CHAPTER B

GENERAL PROJECT ACHIEVEMENTS

1 ORGANIZATION

As a result of the studies and requirements outlined in the Inception Report (Ref. 1), an organizational structure was established for the project as shown in Figure 4. This structure was designed to deal functionally with the major areas of the research which are outlined in the project objectives. These are the studies to develop user costs relationships, using surveys and a series of experiments, together with a study of roadway performance in Brazil. These basic research areas are supported by a management, statistics, computer and instrumentation group.

As can also be seen in Figure 4, where the project's senior personnel are identified, the leadership of the project has been established so that it is shared by the international staff and the Brazilians. The detail organizational requirements have changed a number of times since the Inception Report, although the total personnel requirements have remained more or less constant.

Figure 5 shows the present organizational requirements. These staffing requirements were about 80% satisfied, at the end of the first year of the study. In the last months that figure has slowly moved upward and is at 90% presently. However, the project is unlikely to ever be fully staffed due to personnel attrition, which has averaged about 5% on a quarterly basis over the last year.

2 MEASUREMENT EQUIPMENT

The majority of the activities of this research project involve measurements of one type or another. Therefore, the acquisition or fabrication of the necessary equipment and instrumentation to permit these measurements was a major project undertaking. An even more substantial challenge has been keeping the equipment operational during the study.

Table B.1. shows the various equipment or instrumentation purchased or fabricated to make these required measurements. Each unit is associated with the type of measurement needed. Where a measurement system has been modified to satisfy project needs, the Instrumentation Group has been identified as the Source. The difference between purchase date and the date available for use reflects delays in

