V.5 HIGHWAY TRANSPORT PLANNING IN EGYPT

Progress Report

June 1, 1977 - September 1, 1977

OBJECTIVE

The primary objective of this cooperative effort continues to be the strengthening of Egyptian institutional capabilities for the analysis, planning, and programming of highway investments. This will be accomplished by establishing a data collection and inventory methodology reflecting the parameters appropriate for upgrading and maintenance decisions in Egypt, by applying and calibrating an existing evaluation framework—the Road Investment Analysis Model—for use in these decisions, and by the training of Transport Planning Authority and Cairo University personnel in the use of these data collection and analysis techniques. Emphasis has been placed on the identification, and resolution of the major issues confronting the establishment of appropriate maintenance and upgrading standards and schedulings for Egypt.

Specifically the work will build upon the existing MIT effort in Ethiopia by applying the developed framework and methodology to the following issues:

1) Economic evaluation of proposed projects (both new construction and upgrading of existing links)
2) Economic evaluation of design and maintenance standards in the context of the larger road network
3) Development of projections of future maintenance requirements and traffic patterns
4) Recommendation of equipment required to develop and maintain the data inventory of the network condition and maintenance activities.

To demonstrate the methodology, the team is concentrating on data collection and analyses for a single maintenance zone, through the involvement of Cairo University graduate and undergraduate students, and collaboration with Transport Planning Authority officials and Cairo University on the development and use of this evaluation framework on Egyptian maintenance and upgrading situations of immediate interest. The calibra-

tion aspect of the project involves adapting to Egyptian conditions empirical relationships of pavement deterioration and maintenance effects which have been developed by MIT and applied in Ethiopia, and is expected to proceed over the longer term.

PROGRAM OF WORK

The research activities for the first year have been divided into four general phases. The initial phase is coordination of the research effort, identification of an area of study, and identification of data requirements and availabilities. The second phase is installation of the computer model at the Cairo University Scientific Computation Center, and training of Egyptian personnel in its theory, use, and data requirements and formats. The third phase is detailed data collection and compilation. These phases overlap and are expected to extended through September. The last phase, the analysis of the specific cases chosen by the team, and sensitivity analyses on them, along with tentative conclusions and recommendations derived from them, will proceed concurrently from July through November. December is reserved for preparation of the final report.

PROGRESS TO DATE

The overall program is running close to the original schedule, despite the computer implementation difficulties discussed below. Responsibilities for the various data items required have been distributed among the team members according to their field of expertise, and appropriate data sources within the ministry identified. The zone of study has been reduced from the original zone due to data requirements and limitations imposed by the model on allowable network size. The new zone is bounded on the west and south by the roads on the west bank of the Rosetta Branch of the Nile between the cities of Tawfikieh, Tamalay, Khatatba, and Kanater, and on the east and north by the Cairo-Alexandria Agricultural Road, between the cities of Qalub (just north of Cairo) and Tawfikieh (where the Agricultural Road crosses the Rosetta Branch). The included network, comprising 32 links and 21 nodes (not all of which are traffic generators), is close to the maximum the model is capable at present of analyzing. A map of this study zone is attached.

The required data and methods of collection and processing were demonstrated by Mr. Brian Brademeyer through a series of seminars on the User

Manual, covering each of the data areas in turn. Two links from the study zone were selected as initial case studies to demonstrate the model and data collection and processing, with the data being generated and structured by various Egyptian team members, depending on field of expertise. One link connects the towns of Kafr El-Dauwar and Abu Hiummus via the Cairo-Alexandria Agricultural Road; the other is a new road linking Shibin El Kom to the Rosetta Branch of the Nile at Tamalay. The former has been analyzed at MIT for three construction and two maintenance options, and the results reviewed in Cairo while the latter was used to demonstrate various data collection requirements and options. Data collection forms were also developed for the major data blocks.

The second phase, implementation of the computer model and instruction on its use and data requirements has been successfully concluded, with the Kafr El-Dauwar--Abu Hiummus link being run as an example at the CAPMAS National Computation Center. Implementation on the Cairo University facilities is proceeding, and should be completed shortly. Considerable difficulties were encountered in converting the Road Investment Analysis Model (RIAM) from IBM to ICL hardware facilities, involving: (1) the inability of ICL to read an IBM source tape, which required programmer Ms. Dorria El-Aggon to create an assembler language program to read the IBM tape and pack it in the form used by ICL; (2) the different length of words between the two machines and the unavailability of real variable comparisons for equality on ICL, which required Dr. Sherif Ebeid and Ms. Dorria to scan the program line by line and convert the 92 alphameric comparisons used in the program into the form acceptable to ICL; and (3) the program size reduction necessary for the Egyptian computers, which required that Mr. Brademeyer and Dr. Ebeid devise an efficient ICL-overlay structure. Of minor annoyance were the hardware problems at the ICL of Cairo Unviersity, which caused repated delays.

The third phase, detailed data collection and processing, required a distillation of currently available sources, and implementation of new surveys where the necessary data base was weak or non-existent.

Transport Planning Authority personnel have gathered all data required for the link characteristics and proposed construction projects and maintenance policies (by Engr. Sayed Khalil, Director of Geometric Design) along with data on existing link traffic volumes, (by Engr. Mohammed Khalil,

Director of Traffic Division) and prepared in tabular form, with coding and card punching currently underway . The vehicle characteristics and costs data were collected, on a preliminary basis, by Dr. Abdel Fathy Lashine from available Transport Planning Authority records and the Egypt National Transport Study, Phase I, Interim Report. From these, data deficiencies were identified and are discussed below. A report on the data collection prepared by Engr. Mohammed Khalil, is attached as Appendix I.

The Kafr El-Dauwar--Abu Hiummus example that was run at MIT, and later at CAPMAS, indicated excessive cost savings for intercity taxicabs with reductions in pavement roughness (up to a factor of 5 to 6). The Egyptian team members suspected these values as unrealistic; as they were derived from data in the Interim Report and the Transport and Road Research Laboratory Kenya equations (which were presumably being used outside their calibrated range in this instance). Dr. Lashine of the Transport Planning Authority arranged for an interview survey of intercity taxicab drivers, with the data gathered as well as the differences with the Phase I Interim Report presented in Appendix II to this report. Due to the magnitude of the discrepancies and their implications for the reliability of operating cost predictions, additional surveys on bus and truck costs are now anticipated by the ministry. These new volumes will be used in revised case studies run at MIT and Cairo University.

Traffic counts have been made on all links in the study area. However, origin-destination data was not available, as the zones used in the Egypt National Transport Study, Phase I, Interim Report were too aggregate for our purposes; nor was there information on route choice behavior. To remedy this situation, an O-D interview survey was performed in the study zone on August 8 under the direction of Dr. El-Hawary and Dr. Owais. The interview stations were taken as the stations used for the traffic counts. Fifty-four students and forty-two patrolmen were employed in the one-day survey. The forms were developed by Dr. Mohamed Owais and Mr. Brademeyer, with the finalization done by the entire project group.

Of the questions, two were directed to O-D flows (where are you coming from, where are you going) and the remainder were aimed at determining route choice behavior. Questions asked were: what are the major cities in your route; will you stop at any city enroute; if so, for how long; do you normally take this route; if so, why; if not, why this time; and

what is your estimate of your travel time. The intent of the interview was to get as much information about the route actually used as possible, and an indication of knowledge of available alternatives. This data will be analyzed at MIT after it has been processed by Dr. Owais. A map indicating the survey stations is attached.

