JAPAN INTERNATIONAL COOPERATION AGENCY

INSTITUTE ROAD ENGINEERING
AGENCY FOR RESEARCH AND DEVELOPMENT
MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR STRENGTHENING ROAD TRANSPORT ENVIRONMENT MANAGEMENT IN REPUBLIC OF INDONESIA

FEBRUARY 1995

PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of Republic of Indonesia, the Government of Japan decided to conduct a basic deign study report on the Project for Strengthening Road Transport Environment Management in Republic of Indonesia and entrusted the study to the Japan International Cooperation Agency (JICA).

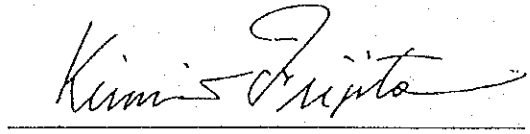
JICA sent to Indonesia a study team headed by Mr. Keizo KAMIYA, Manager of the Asphalt Pavement Research Division, Laboratory of Japan Public Highway Authority and constituted by members of Pacific Consultants International from December 7th to December 23th, 1994.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted a field study at the study area. After the team returned to Japan, further studies were made, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Republic of Indonesia for their close cooperation extended to the teams.

February 1995



Kimio FUJITA
President
Japan International Cooperation Agency

February 1995

Mr. Kimio FUJITA
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

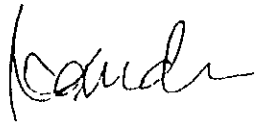
We are pleased to submit to you the basic design study report on the Project for Strengthening Road Transport Environment Management in Republic of Indonesia.

This study was conducted by Pacific Consultants International, under a contract to JICA, during the period of December 1st, 1994 to March 24th, 1995. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Indonesia, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

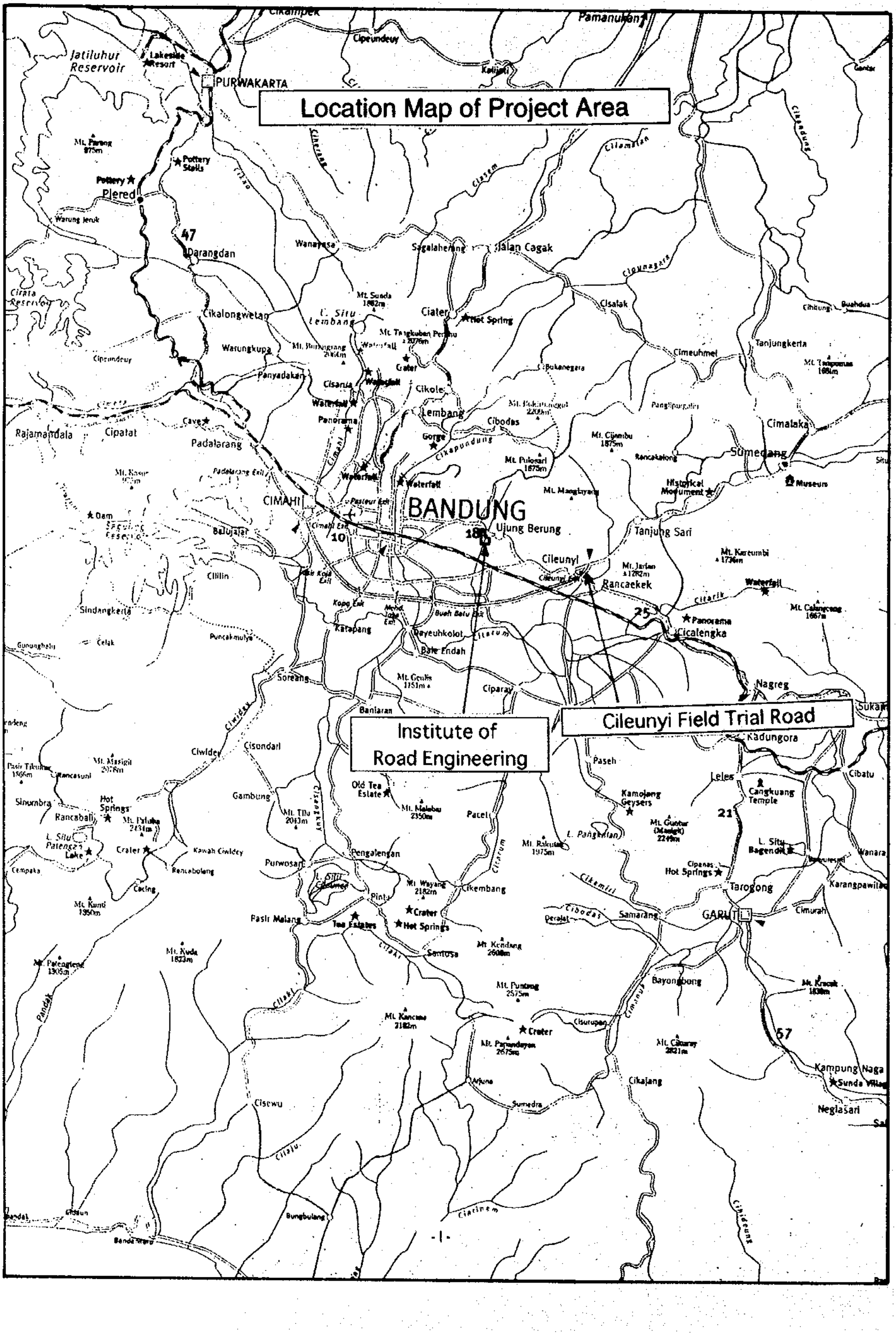
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and the Ministry of Construction and Japan Public Highway Authority. We would also like to express our gratitude to the officials concerned of the Ministry of Public Works, Agency for Research and Development, Institute Road Engineering, the JICA Indonesia office and the Embassy of Japan in Indonesia for their cooperation and assistance throughout our field survey.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



Koki KANEDA
Project Manager,
Basic Design Study Team on the Project
for Strengthening Road Transport
Environment Management
in Republic of Indonesia
Pacific Consultants International