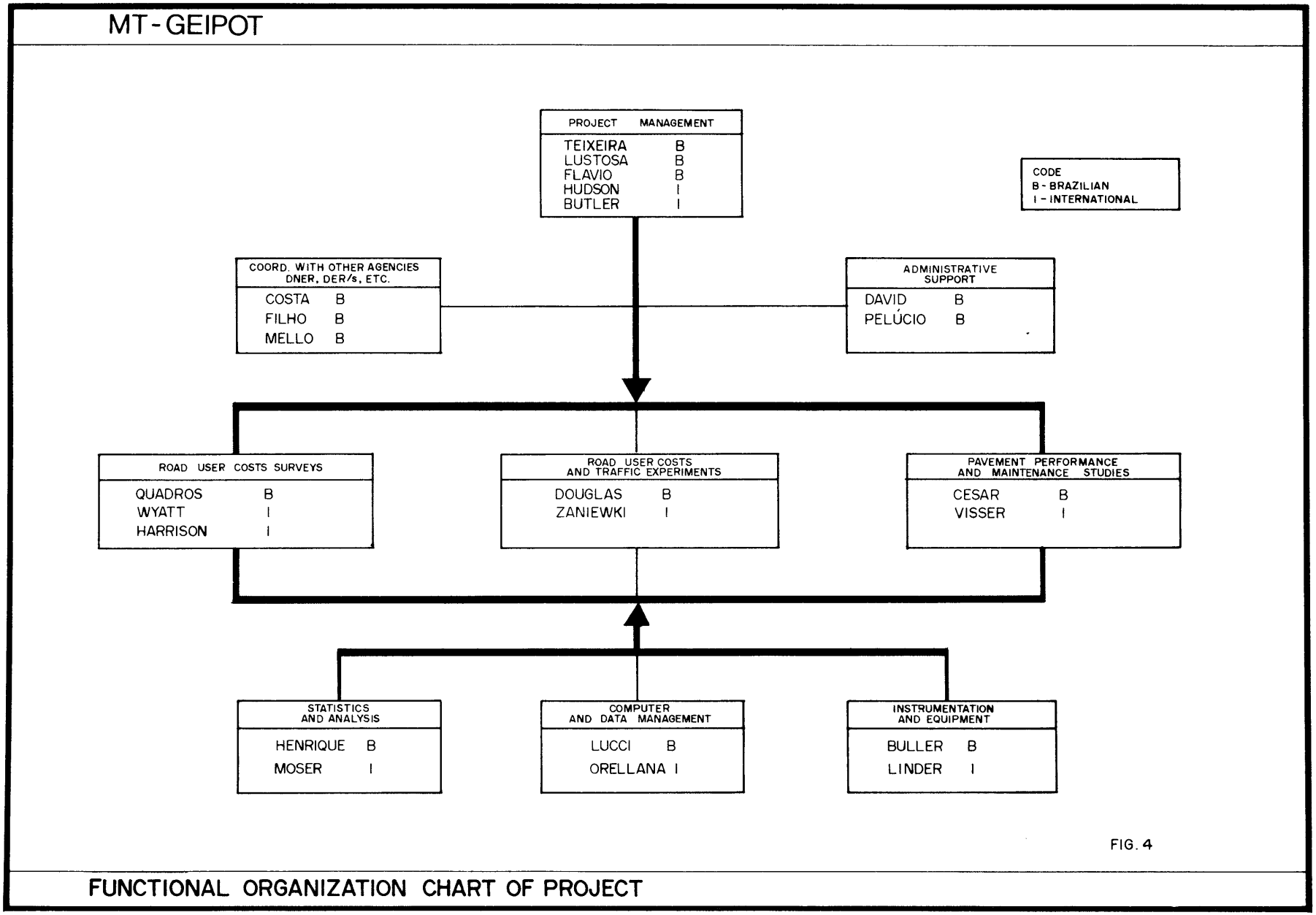
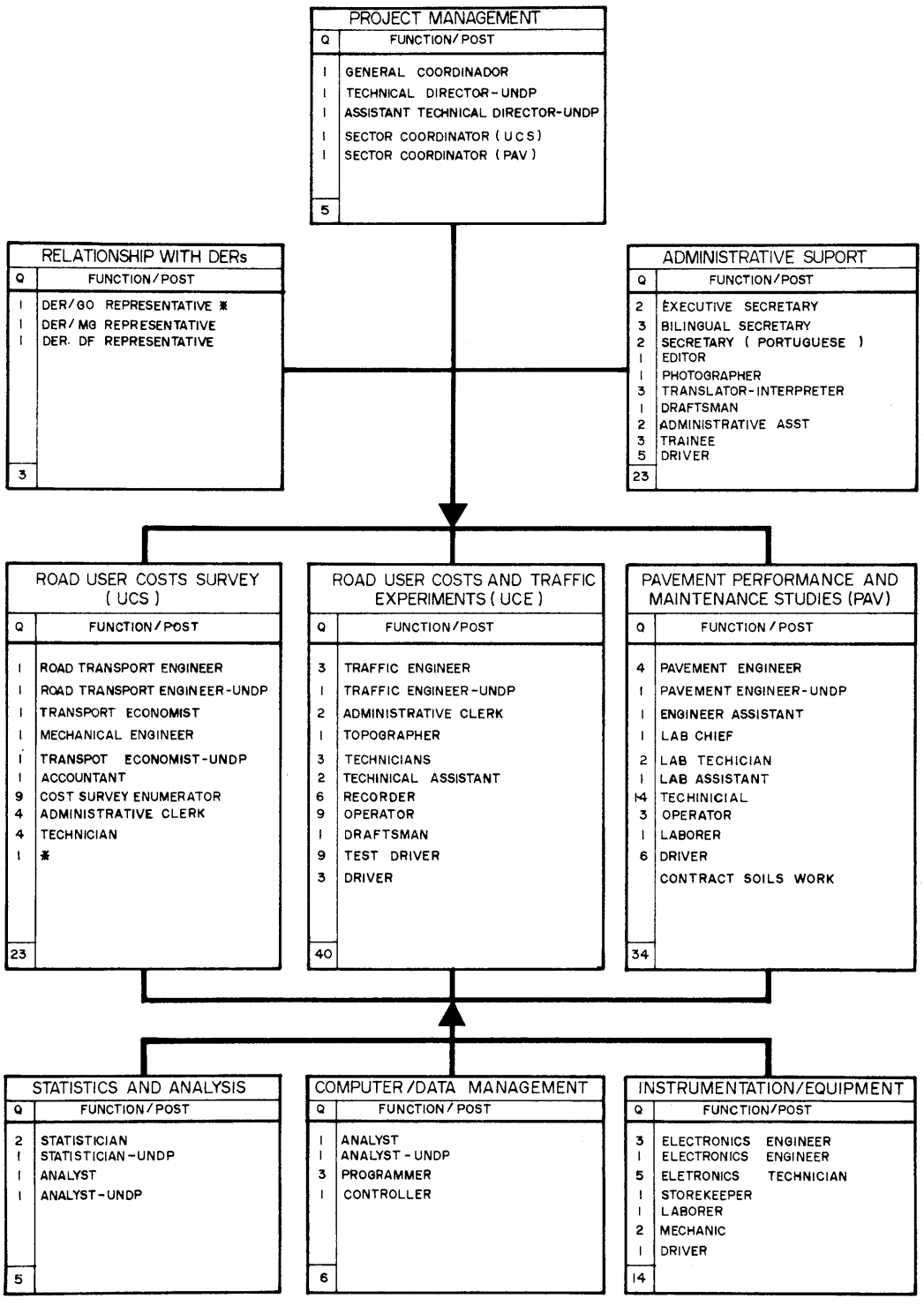