Based on Mr. Michael J. Markow's review of available sources (Appendix III), the project team determined the pieces of equipment desired to conduct the tests for the network condition inventory, and their specifications; these were prepared by Engr. Abd El Maksoud Sadek, General Director for Design and Laboratory Section, and are attached as Appendix IV. A preliminary meeting was arranged between Mr. Brademeyer, Dr. Lashine, Mr. James Norris, and Mr. Richard L. Aitken of the USAID Commodity Import Program to discuss the procedural aspects of obtaining the equipment, and further negotiations between the ministry and AID are currently underway.

Priority has been given to analysis at the network level, as indicated by the objectives. The present link evaluation model is currently being modified at MIT to incorporate these network aspects, with completion expected by mid-September. The data required by the new model has already been collected by the Egyptian team members, and is currently being processed in Cairo.

PLANS FOR THE COMING PERIOD

The work for the coming period (September through December) will be in three areas: calibration of traffic assignment parameters; analysis of the network study zone; and preparation of the final report.

Calibration of the assignment parameters (value of time and diversion intensity) will be performed at MIT once the O-D survey route preference data has been processed by the Egyptian team members. Since all of the study zone lies inside the agricultural area, no attempt will be made at present to determine the effects of the desert on route choice, although this will be addressed in the future. A small computer program will be developed at MIT to convert the data gathered in Cairo into the form acceptable to the LOGIT calibration program. The predicted values of the behavioral parameters will then be used in the network analysis phase.

The network will be preliminarily analyzed to determine the operating

costs and travel times for the various links, providing the cost data necessary for performing the route choice calibration discussed above. Once these behavioral parameters have been determined, the study network will be analyzed under the proposed maintenance policies and construction schedules, and projections of traffic flows and maintenance expenditures developed. Several perturbations around the proposed investment program will also be analyzed for sensitivity.

To accomplish the above tasks and prepare for the final report, Dr. Mohammed Owais will travel to MIT from the period of September 5 to October 5 (or thereabouts). His participation will include the case study analysis, the writing of the final report, and the preparation of a detailed program for the next year. In addition, Dr. Mohammed El-Hawary will visit Boston periodically between late August and mid-October, to Cairo, to monitor project progress.

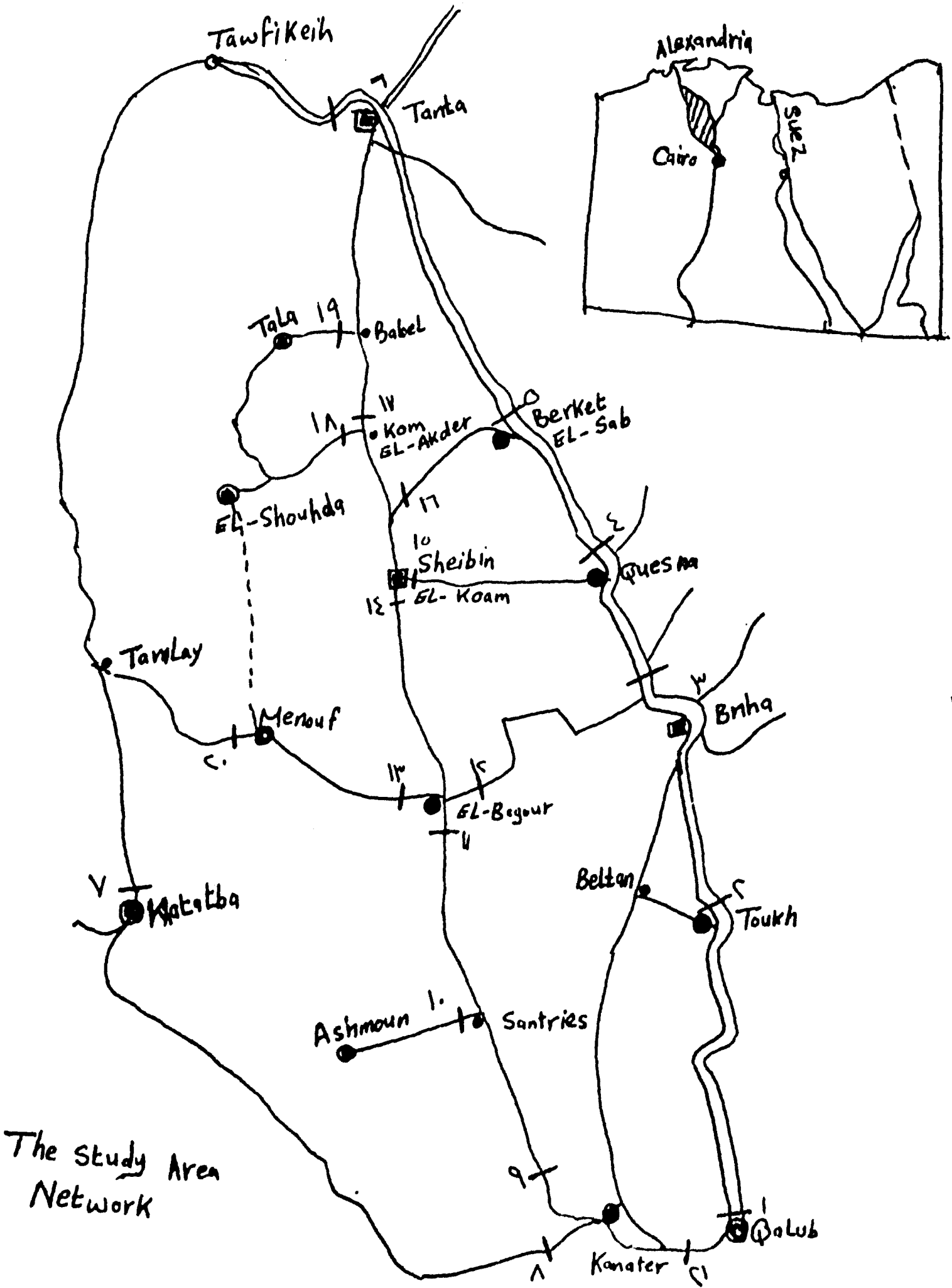
FUTURE DIRECTIONS AND TOPICS OF RESEARCH

In the longer term outlook, we plan to address three interrelated and hierarchical extensions of the current program. The network planning, implementation, and evaluation effort will be expanded to include the rest of the Egyptian network, maintenance organization and capacity constraints, and calibration of the empirical relationships to the Egyptian environment. Capital budgeting and programming techniques will be devised to consider the "optimal" timing and scale of future road investments, and to consider economic, materials, capacity, and institutional constraints to program implementation. Multi-modal models will be developed to consider the intermodal impacts of intercity transport investments, and to address sector improvements in a unified manner, using simplified models of non-road transport.

Concurrently and complimentarily, specific shorter term goals of more modest scale would consider the following items: more sophisticated assignment models which are based on attraction-generation techniques which free the user from O-D demands and path enumeration data requirements; calibration of the environmental factors peculiar to Egypt; expansion of the behaviroal parameters to include the effects of desert travel on route choice, giving planners an indication of what policies should be followed to encourage utilization of desert roads; development of congestion models which reflect the traffic mix and behavioral patterns in

Egypt; and the effects of water table height on road deterioration; among others. Also of interest would be the expansion and updating of the data base relevant to transport investment, and analysis of the organizational and institutional constraints on investment policy.