Location Map of Project Area
Institute of Road Engineering
Cileunyi Field Trial Road
BANDUNG
PURWAKARTA
Jatiluhur Reservoir
Lakeside Resort
Plered
Darangdan
Cikalongwetan
Warungkupa
Panyadakan
Padalarang
Rajamandala
Cipatat
CIMAHI
Batujajar
Cililin
Sindangkerta
Soreang
Katapang
Dayeuhkolot
Bale Endah
Banjaran
Ciparay
Ujung Berung
Cileunyi
Rancaekek
Tanjung Sari
Cicalengka
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Cibodas
Jalan Cagak
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Cipeundeuy
Pamanukan
Tarogong
GARUT
Samarang
Bayongbong
Cikajang
Kampung Naga
Neglasari
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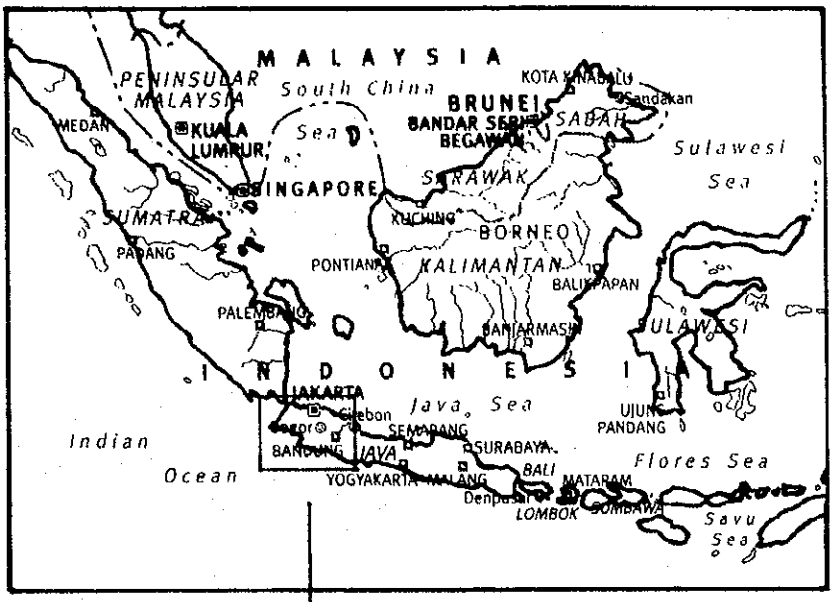
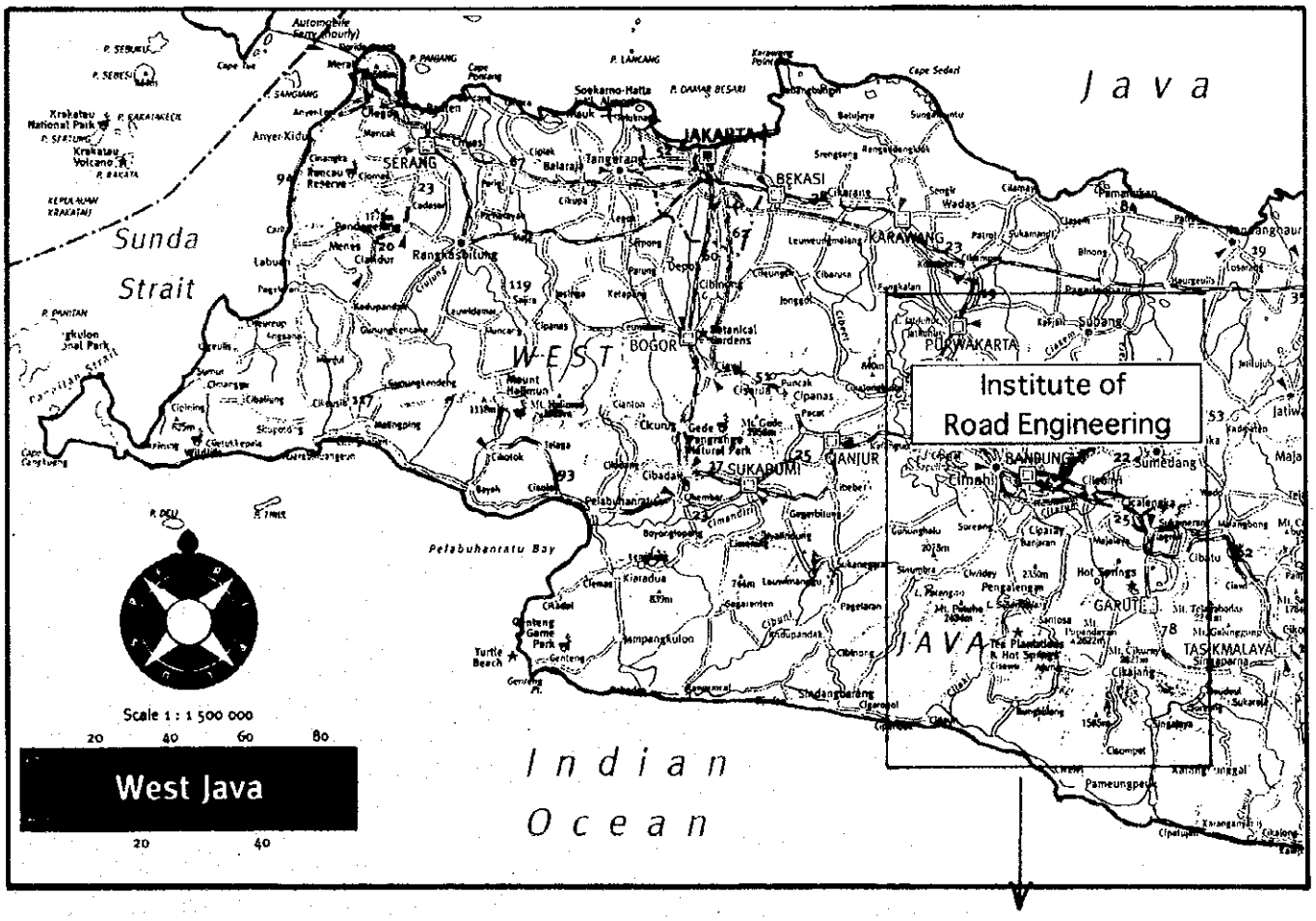
Purwosari
Pintu
Gambung
Ciwidey
Cisondari
Pacet
Paseh
Santosa
Ciseuwu
Bungbulang
Kamojang Geysers
Cangkuang Temple
Hot Springs
Tea Estates
Crater
Old Tea Estate
Waterfall
Panorama
Historical Monument
Museum
47
10
18
25
21
57
-1-

Map of Indonesia and Vicinity Map



Enlarged Map



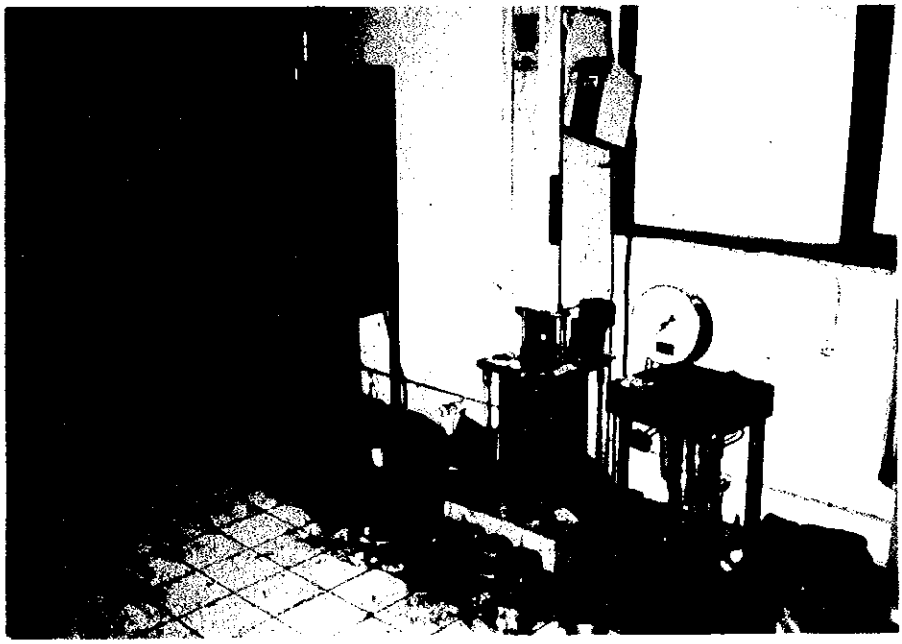
Enlarged Map(Next Page)