FIG. 4

FUNCTIONAL ORGANIZATION CHART OF PROJECT

MT-GEIPOT



* DER/GO REPRESENTATIVE SPENDS OF HIS TIME ON THE USER COST SURVEY

FIG. 5

DETAIL ORGANIZATION CHART OF PERSONNEL (REVISED JULY 1977)

TABLE B.1 - DISPOSITION OF EQUIPMENT AND INSTRUMENTATION ACQUIRED FOR PROJECT MEASUREMENTS

TYPE OF MEASUREMENT	EQUIPMENT NAME	MANUFACTURER OR SOURCE	DATE OF PURCHASE OR MANUFACTURE	QUANTITY ON HAND	DATE AVAILABLE FOR USE	PERCENTAGE OF TIME IN:		
						USE	STANDBY	REPAIR & SERVICE
Pavement Deflection	Dynaflect	SIE	May 76	1	June 76	63%	16%	21%
	Benkelman Beam	Rainhart Co.	March 76	2	March 76	100%	0%	0%
	Benkelman Beam	DNER	March 76	2	March 76	0%	100%	0%
Vehicle Weight	WIM lE	Unitech, Inc.	November 75	1	July 77	5%	3%	82%
	Wheel Scales Model MD500	General Dynamics Corp.	August 75	4	October 75	55%	44%	1%
Traffic Counts	Manual Traffic Counter	Denominator Co., Inc.	August 75	4	October 75	0%	100%	0%
	Non-Recording JRT	Streeter-Amet	August 75	30	October 75	1%	99%	0%
	Non-Recording Model 3700	Fisher & Porter Co.	August 75 and November 75	5 5	October 75 and March 75	1%	99%	0%
	Recording Automatic Counter	Leopold & Stevens, Inc.	August 75 and November 75	10	October 75	10%	80%	10%
Time	Single Action Stop Watch	Camero	August 75	30	October 75	0%	100%	0%
	Double Action Stop Watch	Handhart	August 75	10	October 75	0%	100%	0%
	Split-Second Hand Stop Watch		December 75	8	February 76	95%	0%	5%
Wind Velocity	Windial Wind Speed Indicator = 918	Airglide Instrument Co.	January 76	3 3	March 76	95%	4%	1% 0%
Soils Lab. Equipment	Dynamic Modulus Tester	Russ Newcom SEE	October 75	1	February 76	70%	28%	2%