Other investment opportunities which AID may be interested in funding separately from the present program include improvements in maintenance organization; purchase of additional construction and maintenance equipment; studies of the impacts of transport regulations; and inventory and data base development, such as Phase II of the Egypt National Transport Study.



The Study Area Network

Attachment A: HIGHWAY TRANSPORT PLANNING IN EGYPT

Road Evaluation Equipment

This memo updates an earlier listing of road evaluation equipment for Egypt. It is correlated whereever possible to entries in a set of manufacturer catalogs that have been enclosed. Prices include estimated shipping costs to Cairo.

It appears that manufacturers of pavement evaluation equipment are limited to the firms listed. There are, however, many potential suppliers in the categories of vehicle weighing and traffic counting. Catalog cuts from a sample of these firms have been included to illustrate the range of products available. Lists of other potential suppliers, taken from the Thomas Register and the Industrial Product Director, are appended to the end of the memo.

1. <u>Pavement Roughness Measurements</u>

A. BPR Roughometer: Soiltest, Inc., CT444 or equivalent

Estimated price: $30,000

Manufacturers or Suppliers:

Soiltest, Inc.
2205 Lee Street
Evanston, IL 60202
(312)869-5500

James Cox and Cons, Inc.
PO Box 674
Colfax, CA 95713
(916)346-8322

K.J. Law Engineers, Inc.
23660 Research Drive
Farmington Hills, Michigan 48024
(313)478-3150

Reese Maintenance Corporation
Napolean, OH 43545

B. Road Meter

Estimated price: $2000 - 5000

Manufacturers or Suppliers:

PCA Roadometer
Soiltest, Inc., Model ML-500B or equivalent

Potential Suppliers:

Soiltest, Inc.
2205 Lee Street
Evanston, IL 60202
(312)869-5500

James Cox & Sons, Inc.
PO Box 674
Colfax, CA 95713
(916)346-8322

Mays Ride Meter
Catalog #890: $2000

Rainhart Co.
PO Box 4533
600-608 Williams Street
Austin, TX 73751
(512)452-8848

2. Pavement Deflection Measurements

A. Recordable Benkelman beam, Soiltest HT300 and HT320 or equivalent, 2 required

Estimated price: $1000

Potential Manufacturers or Suppliers:

Soiltest, Inc.
2205 Lee Street
Evanston, IL 60202
(312)869-5500

James Cox and Sons, Inc.
PO Box 674
Colfax, CA 95713
(916)346-8322

K.J. Law Engineers, Inc.
23660 Research Drive
Farmington Hills, Michigan 48024
(313)478-3150

Reese Maintenance Corporation
Napolean, OH 43545

B. Dynaflect

Estimated price: $20,000 plus 2,000 training

Manufacturers:

Radiation Engineering and Manufacturing Co.
Box 214, Rt. 5
Fort Worth, Texas 76126

Lane-Wells, Inc.

C. Road Rater

Estimated price: $60,000

Manufacturer or Supplier:

Foundation Mechanics, Inc.
c/o Wyle Laboratories
1128 Maryland Street
El Segundo, CA 90245
(213)678-4251

3. Skid Resistance

Portable Skid Tester, 2 required

Estimated price: $2000

Manufacturer or Supplier:

Soiltest, Inc. Model HT120
2205 Lee Street
Evanston, IL 60202
(312)869-5500

4. Pavement Coring

4-inch and 6-inch core diameter thin-wall diamond bits to operate with Soiltest DR 705A rig, 60 of each required

Estimated price:

4" core--$400 each
6" core--$600 each

Manufacturer:

Soiltest, Inc.
4"--DR1360 or DR1460
6"--DR1348 or DR1448

5. Axle Loads

A. Weigh-in Motion device--40 pad location required

Weighing and Weighing-in-Motion Systems
Weighwrite In-Motion Weighing
(Requires Trucks to Reduce Speed to 3-4 kph)
Price: $18,000
Smiths Industries
PO Box 209
Industrial Way
Wilmington, MA 01887

Treadle Scale Weighing System
(for static of 3-4 kph weighing)
BLH Electronics
42 Fourth Avenue
Waltham, MA 02154
(617)890-6700

Unitech Dynamic Weighing System
(weighs, counts, and records speed of traveling vehicles)
Price: $35,000 - 50,000
Unitech, Inc.
1005 East St. Elmo Road
Austin, TX 78745
(512)444-0541

Streeter Amet Highspeed Highway Weighing System
Streeter Amet Corp.
Grayslake, IL 60030
(312)223-4801

B. Semi-Stationary or Portable Weigh Scales: 5 required

ELDEC model 3040 with 3410 printer:
Price: $11,000 per pair with printer
LOADOMETER "Hi-Way" scales (no recorders)
Price: $1000 per scale
Loadometer Corporation
1700 Union Avenue
Baltimore, MD 21211

6. Traffic Recording

Streeter Amet Corporation Traffic Classifer
(Model 401) or MR 112/114 Counters

Surveyor Series
Price: $950 - 1700 each
DEPCO
117 East Helena Street
Dayton, Ohio 45404
(513)461-5898

Stevens print-punch recorders
Leupold and Stevens, Inc.
PO Box 688
Beaverton, Oregon 97005

Fisher and Porter punched tape counters
Price $1000
Fisher & Porter Co.
Warminster, PA 18974
(215)674-6000

TRAFFIC COUNTERS

COUNTERS: TRAFFIC
(see also Counters: Electronic)

CONN: EAST NORWALK
LFE TRAFFIC CONTROL DIV., AUTOMATIC SIGNAL Regent St. (Automatic Vehicle Detectors & Counters) (203—838-4791) ..... AAAA
(See Our Catalog in Thomast Under LFE Fluids General Div.)

CONN: NORTH BRANFORD
Multi-Counter Mfg. Co. Stroud Rd. ..... B

CONN: OLD SAYBROOK
Conrac Corp., Cramer Division Mill Rock Rd. ..... AAAA

CONN: WOODBURY
DENOMINATOR COMPANY, INC., THE (Single & Multiple For Classification, Directional & Volume Counts, Traffic Counting Boards) (203—263-3316) ..... B

IL: CHICAGO
Da-Tee-Tronic Corp. 2508 N. Halsted St. ..... AA
B N M COMPANY 5360 Northwest Hwy. (312—775-8600) X
Mangood Corp. 108 W. Adams ..... AAAA

IL: GRAYSLAKE
Streeter Amet Div. Slesser & Wiebe (Automatic, Repeating Portable & Permanent) ..... AAAA

IL: OAK BROOK
Tri-Tronics Co., Inc. 821 Enterprise Dr. ..... A

IL: ST. CHARLES
Rogers Company, Inc. Peoria Rd. at U.S. 64 (Vehicle & Pedestrian Counters & Detectors) ..... A

MN: KANSAS CITY
Drive In Theatre Mfg. Co. 709 No. 6th St. (Car Counters & Displays For Drive-In Theatres) ..... A

MN: [illegible] 136 [illegible] (Instruments & Controls) ..... A

TRAFFIC RECORDERS

NH: BEDFORD
Sprague Lewis & Cyntrick [illegible] Mass. ..... AAAA

OHIO: CLEVELAND HEIGHTS
SERVICE SEQUENCE SYSTEMS INC. 1635 Lee Rd. (Take-A-Number System) (216—321-7255) X