Pictures of Existing Testing Machinery

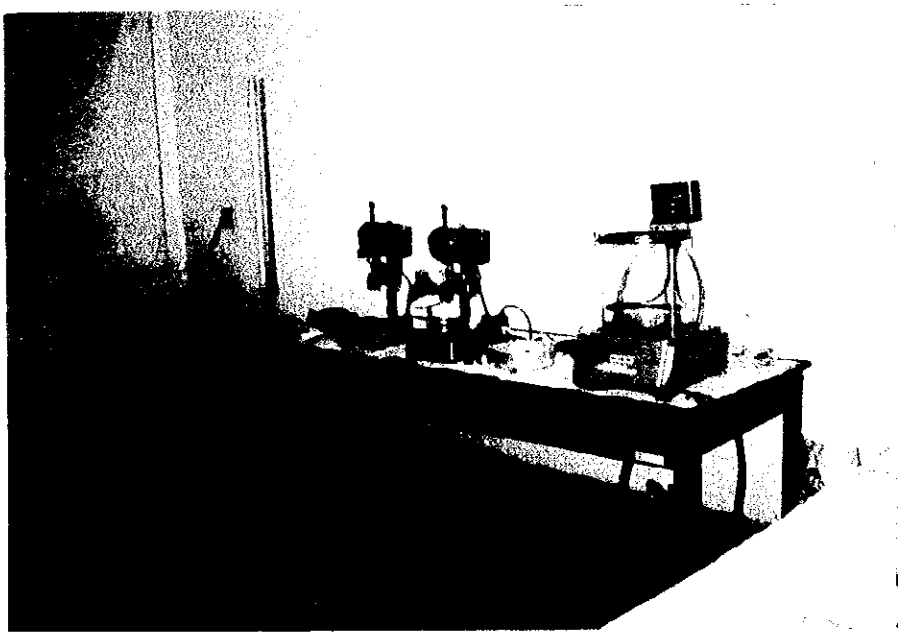
1. Pavement

1.1 Marshall Test Apparatus

Basic instruments including Marshall Test Apparatus and others for laboratory mixing test, those for extracting asphalt content from mixture and for analysing are being equipped. However, many of them are very old, and it is doubtful if they can provide accurate testing results. Many of the automatic apparatuses are out of order.

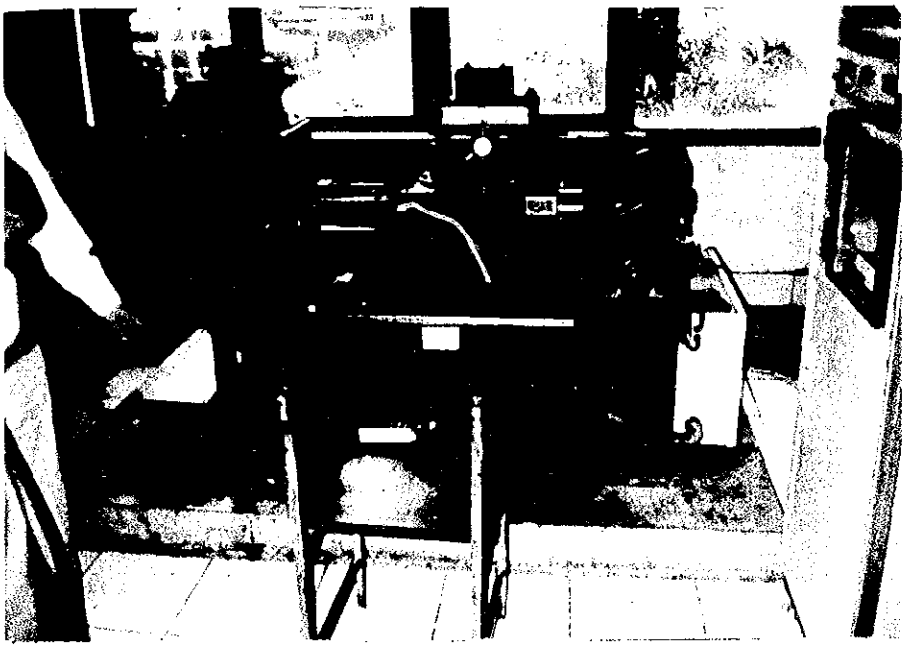


1.2 Automatic Compaction Machine for Marshall Apparatus



1.3 Penetration Testing Apparatuses

1.4 Asphalt Extracting and Analysing Apparatuses

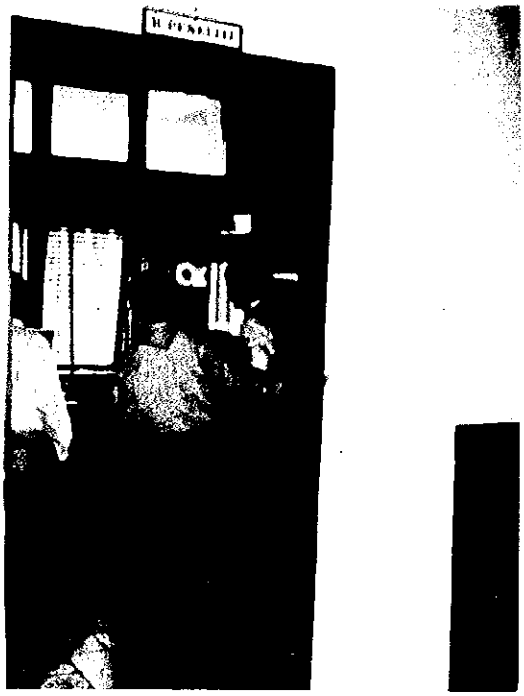


1.5 Wheel Tracking Tester

A Japanese-made wheel tracking testing apparatus is being used. However, there is no thermostatic chamber. They are using this for water percolation test without a base using a 5 cm-thick asphalt mixture sample under room temperatures. Therefore, it is only significant as a comparative test.

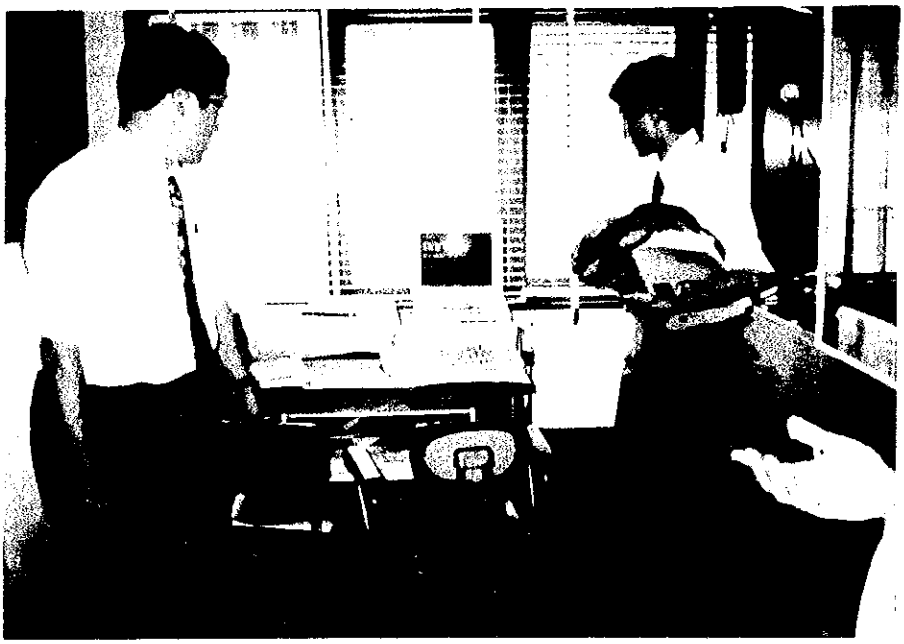
1.6 Ravelling Tester

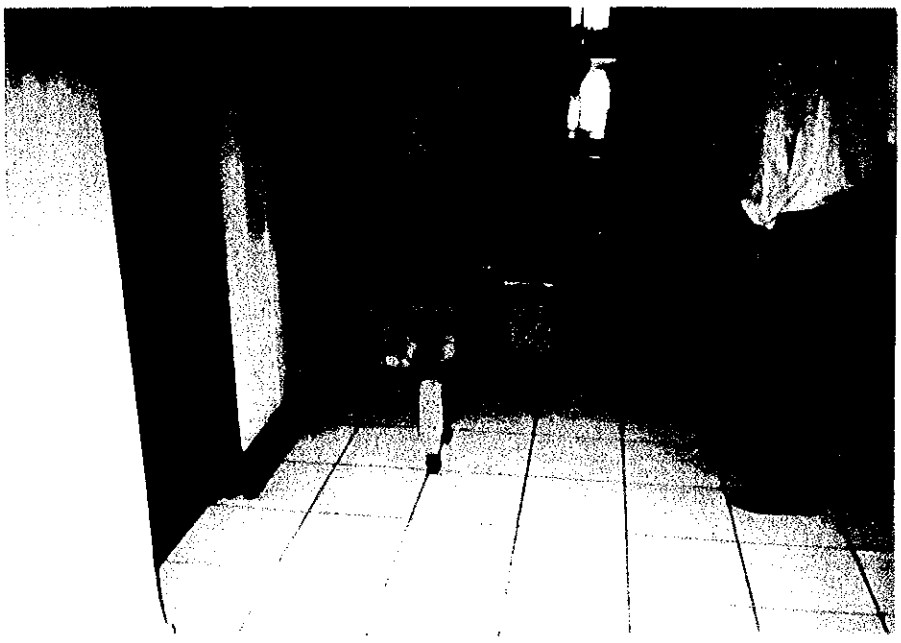
The ravelling test machine is a rotary type using a solid tire instead of a chained tire. They have been using this mainly for abrasion gauge of concrete pavement. The purpose of which is hard to understand.