TABLE B.1 -·DISPOSITION OF EQUIPMENT AND INSTRUMENTATION ACQUIRED FOR PROJECT MEASUREMENTS (CONT.D)

TYPE OF MEASUREMENT	EQUIPMENT NAME	MANUFACTURER OR SOURCE	DATE OF PURCHASE OR MANUFACTURE	QUANTITY ON HAND	DATE AVAILABLE FOR USE	PERCENTAGE OF TIME IN:		
						USE	STANDBY	REPAIR & SERVICE
Rainfall	Eletric Rain Gauge	Texas Electronics Inc.	March 76	2	April 76	0%	100%	0%
	Plastic Rain Gauge	Taylor Sybron Corp.	March 76	6	April 76	95%	5%	0%
Fuel Consumption	Automotive Fuel Measurement System	Fluidyne Instruments	August 75	1	November 75	2%	98%	0%
	Fuel-o-meter	Columbia System Co.	April 76	6	May 76	2%	98%	0%
	Cylinder Fuel Meter	Instrumentation Group	January 76 April 77	9	March 76	56%	21%	23%
Distance	D.M.I. P 1071	Nu-metrics	September 75 through present	18	November 75 through present	55%	35%	10%
	Rolatape Model 394	Rolatape Corp.	October 75	5	November 75	99%		1%
	Surveyors Tape 30 & 15m	K & E	August 75	3		100%		0%
Road Grade	Electronic Grade Meter	Instrumentation Group	October 76	2	October 76	100%	0%	0%
	Ball & Tube Grade Meter	Instrumentation Group	November 76	1	November 76	5%	95%	0%
Roughness	Profilometer	K. J. Law Engrs.	September 75	1	May 76	40%	18%	42%
	Modified Mays-Ride-Meter	Instrumentation Group	March 76 through October 76	4	May 76 through October 76	67%	12%	21%
Road Horizontal Curvature	Gyro Compass	Aviation Instrument Mfg. Corp.	January 76	2	October 76	50%	49%	1%
Vehicle Speed	TR-6 Radar System	Kustom Signals, Inc.	January 76	4	May 76	94%	2%	4%
Vehicle Acceleration	Camera Box	Instrumentation Group	September 76 through August 77	3	September 76 through August 77	55%	30%	15%
	Fotimeter	Instrumentation Group	March 77	2	October 77	0%	100%	0%

shipping or the need to completely check out the unit before it could be used operationally. Some of the equipment shows little or no use during the study and these items warrant a brief explanation.

The DNER Benkelman Beam has not been used because its 4:1 ratio is not as precise as the 2:1 Rainhart unit.

The manual traffic counters have not been needed. Both of the non-recording counters have only recently been designated for use and will be installed at various locations throughout the State of Goiás in the coming months.

Of the three stopwatch types, only the split-second type watches have been useful in the traffic experiments conducted thus far.

The rain gauges were received too late for the rainy season last year, and are currently being installed to monitor the coming season.

Both the Columbia and Fluidyne systems will be used in calibration experiments that have not yet been implemented.