OHIO: DAYTON
DAYTON ELECTRONIC PRODUCTS COMPANY 115 Helena St. (513—461-4951) ..... AA

SURVEYOR TRAFFIC COUNTING SYSTEMS by DEPCO

- Lightweight & Rugged
- Temp. Range −30°F to +150°F
- Compatible with loop or road tube
- Solid-State Circuitry & Pressure Switch
- Safe and Accurate Operation in any Position
- Automated Translation

Specialists in State-of-the-Art Traffic Counting Systems

Dayton Electronic Products Co.
115 East Helena St. • Dayton, Ohio 45404
(513) 461-4951 461-5899

OHIO: DUBLIN
Gammetronic, Inc. 86 S. High (Vehicle) ..... AA

OHIO: UHRICHSVILLE
K-HILL SIGNAL COMPANY, INC. 326 W. 3rd St. (Portable For Highway Total Flow & Directional) (614—622-8421) ..... A

K-HILL "SOLID STATE"

We make Totalizer Traffic Counters; Two Way Directional Traffic Counters; One Way Directional Traffic Counters; Pedestrian & Wildlife Traffic Counters; Counters for Drive-In Theatres, Banks, Shopping Malls, Airports, Gas Station Parking Lots and Wash Racks.
Counters operate from rubber road tube or special treadles. All counters available with solid state circuits. If you have a counting problem, contact us (614) 622-8421.

Bill Hall

K-HILL SIGNAL CO., INC.
326 W. Third St. • Uhrichsville, Ohio 44683

OREGON: BEAVERTON
LEUPOLD & STEVENS, INC. P.O. Box 688-T (Single & Dual Recorders, Print & Punch Tape Record, Teletypewriter Processable) (503—646-9171) .. AAAA

STEVENS PRINT-PUNCH TRAFFIC RECORDERS

Recorder prints and punches on 8 channel tape for in-field reading or teletypewriter processing. Resets to zero after each punch cycle. Dual recording for directional counts or two lanes, and other features. Standard 16 channel recorders and tape readers also available. Write for literature.

STEVENS TRAFFIC PRODUCTS
Leupold & Stevens, Inc.
P.O. Box 688T, Beaverton, Oregon 97005 U.S.A.

PA: SPRING CITY
Micro-Strain, Inc. Stone Run Rd. (Loop Detectors For Traffic Count And Control-Plug-In) ..... A

PA: WARMINSTER
Flocher & Porter Company 51 Warminster Rd. .. AAAA

TC: [illegible]
Sorter [illegible] Inc. Dept. T, P.O. Box [illegible] X

WASH: [illegible]
Opeco Inc. Dept. T, 720 [illegible] St. S.W. ..... AA

COUNTERS-Traffic
[illegible] Co. 8335 Northwest Highway, Chicago, IL 60630 (312-[illegible]
[illegible] Co., Inc. 2336 Melwood Ave., Toledo, OH 43611 (419-[illegible]
[illegible] 476-[illegible]
[illegible] Pa 16066
[illegible] Oh 44663
[illegible] NY 11[illegible]
[illegible] CT 06471
[illegible] Mangood Corp., Grayslake, IL 60030

COUNTERS, Traffic: *See also Counters, Hand Tally*
[illegible] Co. Inc., Main St., Woodbury, CT 06798 (Density recording movement) ..... (I)
[illegible] Corp., 31-40 Park Rd., Tinton Falls, NJ 07724 ..... (JD)
[illegible] Signal Co., Inc., 326 W. Third St., Uhrichsville, Oh 44683 ..... (VL)
[illegible] & Stevens, Inc., Box 688, Beaverton, Or 97005 ..... (JM)
[illegible] Inc., 720 69th St., S. W., Everett, Wa 98203
[illegible] Amet Div. of Mangood Corp., Streeter & Wiebe, Grayslake, IL 60030 ..... (J)
[illegible] 70 [illegible] St., Hartford, Ct 06105 ..... (TBS)

VEHICLE WEIGHING

CAL: BELMONT
HOME, DOUGLAS CORP. 1642 Industrial Weigh (415—592-1616) ..... AA
CONN: STAMFORD
METRODYNE CORP. 22 Acosta St. (203—327-4376) X
IND: TERRE HAUTE
WINSLOW SCALE CO. 25th & Haythorne, P.O. ox 1523 (812—466-1231) ..... AAA
MD: BALTIMORE
LOADOMETER CORP. 1700 Union Ave. (Portable Vehicle Scales For Over-the-Road & Off-Highway Wheel Load Weighing) (301—366-1711) ..... A
MASS: WALTHAM
BLH ELECTRONICS 42-T Fourth Ave. (617—890-6780) ..... AAAA
MICH: SOUTHFIELD
STERLING SCALE CO. INC. 20952 Boening Dr. (Truck) (313—358-0590) ..... AAA
MO: WEBB CITY
WEBB CORPORATION, THE 406 E. Broadway (417—673-4646) ..... AA
NJ: BOUND BROOK
INTEC INC. 416-T Vosseller Ave. (201—356-8112) .. AA
NJ: CLIFTON
HOWE RICHARDSON SCALE COMPANY 680 Van Houten Ave. (201—471-3400) ..... AAAA
OHIO: COLUMBUS
THURMAN SCALE CO. 1937 Refugee Rd. (614—445-8381) ..... AAA
VT: ST. JOHNSBURY
FAIRBANKS WEIGHING DIV. COLT INDUSTRIES 700 E. St. Johnsbury Rd. (802—748-2371) ..... AAAA
WASH: LYNNWOOD
ELDEC CORPORATION 18700 - 13th Ave. W. (On Vehicle) (206—743-1313) ..... AAAA
WIS: RICE LAKE
RICE LAKE BEARING INC. 231 W. Coleman St. (Replacement Scale Parts, Pivots, Bearings) (715—234-9171) ..... AAA

Attachment B: Road Evaluation Equipment Required for Highway Transport Planning in Egypt

A. Pavement Roughness Measurements:

1. One BPR Roughometer: Soiltest, Inc. CT444 or equivalent. This piece of equipment works at an operating speed of 10 miles/hr and it will be used only for calibrating the Portland Cement Association Roadometer which works at an operating speed of 50 miles/hr
2. Four units of PCA Roadometer: Soiltest, Inc., Model ML-500B or equivalent. Also as it is explained in HRB Special Report No. 133, some types of automobiles cannot work with the apparatus for unknown reasons, it is required that the apparatus be supplied with a reliable automobile such as a Ford Custom 500.

B. Pavement Deflection Measurements

1. Recordable Benkelman beam, Soiltest HT300 and HT320 or equivalent, two are required. They will be used to calibrate the Dynaflect.
2. Dynaflect, four are required.

C. Skid Resistance

Portable Skid Tester, Soiltest Model HT120, 2 are required.

D. Pavement Coring

4-inch and 6 inch core diameter thin-wall diamond bits to operate with Soiltest DR 705 rig, 60 of each required.

E. Training

It is required that three young engineers attend a 3-month training course in the United States on using the equipment and on PSI measurements. If it is possible, we would like an expert from the United States to joint the Egyptian team during their first measurements for PSI.

