN

Only two bitumen types are of interest in the program being considered; 60-70 penetration grade for making hot-mix asphalt, and cut backs or liquid asphalt for priming granular base and for tack coats. Both are obtained from Suez and Alexandria refineries.

3. CRUSHED BASE AND OTHER AGGREGATES

Quarries are operating in the mountain foothills about 150 km south of Port Said, producing crushed lime-stone for construction. Any desired sizes can be obtained.

Sands of different characteristics are available from Ismailia and Tenth of Ramadan quarries. The suitable and required gradation can be obtained either for base course or for concrete aggregate and other uses.

4. CURBSTONES

Curbstones, of cast concrete, are provided of different sizes by contractors, according to the requirement. The third height of the face of the curbstone is inclined to the direction of the footpaths. The concrete of the curbstone must have a strength of 275 kg/cm^2 at 28 days from casting and 250 kg/cm^2 at 7 days from casting. The proportion of cement must be not less than 350 kg/m^3 of concrete. The maximum size of gravel should be 1/4 inch and sand shall all pass sieve No.4· No more than 5% of fine material shall pass sieve No. 200.

5. TILE AND BASALT BRICKS

Tiles and basalt bricks are provided by contractors. Tile must be durable, hard and not abrasive under traffic. The basalt bricks shall be prepared from natural basalt quarries, cut according to the required size. They shall be fixed in place with mortar.

6. MASTIC ASPHALT

Mastic Asphalt may be produced locally or provided and placed by contractors. The mastic asphalt consits of clean sand and bitumen and may contain filler material. The materials are mixed after heating the bitumen. The gradation of the combined materials must comply with one of the following gradation.

Sieve No.	Gradation A	Gradation B	Gradation C
3/4 inch	100	-	-
1/2 inch	85-100	100	-
3/8 inch	75-100	90-100	-
No. 4	50-85	75-100	100
No. 10	30-70	70-90	90-100
No. 40	15-40	30-70	45-85
No. 80	8-30	10-40	10-35
No. 200	5-10	5-12	5-10

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