1.7 Elastic Gauge
(made in Australia)

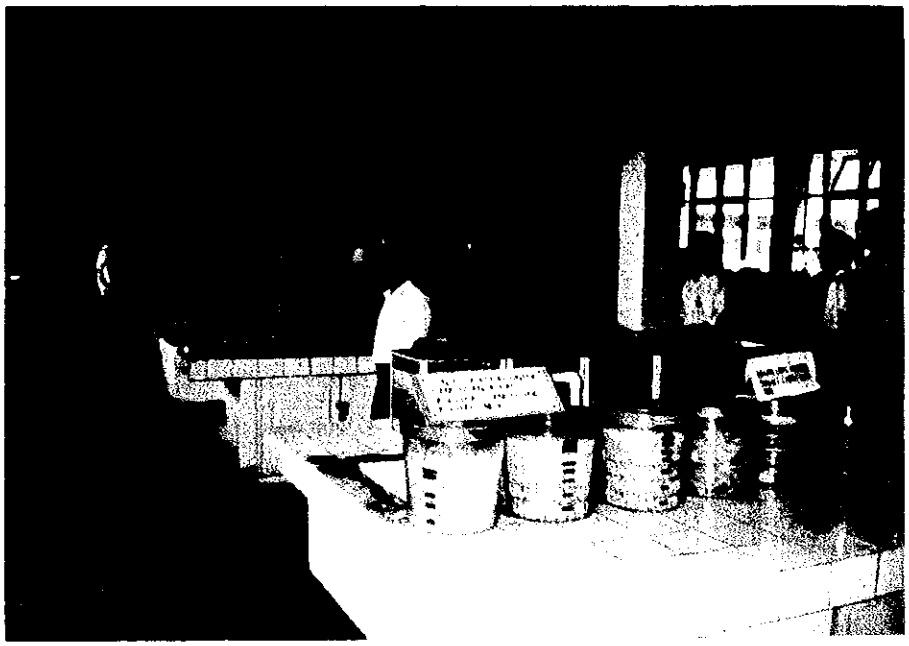
An Australian-made elastic gauge is attractive. However, there is no specimen nor tools for testing around that apparatus. It appears to be used infrequently.





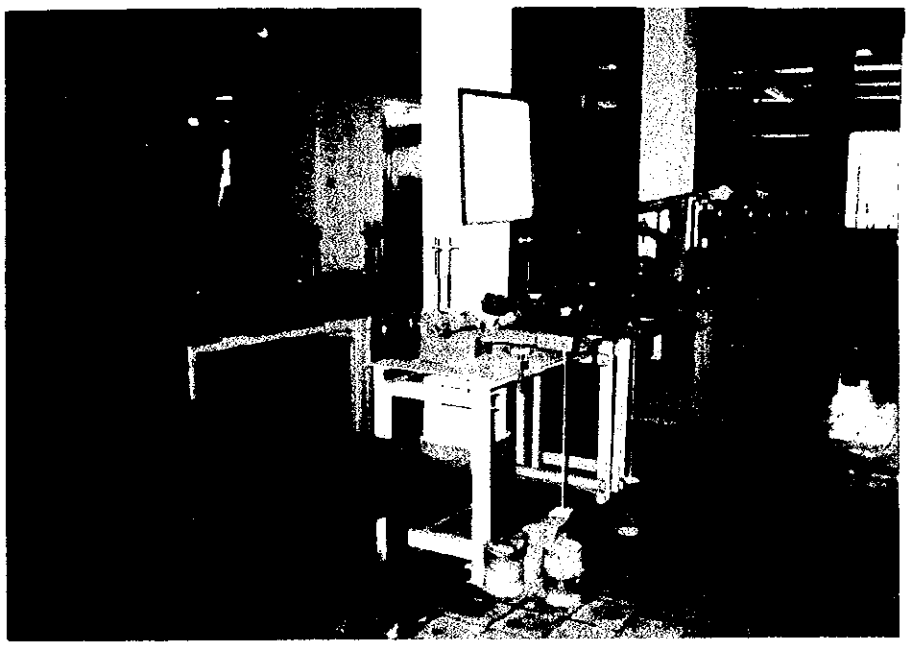
1.8 MU Tester

They have a MU testing apparatus, a towing type tester by the British Road Testing Institute.



2. Soil

Apparatuses to test the physical and dynamic properties of the soil are being equipped.



2.1 Consolidation Testing Machine

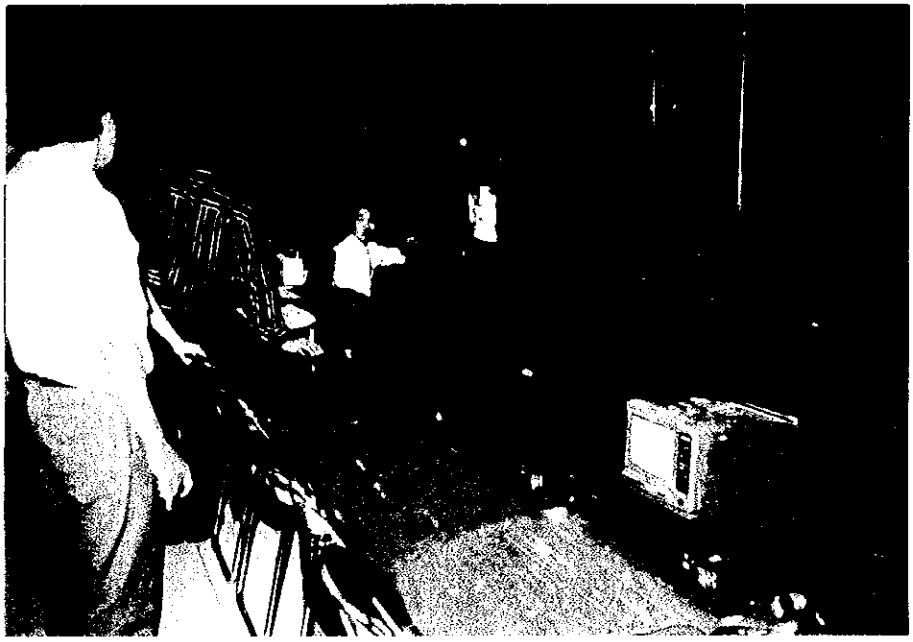
3. Structure

3.1 Amusler-type Universal Testing Machine

Several kinds of static load testing machines are equipped in a large gym-like experimental building.

3.2 Ruin of a Large Structure Bending Test Field

Outside the building, there are traces of several different kinds of large-scale tests to have been conducted in the past. They are superannuated generally, and many of them are not usable.



4. Environment

Apparatuses to analyse traffic and gauge pollution are being equipped gradually. They are counting traffic by the types of vehicles using an automatic traffic measuring mat, or a time-lapse video recorder.