TRAFFIC

A. Weigh in Motion Equipment

Required 5 Streeter Amet Weigh in motion device Model 4500/3

B. Traffic Recording Equipment

a) Required 50 Streeter Amet Corporation Model MR-112 for two lane vehicle counter

b) Required 20 Streeter Amet Corporation Model MR-114 for four lane counter

c) Required 10 Streeter Amet Classifier Model 401

N.B. All equipment has to be supplied complete with all necessary accessories, and spare parts for 10 years.

Training

It is required that three engineers each attend a one month training course in the United States on using and repairing the equipment.

ATTACHMENT C

HIGHWAY TRANSPORT PLANNING

PROGRAM

REPORT

for

INVENTORY: CONSTRUCTIONS, STANDARDS

SCHEDULED, STANDARDS RESPONSIVE & MAINTENANCE

COLLECTED DATA

Ministry of Transport
Egyptian Highway and Water
Authority

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INTRODUCTION

According to the agreement held by:

--THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

--FACULTY OF ENGINEERING CAIRO UNIVERSITY.

--MINISTRY OF TRANSPORT AND COMMUNICATIONS.

a) TRANSPORT PLANNING AUTHORITY.

b) ROADS AND WATERWAY EGYPTIAN AUTHORITY.

For adopting the Massachusetts Institute of Technology Road Investment Analysis Model for use in evaluating alternative design, construction and maintenance strategies for the Egyptian Road Network:

The Faculty of Engineering and the Ministry of Transport personnel have cooperated to begin to study the Monofia and Qalubia governates Road network.

The data collected here for the road conditions, Road inventory, geometric standard, traffic counts, vehicle characteristics depend on:

a) The actual information taken from the field survey, traffic survey, and laboratory tests.

b) Adoptation the AASHO Interim Guide methods for calculation of both the total EQUIVALENT SINGLE AXLE LOAD per lane and the Structural Number.

c) AASHO ROAD TEST RESULTS Applied to pavement design in Illinois: H.R.R.--No. 90 (1965).

The road network studied consists of the following links.

1.	SHOUBRA/QALUB	Double	Direction	road	length	7.0 km
2.	QALUB/BANHA	"	"	"	"	35.0 km
3.	BANHA/TANTA	"	"	"	"	44.0 km
4.	TANTA/KAFR EL ZIAT		"	"	"	18.0 km
5.	KAFR EL ZIAT/TOFICIA		"	"	"	8.0 km
6.	QALUB/KANATER	"	road	"	"	9.6 km
7.	KANATER/SANTRISS		"		"	18.0 km
8.	SANTRISS/BAGOR	"	"	"	"	14.0 km
9.	BAGOR/SHEBIN EL KOM		"	"	"	13.0 km
10.	SHEBIN EL KOM/KOM EL AKDER		road	"	"	5.0 km
11.	KOM EL AKDER/BABEL		"	"	"	9.0 km
12.	BABEL/TANTA		road	"	"	11.0 km
13.	KANATER/KATATBA		"	"	"	39.0 km
14.	KHATATBA/TAWFICIA		"	"	"	53.0 km
15.	ASHMON/SANTRISS		"	"	"	9.0 km
16.	BANHA/BAGOR		"	"	"	18.0 km
17.	BAGOR/TAMALAY		"	"	"	23.0 km
18.	BERKT SABEH/SHEBEN EL KOM		"	"	"	12.0 km
19.	QUESSINA/SHEBIN EL KOM		"	"	"	12.0 km
20.	SHOHADA/TALLA/BABEL		"	"	"	17.0 km
21.	SHOHDA/MONOF		"	"	"	km
22.	KANATER/BILTAN		"	"	"	21.9 km
23.	BILTAN/TOKH		"	"	"	4.0 km
24.	BILTAN/BANHA		"	"	"	9.1 km

PAVEMENT DESIGN ADOPTED

FOR THE STRUCTURAL NUMBER

In determining the structural number, the following equations were used:

$$Dt \text{ (or) } SN = a_1D_1 + a_2D_2 + a_3D_3$$

Where a_1, a_2, a_3 are coefficients of relative strength of the surface, base and subbase respectively.

and D_1, D_2, D_3 are thickness in inches of the surface, base and subbase respectively for the composite pavement.

For the coefficients a_1, a_2, a_3 we have used both the following tables:

--AASHO Interim guide coefficients Table 1.

--AASHO Road Test Results applied to Pavement Design in Illinois H.R.R. No. 90 1965 (Table 2).

TABLE 1

COEFFICIENTS OF RELATIVE STRENGTH OF PAVEMENT COMPONENTS

PAVEMENT COMPONENT	COEFFICIENT (3) a_1	a_2	a_3
Surface course:			
Road mix (low stability)	0.20		
Plantmix (high stability)	0.44 (4) *		
Sand asphalt	0.40		
Base course:			
Sandy gravel		0.07 (2)	
Crushed stone		0.14	
Cement treated (no. soil cement):			
650 psi or more (1)		0.23 (2)	
400 psi to 650 psi		0.20	
400 psi or less		0.15	
Bituminous treated:			
Course graded		0.34 (2)	
Sand asphalt		0.30	
Lime treated		0.15 - 0.30	
Subbase:			
Sandy gravel			0.11 (4)*
Sand or sandy-clay			0.5 - 0.10

1. Compressive strength at 7 days
2. This value has been estimated from AASHO Road Test data, but not to the accuracy of those factors marked with an asterisk.
3. It is expected that each state will study these coefficients and make such changes as their experience indicates necessary. (Sources AASHO 127, P, 22)
4. After AASHO ROAD TEST Equation.

TABLE 2

MINIMUM COEFFICIENTS FOR PAVEMENT STRUCTURE MATERIALS

MATERIALS	Min. Strength Requirements			Coefficients		
	MS	CBR	PSI	a_1	a_2	a_3
Bituminous surface subclass						
B-1, B-2; B-3, and B-4	300			0.2		
B-5 and I-1	900			0.3		
I-11	1,700			0.4		
Base Course						
Granular						
Gravel, Grade 7		50			0.10	
Gravel, Grade 9		70			0.12	
Crushed stone, Grade 8		90			0.13	
Water bound macadam		110			0.14	
Selected soil stabilized W/P6			300[c]		0.15	
Granular material stabilized			1450[c]		0.20	
W/PC plant mix			650[c]		0.23	
Granular material stabilized			450[c]		0.20	
W/lime flyash			650[c]		0.23	
Granular material stabilized W/bit materials						
Emulsified asphalts	300				0.16	
Liquid asphalts	400				0.18	
Paving asphalts	600				0.20	
	900				0.24	
PC concrete (new	1,[illegible]		2,500[c]		0.50	
Subbase						
Gravel						
Grade 11		30				0.11
Grade 7		50				0.12
Grade 4		70				0.13
Crushed stone						
Grade 8		90				0.14

--For calculating the traffic count and data in terms of equivalent 18--kip single--axle load applications we have used the following tables:

AVERAGE EQUIVALENCE FACTORS FOR THE DESIGN OF FLEXIBLE PAVEMENT STRUCTURE AASHO INTERIM GUIDE

Serviceability index expected to be reached at the end of the design period: 2.0

TABLE 3

AXLELOAD	EQUIVALENT FACTORS	
	SINGLE AXLES	TANDEM AXLES
2000 - 8000	0.006	---
8000 - 16000	0.18	0.02
16000 - 20000	1.00	0.08
20000 - 20000	2.35	0.17
24000 - 30000	5.80	0.42
30000 - 34000	12.00	0.83
34000 - 38000	20.00	1.38
38000 - 44000	33.00	2.40
44000 - 48000	---	3.50
Passenger Cars	0.0002	

Source: AASHO (127, p. 19a)

SOURCES OF DATA

1. For the location, geometric and traffic count data:

   a) Field survey has been carried out under observation of Eng. Mohamed Khalil Hassen

      --the survey crew consists of 2 groups:

      each group consists of six men and a driver.