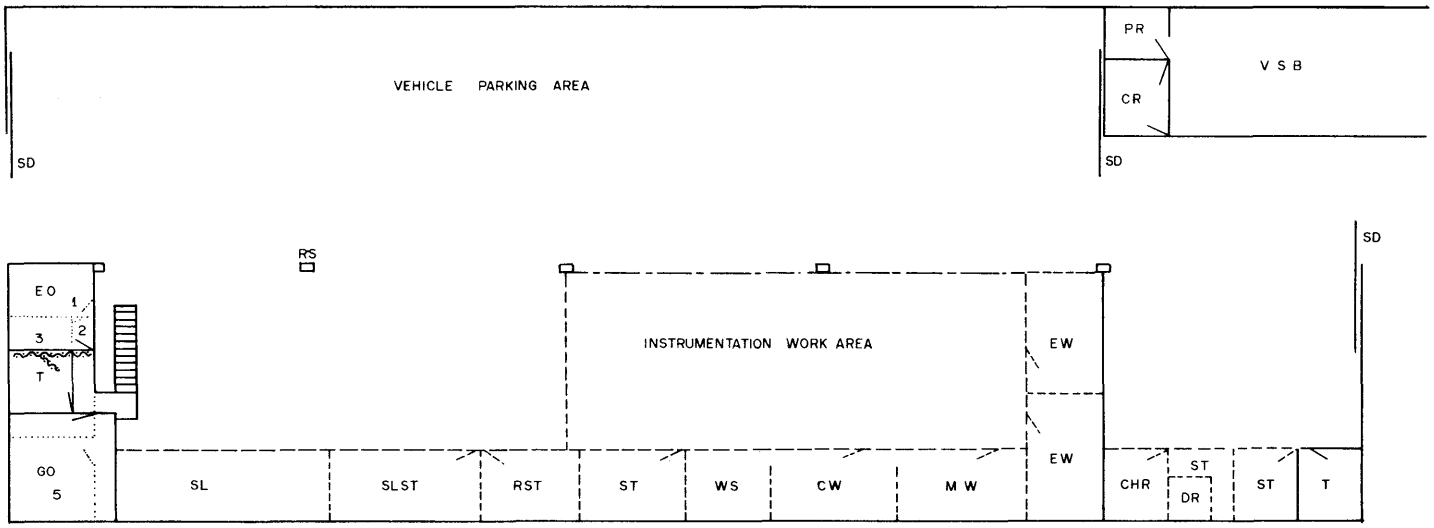
3 *WORKSHOPS*

From the project's inception it was realized that instrumentation support was basic to the objectives of the research, as the studies and experiments planned demanded the installation, adaptation and fabrication of sophisticated equipment, and the maintenance of a diversified vehicle fleet.

The workshops were set up in the garage building of GEIPOT, which was given over to the project. The premises are located about 7 km from the project headquarters, in GEIPOT's main office building. The garage building area was partitioned with wire cages to house the different workshops, and electricity supplies were installed. Other cages were used to accomodate supply stores, the soils laboratory - a support element for the pavement studies - and a staff room. The existing offices are being utilized as indicated in Figure 6, with the technical office being partitioned to house the analogue-to-digital converter and to provide suitable space to work on the associated data.

MT-GEIPOT

SCALE: 5mm Im



LEGEND

CR	COMPRESSOR ROOM
CHR	CHANGE ROOM
EO	ENGINEERS' OFFICE
EW	ELECTRONICS WORKSHOP
DR	DARK ROOM
GO	GENERAL OFFICE
CW	CARPENTRY WORKSHOP
MW	MECHANICAL WORKSHOP
PR	PUMP ROOM
RS	ROOF SUPPORT PILLAR
RST	RADAR STORE
SD	SLIDING DOOR
SL	SOILS LABORATORY
SLST	SOILS LABORATORY STORE
ST	STORE
T	TOILETS
VSB	VEHICLE SERVICE BAY
WS	WELDING SHOP

1	TRANSPORT OFFICE
2	TOILET
3	ANALOGUE-TO-DIGITAL CONVERTER ROOM
4	TECHNICAL OFFICE
5	SOILS LABORATORY

} GROUND FLOOR

——— CONCRETE BLOCK WALL (ORIGINAL)
– – – – PROJECT ADDITION
..... ORIGINAL GROUND FLOOR CONCRETE BLOCK WALL
~~~~ PARTITION (PROJECT ADDITION)
—·—·— DEMARKATION LINE PAINTED ON THE FLOOR

FIG. 6

GARAGE AND WORK SHOPS FLOOR PLAN
~~~~

The vehicle service bay was equipped with a hydraulic lift and pressurized greasing operation, and the two electrocnics workshops were lined with sound-proofing material to reduce noise levels. The objective of the adaptations was to provide the best possible facilities for all the electrical, electronic and mechanical work required, within reasonable financial limits.