5. Cileunyi Field Trial Road

3.2 kilometers long

SUMMARY

SUMMARY

The Republic of Indonesia has allocated 19.1 percent of the total official development budget to improve the country's traffic and communications systems in the 5th Five Year Plan (1989-1993) which terminated in March 1994. The government has tried to meet the increasing demand in land traffic by prolonging the total length of roads.

Under the 6th Five Year Plan starting in April 1994, the development of roads is considered to be the most important in the transportation sector. The development budget for the transportation sector amounts 33 trillion rupia, 22 trillion or 67 percent of which is allocated to road-related expenses. In addition to the traditional road construction and improvement, the problems of urban traffic, measures against deteriorating traffic environment and the improvement of road maintenance technologies are required.

The basic objectives for the Road Sector in the 6th Five Year Plan are as follows:

1) Effective development investment and efficient maintenance and management
2) Providing equal services to all regions, i.e., improvement of access roads to rural populace
3) Building functional road networks according to the development goals laid by the government, region and sector.
4) Promotion of transferring the responsibility of maintaining road networks to the local governments concerned by human resource development and structural changes.
5) Implementation of environmental assessment prior to planning road improvement and maintenance projects.

The concrete goals are to construct and improve roads (main roads, branch-roads, regional roads and toll roads) and to rehabilitate and replace the existing bridges and build new bridges. For the proposed road construction extending 10,000 kilometers, topographically difficult sites (for which reason, no road has been constructed) are included. For these sites, weak soil improvement measures and bridge construction are required.

The Road Research Institute (IRE), the only one research and technological development agency in the country under the Ministry of Public Works, is now addressing a new research theme of developing road-related technologies to support the priority area of the road development sector in the new Five Year Plan. However, the existing facilities, equipment and apparatuses will not enable them to realize their assignment adequately. Their limited

budget will not allow purchases of new research equipment. Hence, they are not able to work for the urgent and high priority subjects in the new Five Year Plan.

In 1991, the IRE worked out a letter of request to the Japanese government and submitted it through the Ministry of Public Services and BAPENAS (National Development Planning Agency).

They requested the replacement of the existing testers, and the improvement of the field test site for pavement and other testing facilities. Subsequently, the IRE expanded the range of their research based on the new Five Year Plan from pavement field tests to include the development of new road construction technologies. Along with this, the emphases were shifted to environmental problems, pavement standardization, weak-soil measures, and various types of bridges. Based on the new research plan, the IRE wrote a new letter of request in May 1994. The Indonesian government submitted this proposal at the regular bilateral meeting in September of the year.

In response to a request from the Government of the Republic of Indonesia (hereinafter referred to as "the Government of Indonesia"), the Government of Japan decided to conduct a Basic Design Study on the Project for Strengthening Road Transport Environment Management in the Republic of Indonesia (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Republic of Indonesia a study team and is scheduled to stay in the country from December 7 to 22, 1994. The Mission had meetings with some governmental agencies concerned in the country, and made field surveys. During the mission's stay, the IRE Director handed to the head of the mission a revised letter requesting changes in the list of equipment/apparatuses requested, and a new list of requested equipment/apparatuses based on the new document for request.

The newly requested equipment/apparatuses are as follows:

a. Testers of asphalt pavement - Multifunctional High Speed Road Monitor, Traffic Load Simulator, etc.
b. Soil Testers - CBR Testing Machine, Dynamic Triaxial Tester
c. Concrete Structure Testing Machines - Impact Echo Testing Machine, Air Pollution Research Car, etc.
d. Traffic Environment Monitoring Equipment - Traffic Noise Research Car, Air Pollution Research Car

The Basic Design Study Team, through meetings with the government officials and surveying the project sites, understood the actual situation of the road-related sector, project sites, the background, content, executive as well as maintenance/monitoring system, gathered basic data and conditions for making the basic design.

With regard to the equipment/apparatuses requested by the IRE, the Mission examined them in terms of relevance with the proposed research theme, specifications and efficacy. The Mission selected and gave high priority to the equipment/apparatuses which are urgent and adequate to be granted by the Japanese government.

Among the 20 items, installation is required of 8 items. For newly introduced items, in order to expedite the start-up by proper use of them, an initial instruction training was decided to be conducted. Such training is required of 10 items.

Based on the meetings and confirmations, on-the-site surveys and based on the analysis and discussion after return, the Mission regards it as appropriate to apply their request for cooperation-in-grant by the Japanese government. The following is the outline of the equipment/apparatuses under this Project.

The executing agency of this Project is the Indonesian Road Research Institute (IRE) which is one of the three institutes under the Research Development Agency of the Ministry of Public Works. The Institute also acts as a maintenance and monitoring executor.

These equipment and apparatues will be installed within the IRE premise with ample space. Therefore, there is no problem as to their accommodation and installation.

Equipment List to be supplied

No.	Equipment Name	Quantity	Purpose
1	Multifunction High Speed Road Monitor	1	measurement of various conditions of road surface
2	Automatic Compaction Machine for Marshall apparatus	1	Mixing test of Asphalt mixture
3	Wheel Tracking Tester	1	Stability testing machine for asphalt mixture
4	Rotary Evaporator	2	Analyzing the component of bitumen
5	CBR Testing Machine	2	measurement of supporting strength of subgrade or subbase materials
6	Dynamic Triaxial Tester	1	Dynamic character tester of granular materials
7	Triaxial Tester	1	Tester of soil strength
8	Boring Machine	1	to get Soil samples from under ground of soft stratum
9	Gradient consolidation	1	consolidation tester adding the invaluable load
10	Geographical information system	1	Data base using maps
11	Impact-Echo Test Machine	1	anti-corruption test of invisible concrete cracks
12	Traffic Noise Research Car	1	Measurement and analyzing of Traffic Noise around road
13	Air Pollution Research Car	1	Measurement of air pollution around road
14	Traffic Data logger	4	measurement, record and analyzing of Traffic
15	Speed Gun	2	Measurement of speed of running car
16	Asphalt Consistency Tester	1	Tester of principal character of asphalt bitumen
17	Internal water Pressure tester	3	Measurement of internal pressure under the embankment
18	Traffic Simulator	1	Accelerating Rutting test of Pavement
19	Fuel Consumption Measurement	1	Measurement of Fuel consumption of test car for the Road condition
20	Portable Skid Resistance Tester	2	Measurement of Skid Resistance

Among the equipment to be delivered, three items, namely Multifunctional High Speed Road Monitor Car, Traffic Noise Research Car and Air Pollution Research Car, should be assembled before shipment. It is suggested that the assembling and test driving of these equipment be implemented in Japan, taking into consideration the convenience for execution and management.

The rest can be procured either in Japan and a third country. However, in order to avoid troubles in start-up adjustment after arrival in Indonesia, the Mission considers it advantageous economically and for other reasons, if the equipment and apparatuses be collected in Japan in principle, and transported all from Japan after inspecting the quality and functions of all the items.

The majority of them are planned to be transported by containers, while the Multifunctional High Speed Road Monitor Car, Traffic Noise Research Car and Air Pollution Research Car will be transported by vehicle transporting ship. They will be transported in two separate shipments at two different times, due to the manufacturing periods, the delivery time, and the need of training for operation.

It is the Mission's judgement that the tax-exempting procedures are articulated for custom clearance for the equipment and apparatuses involved in this project. There is no problems arising from the on-going survey for this case, therefore, it is understood that ther is no problem in procuring some of the equipment and apparatuses from other countries.

The total time period required for the implementation of the project planned to be a full year, consisting of 2.6 months for planning, 2.4 months for bidding and contract, and 7 months for processing equipment and apparatuses, transportation, installation, and initial instruction.

When the equipment and apparatuses necessary for research work are applied through this Project, the limited budget of the IRE can be spent for research and development work, instead of purchasing new equipment. As a result, it is expected to enable the IRE to concentrate their energy into basic researches such as the method of time-consuming processing of weak soil, surveys on the actual situation of the nationwide road networks and designing their maintenance and management plans, research on the supporting strength of pavement taking Indonesia's climate and local materials into account, and defining the standard values considering traffic environments.