      --collecting geometric data was done by two engineers.

   b) The equipment for the survey consists of 20 Traffic counters and two cars.

2. Other Data and Calculation have been carried out by Eng. Abdel Maksoud Sadek, Road Laboratory Department

   Eng. Sayed Ali Khalil, Road Laboratory Department

   Eng. Mohamed Shaker, Road Laboratory Department

   Eng. Ibrahim Nusser, Faculty of Engineering

   Eng. Sayed Abd El Azem, Faculty of Engineering

3. SOIL DATA (subgrade CBR) have been from previous tests carried during execution of the construction of the Roads.

4. The WEATHER (ANNUALRAIN Fall, Dry and wet season length).

   DATA Have been taken from the Meteorology Department Information.

4. For PAVEMENT DATA (surface type, shoulder, carriageway thickness): Pavement field borings have been carried out to determine pavement thicknesses in addition to visual inspections of the pavement surface (deformation, wearing, cracking).
5. For the FINANCIAL COST, Prices and UNIT COSTS have been taken from the up-to-date construction costs of the highway projects items.

EXAMPLE FOR CALCULATION SHEETS

We mention here after an example for the data collected for the link QALUB/BANHA.

--The QALUB/BANHA link consists of 3 sections which run from

Kilo 15.0 - 26.0

26.0 - 35.0

and from Kilo 35.0 - 50.0

---

1. The Pavement of which consists of

   1. <u>SECTION (1) from Kilo 15 - Kilo 26</u>

The first pavement of this section was constructed in 1958, consisting of:

a) A layer of pitran gravel of thickness 25cm = 10".

b) Portland cement concrete layer (without shrinkage or expansion joints) of thickness 17.5 cm = 7".

c) Hot mix asphalt concrete of thickness 5.0 cm = 2".

--Then first reinforced repavement of this section was constructed in 1962, with the layers as follows:

d) A layer of pit run gravel of thickness 25 cm = 10".

e) Asphalt concrete binder course of thickness 5 cm = 2".

--And in 1972

f) The last surfacing of hot mix asphalt of thickness 5 cm = 2".

2. Section (2) from Kilo 26 - 35

a) Consisting of an old layer of limestone of thickness 25 cm = 10".

--In 1955

b) A layer of 15 cm = 6" or pitrum gravel.

d) A layer of hot mix surface course f 5 cm = 2"

--In 1962

e) A layer of hot mix asphalt concrete f 5 cm = 2"

--In 1972

f) A layer of open graded (premix) hot mix asphalt concrete 6cm = 2.4.

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--In 1962

e) A layer of 5 cm = 2" hot mix ashpalt concrete and then in 1972.

f) 6 cm = 2.4" open graded (premix) hot mix asphalt concrete.

g) 4 cm = 1.6 hot mix asphalt concrete surface course.

TABLE 4

CALCULATION OF STRUCTURAL NUMBER (SN OR DT) FOR LINK: QALUB/BANHA

Year of Const.	Type of Material Used in Layer constructed	Section 1 From kilo 15 - 26 layer cms	layer inches	Coeff	ΣSN	Section 2 From kilo 26 - 35 layer cms	layer inches	Coeff.	ΣSN	Section 3 From kilo 35 - 50 layer cms	layer inches	Coeff.	ΣSN
1955	Macdam calcarous stone.					15.0	10"	0.14	1.40				
	Stab. sandy clay									15.0	6"	0.05	0.30
	Pit run gravel base	10.0	4"	0.07	0.28	15.0	6"	0.07	0.42	25.0	10"	0.07	0.70
	Port. concrete slab	17.5	7"	0.5	3.50								
	Hot mix asphalt concrete	5.0	2"	0.4	0.80	5.0	2"	0.4	0.80	5.0	2"	0.4	0.80
						5.0	2"	0.44	0.88	5.0	2	0.44	0.88
1962	Pit run gravel	25.0	10"	0.07	0.70								
	Hot mix asphalt concrete binder	5.0	2"	0.40	0.80								
	Hot mix asphalt concrete surface					5.0	2"	0.44	0.88	5.0	2"	0.44	0.88
1970	Hot mix asphalt concrete surface	5.0	2"	0.44	0.88								
1972	Hot mix open graded. (premix)					6.0	2.4	0.34	0.816	6.0	2.4	0.34	0.816
	Hot mix asphalt concrete surface					4.0	1.6	0.44	0.704	4.0	1.6	0.44	0.704
	Total Structural Number				6.96				5.900				5.080
	Total Thickness of Pavement in MM.	675				650				650			

CALCULATION OF STRUCTURAL NUMBER FOR PROJECT (OVERLAY 1)

--Layer suggested to be constructed:

Hot mix open-graded (premix) of 6cm = 2.4"

S.N. for OVL 1 } 2.4 x 0.34 coeff. = 0.800

For Project (OVERLAY 2)

--Layers suggested to be constructed:

a) Hot mix open graded (premix) of

6 cm = 2.4".

SN = 2.4 x 0.34 = 0.800

b) Hot mix asphalt concrete surface course of 5.0 cm = 2".

SN = 2.0X 0.44 = 0.88

ΣSN = 1.680

for Ovl2

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TOTAL STRUCTURAL NUMBER OF SECTIONS AFTER PROPOSED OVERLAY

For OVL 1

Section 1 = 6.96 + 0.8 = 7.76

Section 2 = 5.90 + 0.8 = 6.70

Section 3 = 5.08 + 0.8 = 5.88

* * * * * * * *

For OVL 2

Section 1 = 6.96 + 1.68 = 8.64

Section 2 = 5.90 + 1.68 = 7.58

Section 3 = 5.08 + 1.68 = 6.76

* * * * * * * *

CALCULATION FOR EQUIVALENT

SINGLE AXLES PER LANE

SINCE OVERLAY AND SINCE SEALING

FOR QALUB/BANHA LINK

Years since last overlay = 4

Years since last sealing = 2

VEHICLE TYPE	NUMBER/DAY/LANE	NUMBER OF AXLES	COEFF. FACTOR	N'ESAC/LANE/DAY
Private	4803	2	0.006	57.5
Lorry	1060	2	0.18	381.5
Lorry with Truck	457	2 single 2 dual	0.18 0.42	547
Bus	252	2	0.18	90.5
				1076.5

Equiv. Singel Axles/lane/ 4 year = 1076.5 x 4 x 36 = 2.153 M.11

Calculation for total FINANCIAL COST:

For Project: OV1 1:

Price of Premix course of 6.0 cm	= 50000 x 15 x 2.0 =	1,500,000 LE
Price of Patching for 1cm average	= 50000 x 15 x 4 =	300,000
Sealing or tack coat	= 50000 x 15 x 0.2 =	150,000
Shoulder paving		
3 cm premix course	= 2 x 50000 x 1 x 10 =	100,000
18.5 cm wear course	= 2 x 5000 x 1.25 x =	125,000
Miscellaneous	=	400
		2,575,000 LE

For project OVL 2

The same items above + Surface course of 5 cm thickness =

50000 x 15 x 2.4 = 1,800,000

Total 4,375,000 LE

ATTACHMENT D

INTERCITY TAXICAB OPERATING COSTS

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INTERCITY TAXICAB OPERATING COSTS

1. INTRODUCTION

The vehicle operating cost is considered to be one of the essential items to be taken into consideration in the economic analysis of projects related to road construction and maintenance. Chapter 4 of the draft report of the Highway Cost Model (HCM) examines this item in detail and illustrates upon the input data required for the Model.