The workshops' functions are:

- To install, test, calibrate and maintain available instruments;
- To design, construct, make work, install, calibrate and maintain other instruments, as required;
- To carry out all minor vehicle repairs and maintenance;
- To train staff in the operation of all the instruments used and workshop practices and maintenance methods;
- To ensure maximum possible availability of all equipment for use in the field.

Major achievements in the area of instrumentation support include the installation of the Mays-Ride-Meter, the adaptation of fuel meters to test vehicles, the manufacture of camera boxes, the development of a digital display unit for the Maysmeter, and the correction of faults in the Profilometer, WIM system, Dynaflect, DMI and radar speed monitors. A complete and detailed report covering all the project's instrumentation is currently being written. This report will detail instrumentation design and fabrication, together with measurement system development, calibration, maintenance and repair. It will also outline equipment and instrumentation crew requirements, training and operating procedures, schedules, production and problems.

a Soils Laboratory

A soils laboratory was established to control the work performed by the consultants in the field. This initial objective has been augmented by having the research laboratory carry out all the laboratory tests. This was required because of the unexpectedly high cost and the low precision achieved when the work was done by consultants in the field.

Space for the laboratory was found in the GEIPOT garage, with adequate water and electricity supplies, occupying a total area

of 63.3 square meters. A floor plan of the laboratory area is shown in Figure 6.

The laboratory is equipped to carry out most standard laboratory tests, such us:

- Sample preparation;
- Grading analysis;
- Atterberg limits;
- Moisture contents;
- Laboratory density;
- Laboratory CBR;
- Resilient modulus of soil and asphaltic material samples.

4 *COMPUTER FACILITIES*

At the start of the project it was recognized that the magnitude of the data to be handled would require access to suitably equipped computer facilities. Specifications were drawn up outlining the basic characteristics required. Identified initially as fulfilling these specifications were two installations in Brasilia, the facilities of the Senate and those of the University of Brasilia. Neither proved suitable and the search was continued.

The Expert Working Group (EWG) in their meeting of December 1-5, 1975, strongly recommended to GEIPOT that the project have an electronic data-processing capability within their offices. This involved the establishment of a fully remote batch terminal. This criterion was added to the specification and a concerted effort was made to establish these inhouse capabilities.

In the interim, it became mandatory to have some facilities available, even if less than desired. So,

- A contract was established in February 1976 with *Companhia Auxiliar de Empresas Elétricas Brasileiras* (CAEEB). Their facilities were small (252k memory), and they did not have any statistical software to support our analysis requirements. However, they were fairly reliable, close to GEIPOT, and they could be used in the establishment of programs and files to handle the substantial data management requirements of the project. This installation con

tinues to serve in this role at present;

- In April 1976, arrangements were made with *Empresa Brasileira de Pesquisa Agropecuária* (EMBRAPA) to use their facilities and software statistical package (SAS).

After an exhaustive review of options, GEIPOT made the decision to install a remote job entry terminal which could be tied to the DNER IBM 370 computer facilities located in Rio de Janeiro . The steps needed to implement this decision included:

- Locating available terminal equipment;
- Obtaining authorization from the Ministry of Transport;
- Establishing a contract with DNER;
- Arranging contracts with the telephone companies in Rio and Brasilia;
- Selection and purchase of complementary equipment and installations;
- Contracting with Burroughs for the actual installation of the terminal in GEIPOT.

The remote terminal was installed in February 1977, but only in June 1977 was the remote job entry system usefully operational.

Project files and programs were established at the DNER facility during July and August 1977; so the inhouse computer facilities, sought since early in the project, have only recently become available to the project, that is, two years after the start of the project. This facility will be used for all data processing requirements. However, as backups, both the CAEEB and EMBRAPA installations are being retained.