As the fruit of the project, the IRE's road construction technology will be enhanced and by sharing it widely with the nation, the project will be a great help in achieving the goals of the new Five Year Plan.

In addition, following concrete effects are expected:

1) Reduction of air pollution and traffic noise as a result of researching the measures to improve traffic environments, and by regulating environment standards.
2) Review of the existing road structures will be promoted.
3) Roads will be constructed in areas hitherto prevented due to the weak soil and being mountainous. These new roads will help reduce traveling time and cost, and traffic accidents, hence, credibility of transportation will be improved as a whole.
4) The technical standard of researchers will be enhanced. By sharing their research achievements widely, the level of technology of the country as a whole will be heightened.

This project basically is aimed for the improvement the IRE's facilities and equipment. However, considering the potential effect on whole Indonesia when the research results are to be put into practice, it is judged appropriate that this project be implemented as a grant aid assistance.

The present IRE organization will suffice for the operation and management of this project. For smooth implementation of this project, the Government of Indonesia is expected to ensure the following:

1) Cooperation and support for custom clearance, domestic transportation, and installment work within the IRE premise.
2) Establishment of the inter-section system within the IRE responsible to promote use and maintenance of the equipment and apparatuses.
3) Insurance of budgetary allocation for research works that will make continuous use of the equipment and apparatuses.
4) Establishment of a system which will facilitate collaboration between the IRE and the Ministry of Public Works, and periodical exchange of information between the two.

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CHAPTER 1 BACKGROUND OF PROJECT

CHAPTER 1. BACKGROUND OF THE PROJECT

1.1 Background of the Project

The 5th Five Year Plan (1989-1993) which was completed in March 1994 was implemented favorably as a whole, and nearly 7-percent growth rate is expected against the estimated average 5-percent growth. The goals laid for each sector are generally going to be achieved as planned. 19.1 percent of the government's development budget was allocated to the transportation and communications field, as a result, the total length of roads increased from 228,000 km in 1988 to 283,000 km in 1990. Through such efforts, the government has been trying to meet the ever-growing demand in road traffic.

Under the 6th Five Year Plan starting in April 1994, the development of roads is considered to be the most important in the transportation sector. In addition to the traditional road construction and improvement, the problems of urban traffic must be solved, measures against deteriorating traffic environment must be taken, and the improvement of road maintenance technologies are required. In other words, along with the expanded road networks, the development of road construction and maintenance technologies is becoming increasingly important.

Since its 1st Five Year Plan beginning in 1969, the Government of Indonesia has put emphases on road construction and improvement in every mid-term national economic development plan as follows::

1st Plan: Rehabilitation of main roads left untouched since the end of Dutch rule.

2nd Plan: Road construction in regions to promote regional development, and long-term improvement plans for main roads including toll roads.

3rd Plan: Improvement of the existing roads, and promotion of the construction of toll roads

4th Plan: Assurance of safety of roads, improvement of incidental facilities, and improvement of roads connecting production sites and market places

5th Plan: Improvement of roads in rural areas, construction of high standard roads, and improvement of functions of roads in large cities.

Based on the past achievements, "Access improvement in underdeveloped villages" was added to the maintenance of the existing roads in the 6th Five Year Plan. The major focus of the Plan is the extension of roads by 10,000 kilometers. Under this Plan, roads will be constructed in topographically difficult areas for which reason no road has been constructed to date. For this purpose, weak soil improvement measures and higher bridge construction technologies are increasingly expected.

The Road Research Institute (IRE) is the only one research and technological development agency in the country under the Ministry of Public Works. It has a staff consisting of 462, of which 284 research and technical development staff as of 1994.

The IRE has set new policies based on the 6th Five Year Plan, and accordingly, is undergoing re-structuring which will take one year.

The IRE plans, with the new structure, to make research and development work for weak soil and bridge construction required to materialize the 10,000 km-Extension Plan and Better Access to Underdeveloped Villages initiatives.

The budget for the IRE for 1994/95 fiscal year is about 4.6 million dollars including subsidies from overseas donor agencies. For the research and development work as stated above, the existing equipment and apparatuses do not meet the requirements, and its budgetary scale does not allow the procurement of new equipment and apparatuses, needless to say, to meet the needs that require an urgent survey.

Under the circumstances, the Government of Indonesia requested the Government of Japan for grant aid assistance for the equipment and apparatuses required for the IRE to be better equipped for their new research assignments.

1.2 Outline of the Request and Main Components

The first request of this project was drafted in February 1991 when the 5th Five Year Plan was undergoing. At that time, the construction of high-standard roads was a priority, and with a suggestion by the then General Director of Road Department, stronger emphases were placed on the environmental issues that were gathering public attention, the replacement of pavement testing apparatuses, and the improvement of field testing facilities. The IRE worked out a letter of request to the Government of Japan and submitted it through the Ministry of Public Services and

BAPENAS (National Development Planning Agency). The contents of the request were as follows:

- Development and improvement of asphalt and concrete pavement technologies
- Measures against traffic pollution
- Development of technologies to re-use asphalt

Later, the IRE shifted its priorities based on the new Five Year Plan to environmental issues, standardization of pavement quality, measures for weak soil, and bridge construction study. And in May 1994, the IRE updated the letter of request to the Government of Japan including changes made to the 1991 request. In the new request, a stronger emphasis is placed on the development of new roads and related technologies rather than field testing of pavement.

When Basic Design Study Team visited Indonesia from December 1994 to conduct a basic design study, the IRE Director handed to the head of the mission on December 13 an official letter informing of the changes in the list of equipment/apparatuses requested, and a new list of requested equipment/apparatuses based on the new letter of request. (see Annex 6)

The newly requested equipment/apparatuses with some changes to the 1994 request are as follows:

a. Testers of asphalt pavement - Multifunctional High Speed Road Monitor, Traffic Load Simulator, etc.
b. Soil Testers - CBR Testing Machine, Dynamic Triaxial Tester
c. Concrete Structure Testing Machines - Impact Echo Testing Machine, Air Pollution Research Car, etc.
d. Traffic Environment Monitoring Equipment - Traffic Noise Research Car, Air Pollution Research Car

1.3 Projects and/or Programs of Other Donors

Joint research works being implemented by the IRE in collaboration with donors as of December 1994 are as listed below:

< British TRL >

- Development of the evaluation methods for the service standards of the existing bituminous paved roads

- Research on applicability of road construction materials
- Identification of easily collapsable soils
- Building the database for national and provincial roads, and the calculation formula for road deterioration
- Development of bituminous surface design specification and design methodology
- Side-slop collapse
- Traffic capacity
- Database of accidents and analysis
- Identification of spots with frequent accidents and measures for such spots

< Italian ANAS >
- Quality assurance
- Re-use

< Swedish SNRA >
- Traffic capacity
- Road safety measures

< Spanish CEDEX >
- Test run track facilities

Future joint research commitments

< British TRL >

With a subsidy from the World Bank, road survey and development in general, transfer of technology, standardization, pavement testing tools

< Swedish SNRA >

Development of Indonesian Traffic Capacity Manual

The research themes using the equipment/apparatuses provided through this Project will meet the objectives laid in the 6th Five Year Plan, and newly emerging themes which hitherto have been unable to address due to lack of equipment/apparatuses.

CHAPTER 2 OUTLINE OF THE PROJECT

CHAPTER 2. OUTLINE OF THE PROJECT

2.1 Objectives of the Project

1) Grant of testing instruments by which a certain level of research outcome is expected, and equipment/apparatuses that enable the IRE's data collection and thus help them advance with their research and development works. Prior to the selection, the research themes proposed by the IRE were reviewed according to the purpose of this Project that reads "To respond to the widening research needs based on the new Five Year Plan, the Project will help the IRE with upgrading their research equipment, so as to enhance IRE's road technology development as part of Japan's contribution to the general road development program of Indonesia."