During the first run of the computer program for the link of the Cairo-Alexandria Highway between Kafer El-Dawar and Abou-Hoomos, and due to the preliminary nature of such investigation, it was decided to use any available data without going into detail of their precise accuracy. The Berger-Dorsch Egypt National Transport Study, Phase I, interim report, provided these necessary basic data.

2. VEHICLE CLASSIFICATION

The vehicle classification scheme of the HCM proposes five different types of Vehicles:

Motor Cars

Light Goods

Buses

Medium Goods

Heavy Goods

In view of the nature of the different types of vehicles operating on the Highway network in Egypt, some alterations on this classification was introducted.

A. Motor Cars

The motorcars under the HCM proposed scheme include passenger vehicles

seating not more than nine passengers. Estate cars, taxis and hired cars are also included, but not "land-rover" or "mini-bus" types of vehicles.

The data provided by the Berger-Dorsch report, however, illustrates upon some basic differences between the operating characteristics of both private cars and intercity taxicabs (ICTC). This is primarily due to the annual milcage of each type which was estimated to be over 100,000 km for ICTC, whereas for private cars this would normally not exceed 15,000 km. Hence it was considered more appropriate to introduce in the HCM two types for the motorcars.

i. Private Cars

This includes all passenger vehicles having a plate number with "P" registration.

ii. Intercity Taxi Cabs (ICTC)

This includes non-meter taxis operating outside urban areas.

B. Light Goods

The Berger-Dorsch report indicates that this category of vehicles does not represent any appreciable percentage among the different types of vehicles on the road. This type was not, therefore, considered in the present study.

C. Buses, Medium Goods and Heavy Goods

These types were studied in accordance with the requirements mentioned in the HCM classification.

3. OPERATING COSTS

As mentioned before the preliminary data concerning the operating costs

were taken directly from the Berger-Dorsch report. The next step was to carry out a detailed study with the objective of achieving realistic figures concerning the operating costs of the different types of vehicles. The first phase of this investigation was directed towards the operating costs of ICTC.

4. STATIONS FOR THE SURVEY

These were designed to cover the main corridors along which the ICTC operate over the Delta and Upper Egypt as follows:

a. Cairo Zone

There are three main stations in the Cairo area:

1. Cairo--Delta: Destinations for ICTC are: Alexandria; Damanhour, Tanta; El-Mansoura Damietta; El-Mahalla; Shebin El-Kome; Menouf; Desouk; Quesna; Benha.

2. Cairo--Upper Egypt: Destination: Beni-Swaif; El-Menia; Assiut; Sohag, Safaga; El-Fayoum.

3. Cairo--Suez Canal Zone

Destination: Port Said; Ismaillia; Suez; Zagazig.

b. Alexandria Zone

Destination: Mersa-Matrah; Dananhour; Tanta, El-Mahalla; Rasetta; El-Mansoura, Kafer El-Dawar, Zagzig, Cairo.

c. Tanta Zone

Destination: Cairo; Alexandria, Damanhour; Ismailla; Kafer El Sheikh; El-Mansoura, Port Said, Ismaillia.

d. Port Said Zone

Destination: Cairo; Suez; Ismaillia; Tanta; Mahalla; Damietta; Mansoura; Alexandria; Zagazig

e. Ismaillia Zone

Destination: Cairo; Prot Said; Suez; Mansoura; Zagazig.

5. INTERVIEW FORMS

These were prepared with the objective getting a true picture about the operating costs of this type of vehicle, a copy of these forms is attached with this report.

6. EXECUTION OF SURVEY

This task was undertaken by interviewing the drivers at the stations. Two engineers and their assistants spent eight working days on that job. As expected there was at the beginning of the interviewing a reluctancy on the drivers' side to answer them, thinking that the survey might be connected with the Income Tax authority. Other drivers tried to give the impression that they are loosing heavily. Later when they were assured that there was nothing in this interview related to the income tax authority, the forms themselves were the primary support for this view as they contained nothing about their names or their licensing number, a more positive and accurate response was achieved. On the other hand there was some sort of a cross-checking in the forms themselves which would indicate those who might grossly under- or over-estimate any item.

During the interview it was noticed that most of the drivers do not

own their cars. There eixst several private companies who own and operate these services employing the drivers. Data from those who operate these companies were also included in the survey.

Altogether there were about 320 completed interview forms. Twenty of them were rejected as being completely outside the normal range. The rest of the forms were grouped and analyzed to give the answers required.

7. RESULTS

The results were obtained by getting the mean value of each item.

A. Annual Mileage = 70,180 km.

It might be of interest to know that the results indicate that there is a direct relation between the annual mileage of ICTC and the distance between the two cities along which the car operates. The longer the distance between the two cities the larger the annual mileage. The range varied between 36,000 up to 100,000 km/year.

B. Type of Car

The Peugeot 504 GL Estate car dominates the fleet of the ICTC operating on the Egyptian highway. This type, with 7 passengers, presents about 62% of the total number interviewed. One would expect roughly the same percentage would apply for the car s which were in operation during the interview. It might be of interest to know that second to this type of car in percentage is the preceeding Peugeot 404 Estate car.

Characteristics of Peugeot 504 GL Estate

Max towing capacity = 1500 kg

Max power, DIN 93 bhp

Max road speed = 160 km/hr

Engine 4 cylinder, super gasoline

C. Average Present AGE of the Cars

It is noticeable that the average ICTC is relatively new.

Average Age = 4.00 Years

D. Fuel Consumption

Type of fuel: super gasoline

Basic Consumption = 7.67 km/Lt

Basic Cost = 0.08 LE/Lt

Annual Cost = $70180 \times \frac{1}{7.67} \times 0.08$

= 732.02 LE

E. Engine Oil

Basic Consumption = 0.0007 Lt/km

Basic Cost = 0.27 LE/Lt

Annual Cost = 70180 x 0.0007 x 0.27

= 13.40 LE

F. Lubrication

A total sum of 28.00 LE/year

G. Tires

Lifetime = 22,500 km/tire

Cost/tire = 25.0 LE (official price) 52.00 (Actual Price)

Annual Cost = $4 \times 25 \times \frac{70180}{22500}$ = 311.92 LE

H. Maintenance

a. Parts = 250.0 LE/yr

b. Labor = 332.0 LE/yr

I. Driver Cost

As explained before most of the drivers work for several companies. In general the driver receives 20% of the gross revenue earned by the ICTC.

Therefore total cost of driver/year = $0.20 \times \frac{0.54}{100} \times 6.6 \times 70180$

= 500.26 LE

J. Annual Registration

LE 120

K. Fines (for committing any offense against traffic law)/year

LE 48/year

L. Garage

LE 60/year

M. Parking (Fees for the use of the public station)

LE 208.8/year

N. Administrative Overheads

154.8 LE/year

O. Insurance

Due to the high rate of accidents of this type of cars, public insurance companies refuse to make any insurance policy with their operators

GENERAL INFORMATION

Average Speed = 70.18 km/hr (from any city center to city center)

Occupancy Rate = 6.6 passenger/ICTC

Average Fares = 5.4×10^{-3} LE/km

ATTACHMENT E

O-D TRAFFIC SURVEY ON RURAL NETWORK

Dr. Mohamed Owais

1. Objectives

Traffic assignment methods deal with the problem of allocating fixed traffice demands between origin-destination (O-D) paris to an existing or hypothetical transportation network made up of links connecting nodes.

The Logit Diversion Model adopted for traffic assigned on Delta Rural Highway Network in Egypt formulation is:

$$V_i = V \frac{\exp(-\theta \cdot GP_i)}{\sum_{j=1}^{m} \exp(-\theta \cdot GP_j)}$$

where

V_i = volume of a certain vehicle type in a certain year assigned to path i between a certain origin and destination;

V = total demand of this vehicle type in this year between this origin and destination;

θ = intensity of diversion parameter for this vehicle type;

M = number of paths between this origin and destination; and

GP_i = generalized price of path i for this year and this vehicle type.

The generalized pri e formulation is:

$$GP = VOC_i + VALTIM \cdot TT_i$$

where

VOC_i = vehicle operating costs over path i for this year and this vehicle type,

$VALTIM$ = value of time for this vehicle type, and

TT_i = travel time over path i for this year and this vehicle type.

The model's parameters, VALTIM the θ, are vehicle type specific, and will be estimated using disaggregate data concerning route choice.

For the purpose of calibrating both parameters, VALTIM and θ, a survey was conducted on the 8th of August 1977.

2. Design of interview sheet

The interview sheet was designed to collect information about vehicle type, O-D pair route choice. For the O-D pair route choice, three criteria were considered in designing the form: previous knowledge about O-D route alternatives, perception of travel time, and pre-trip route decision. A typical form sheet is included in this report.

3. Selection of interview stations

The interview stations were selected so as to interview traffic in both directions on each link of study area network. Twenty-one interview stations were selected. These stations were located near traffic police check points. Steel barriers were located at interview points for safety precautions. In the following table a list is given for station number and location, and a diagramatic sketch shows the locations.

Station Number	Location
1	Kalama
2	Touck
3	Kafer El-Gazar
4	Quesna
5	Defra
6	El-Tadreib
7	Katatba
8	Nicla
9	Abou-Yoesf
10	Sanries
11	Kafr-El-Gonami
12	Angahs
13	Sars El-Layar
14	Shenwan
15	Meet Abou Sheah
16	El-Kased
17	Betebs
18	El-Batanon
19	Kafer-El-Arab
20	El-Kamsean
21	El-Hadsah

4. Organization

4.1 Interviewing Crews

The Cairo-Alexandria agricultural expressway carries a heavy traffic volume, much more than any other link in the network. For this reason, six interviewers were allocated for each of stations 1 and 2 to interview vehicle drivers in each direction. For stations 3 to 6 four interviewers were allocated for each station. For the rest of the stations, 7-21, two interviewers were allocated; bringing the interview team to 54 members. Also, another 5 interviewers were listed for reserve. At each interview station two traffic policemen were allocated to stop traffic in both directions. Also, patrols in cars were organized to check the progress of the interviewers. Before the survey day, a lengthy meeting was held at Cairo University between the supervising team of the survey and the graduate students from the Civil Engineering Department taking part in the interview. In this meeting, the interview questionaire was discussed and questions raised from the students were answered.

4.2 Timing of Survey

A typical weekday representative of average traffic volumes was chosen for conduting the survey: Monday, the 8th of August, 1977. Traffic driver interviews were conducted from 7:00 a.m. until 19:00 p.m., with a break from 13:00-14:00 p.m.

4.3 Distribution of interviewers to allocated stations

During the meeting held at Cairo University it was decided that all the persons participating in the survey would gather at Cairo University main entrance at 5:00 a.m. on the survey day. Six routes were selected to distribute the interviewers at their interview stations before 7:00 a.m. A bus conveyed the interviewers of stations 1-6 using route number 1. Five Peugeot 6-seat intercity taxis covered the rest of the stations, with stations number 21, 8 and 7 as route 2, stations 9, 10 and 11 as route 3, stations 12, 13 and 20 as route 4, stations 14, 15 and 16 as route 5, and stations 17, 18 and 19 as route 6.

5. Results

5.1 Zoning

The study area was divided into a number of zones. The zone boundary is the governorate boundary of the Markaz which was also considered as zone centroid. The external area surrounding the study area was divided into 11 zones. These boundaries of the external zones were chosen as a natural barrier, such as a canal, and as each zone generated or attracted traffic using a major highway crossing the study area.

5.2 O-D Matrix for each interview station

After the data had been collected, manual processing was carried out. Since five vehicle types were interviewed (private cars, intercity taxis, bus, trucks and trucks with trailers) there are five O-D matrix sheets for every interview station. As the sample size interviewed for each vehichle type was considered as representative of the daily traffic, the O-D matrix was expanded by a factor which is the Average Daily Traffic (ADT) divided by the sample size. Each cell in the O-D matrix was then multiplied by this factor.

5.3 Master O-D Matrix

The master O-D matrix was obtained by adding together the enlarged O-D cells for each vehicle type at each interview station for the 21 stations, producing 5 master O-D matrices for the 5 vehicle types. A typical form of the data analysis is given.

STATION NO.

VEHICLE TYPE

TOTAL SAMPLE SIZE =

A.D.T. =

E.F. =

O \ D	CAIRO	QLUB	TOKH	BNHA	QSWA	BR-SE	TANTA	KAFR ZIAT	KOM HAMADA	BADR	TALA	EL-SHOUHADA	SH. EL KOM	MONOUF	BAGOUR	ASHMON	KANATER	1	2	3	4	5	6	7	8	9	10	11
CAIRO																												
QLUB																												
TOKH																												
BNHA																												
QSWA																												
BR-SE																												
TNTA																												
KAFR ZIAT																												
KOM HAMADA																												
BADR																												
TALA																												
EL-SHOUHADA																												
SH. EL KOM																												
MONOUF																												
BAGOUR																												
ASHMON																												
KANATER																												
1																												
2																												
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												
11																												

وزارة الداخلية - وزارة النقل
جامعة القاهرة -

صحيفة الاستقصاء الشخصي على الطريق
نموذج الطرق الاقتصادى

رقم الصحيفة ☐☐☐☐ محطة رقم ☐☐ التاريخ ☐☐ يوم ☐☐ شهر ☐☐ توقيت الانتهاء من الاستقصاء ☐☐☐☐ توقيت البدء فى الاستقصاء ☐☐☐☐ دقيقة ساعة

١	٢	٣	٤	٥	٦				٧	٨		٩
رقم مسلسل	نوع المركبة	مكان بدء الرحلة المحافظة - مركز أو قسم	مكان انتهاء الرحلة المحافظة - مركز أو قسم	اسماء المدن التى تمر عليها خلال الرحلة	هل تتوقف فى اى من هذه المدن خلال الرحلة				الزمن الذى تستغرقه الرحلة	هل تستخدم هذا الطريق باستمرار		اسباب استخدام أو عدم استخدام الطريق
					لا	تمر				نعم	لا	
						اسم المدينة	الطريق من التوقف	مدة التوقف				