2) Selection of appropriate equipment/apparatuses within the scope allowed for a grant aid assistance, upon comprehension of the IRE's operating capability.

3) Installation of equipment and training operators

Since the equipment/apparatuses to be provided are for testing purposes which are not used for general purposes, they will be custom made. They require installation upon delivery, and training of operators before commissioning. Therefore, the Project includes the installation of the training of operators by sending technicians from Japan.

4) Assessment of the efficacy and adequacy of the project

The greatest factor for a success of any research program is the ability of staff members. The location of a research institute or equipment are supporting factors. Therefore, the contents and background of the request by Indonesia, i.e., the research themes of the IRE and the competence and their executing system should be studied, and the equipment and the scope for upgrading the IRE's capabilities must be surveyed, thereafter, the potential efficacy and adequacy of the Project as a grant aid assistance is to be assessed.

2.2 Study and Examination

In September 1994, a discussion on this project was held during the annual bilateral meeting between the two governments on technical assistance. The discussion

material tabled at this meeting was the 1991 request asking for the following research instruments:

a. Testers of asphalt pavement
b. Concrete Structure Testing Machines
c. Traffic Environment Monitoring Equipment
d. Field testing machines including Asphalt and Crusher plants

The IRE in May 1994 submitted to the Ministry of Public Works a new list of equipment and apparatuses required according to the 6th Five Year Plan starting in April 1994. The 1994 request includes equipment/apparatuses for developing measures for weak soil, and for studying bridge construction indispensible for building access roads to underdeveloped villages in remote and mountainous areas.

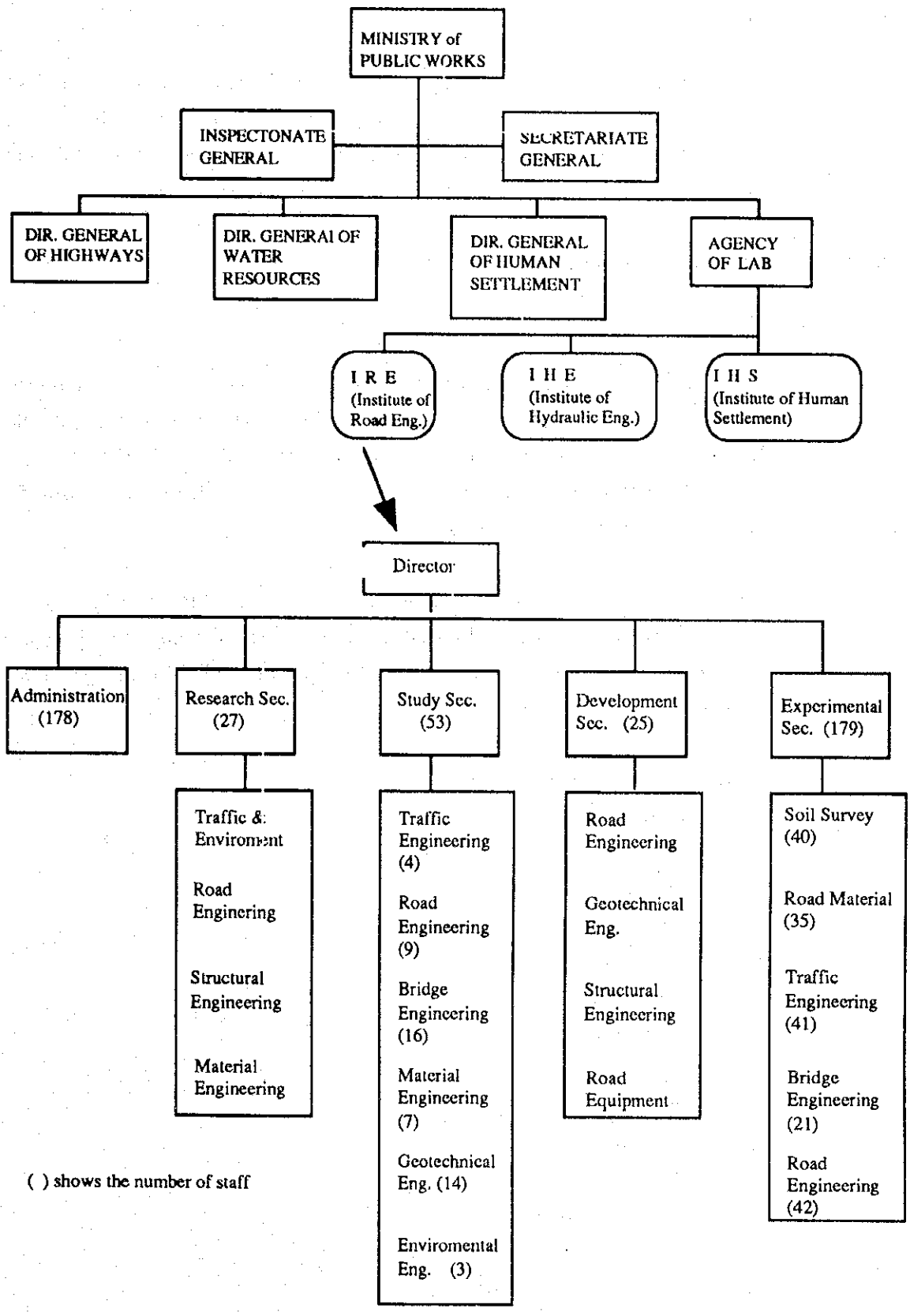
Upon discussion among the Mission members, the Japanese embassy to Indonesia and the Ministry of Foreign Affairs, it was found that by responding to the IRE's request based on the new Five Year Plan Japan can contribute to the general road development program of Indonesia, as it will help the IRE with upgrading their research equipment, and enhance IRE's road development technology through training their R & D personnel.

The Mission, therefore, conducted a survey based on the list of newly requested equipment and apparatuses. After looking into their relevance to the IRE's proposed research themes, specifications and effectiveness, the Mission selected the equipment and apparatuses as listed in Appendix 8 as being appropriate and urgent for the research themes.

2.3 Project Description

2.3.1 Executing Agency and Operational Structure

The IRE has about 500 employees, 150 among whom are graduates of two-year college and higher. In the 1994 plan, the IRE has 462 workers, among them 284 are technical workers. The structure of the IRE is shown below.



( ) shows the number of staff

2.3.2 Budget

The total budget required of the IRE to implement all the planned research projects amounts 6.4 billion Rp. For 1995 fiscal year budget, the IRE plans to allocate 2.3 billion Rp. for general expenditure and 7 billion Rp. for research and development. From this budget plan, it is unlikely that R & D turns to be insufficient.

2.3.3 Location and Conditions of the Project Site

1) Outline

The IRE is located at at 10 km east of Bandung city and is faced to a main road. It has an area of 50 hectare. It is one of the three research institutes under the Research and Development Agency of the Ministry of Public Works. The IRE has been undertaking oragnizational restructuring since 1994 to adopt itself for implementing the 6th Five Year Plan.

As the country's sole research institute in charge of R & D in the field of roads, the IRE is supporting the road construction and traffic development programs implemented by the Road Bureau of the Ministry of Public Works. The main activities of the IRE include:

- Research and Development
  - Applied research
  - Analysis
  - Standardization
- Scientific Support
  - Technical advice
  - Arbitration
  - Certification
- Dissemination
  - Seminar
  - Publication
  - Training
  - Data information

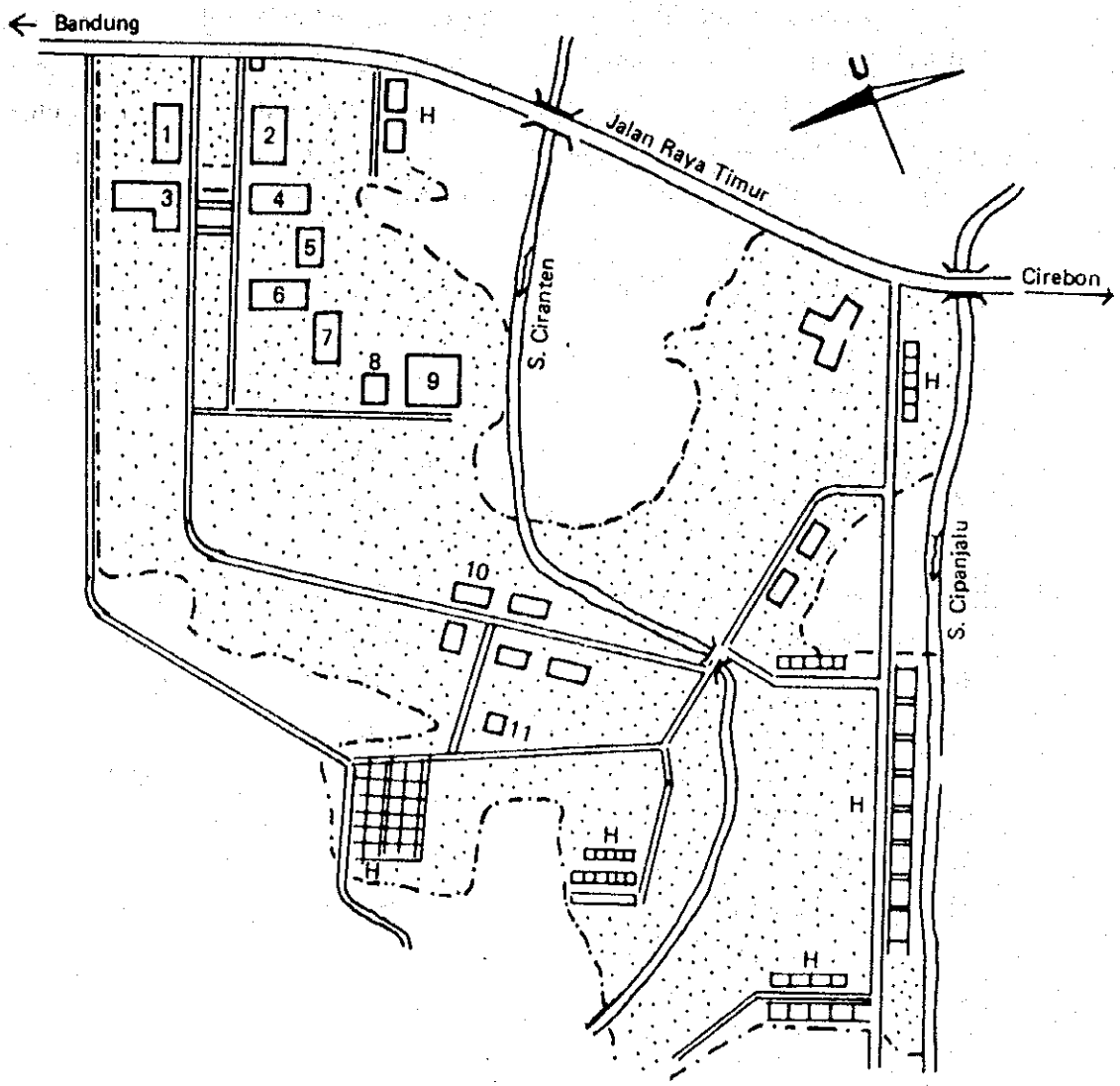
2) Facilities

In the premise of the IRE, there are an administration building, auditorium, research and experiment buildings and an outdoor test field. In the test field, full-scale field test facilities (for piling, suspension bridge, and truss bridge, etc.) are equipped. In addition, an obsolete asphalt plant and a crusher are placed. However, most of the premise is still an open field for future use.

The existing structures of the IRE and floor areas are shown below:

	Structure	Area (sq. m)	Floor Space (sq. m)
1.	Open space	447,596	-
2.	Office building	3,630	6,606
3.	Library	-	144
4.	Research & Development	4,349	6,298
5.	Storage	480	720
6.	Workshop	1,913	1,913
7.	Roads	39,500	-
8.	Gym	1,850	1,850
9.	Tennis court	1,722	-
10.	Guest house	2,265	492
11.	General hospital	217	90
12.	Land available for future use	26,598	-

LAYOUT OF THE INSTITUTE OF ROAD ENGINEERING



Legend:

1. Administration Bldg.
2. Head Office Bld.
3. Conference Bld.
4. Road Eng. Bld.
5. RBO Bld.
6. Material and Chemical Lab.
7. Geotechnical Lab.
8. Traffic Engineering Bld.
9. Structural Lab.
10. Workshop
11. Mosque

H: Housing

3) Existing Equipment and Apparatuses

		Equipment/Apparatus
a.	Pavement	• Laboratory mix test • Asphalt extraction • Asphalt content analysis • Wheel tracking test • Elastic Gauge • Towing Type MU Tester • FWD Tester • Concrete pavement
b.	Soil	• Physical and dynamic test • Consolidation testing machine • Compaction testing machine • Single-axis compression testing machine
c.	Structure	• Static load testing machine • Outdoor large-scale loading test • Exterior truss bridge
d.	Environment	• Traffic analysis • Pollution • Automatic traffic measuring mat • Time-lapse video recorder

2.3.4 Outline of Equipment

After a study of the requested equipment and apparatuses in terms of the relevance to the IRE's research themes, specifications and efficacy, the Mission selected the equipment and apparatus in order of priority which are applicable as a grant aid assistance, and which are considered urgent.

Equipment List to be supplied

No.	Equipment Name	Quantity	Purpose	Instruction
1	Multifunction High Speed Road Monitor	1	measurement of various conditions of road surface	Yes
2	Automatic Compaction Machine for Marshall apparatus	1	Mixing test of Asphalt mixture	
3	Wheel Tracking Tester	1	Stability testing machine for asphalt mixture	
4	Rotary Evaporator	2	Analyzing the component of bitumen	
5	CBR Testing Machine	2	measurement of supporting strength of subgrade or subbase materials	
6	Dynamic Triaxial Tester	1	Dynamic character tester of granular materials	Yes
7	Triaxial Tester	1	Tester of soil strength	Yes
8	Boring Machine	1	to get Soil samples from under ground of soft stratum	
9	Gradient consolidation	1	consolidation tester adding the invaluable load	Yes
10	Geographical information system	1	Data base using maps	
11	Impact-Echo Test Machine	1	anti-corruption test of invisible concrete cracks	Yes
12	Traffic Noise Research Car	1	Measurement and analyzing of Traffic Noise around road	Yes
13	Air Pollution Research Car	1	Measurement of air pollution around road	Yes
14	Traffic Data logger	4	measurement, record and analyzing of Traffic	Yes
15	Speed Gun	2	Measurement of speed of running car	
16	Asphalt Consistency Tester	1	Tester of principal character of asphalt bitumen	
17	Internal water Pressure tester	3	Measurement of internal pressure under the embankment	
18	Traffic Simulator	1	Accelerating Rutting test of Pavement	Yes
19	Fuel Consumption Measurement	1	Measurement of Fuel consumption of test car for the Road condition	Yes
20	Portable Skid Resistance Tester	2	Measurement of Skid Resistance	

2.3.5 Operation and Maintenance Plan

As Appendix 11, few equipment/apparatus requires regular maintenance service. As nothing requires expensive maintenance service, the expenses will be fully covered by the IRE's general administration budget. For reference, the IRE's general administration budget including personnel expenses is 2.4 billion Rp., and that for R & D is 3.4 billion Rp. in 1994.

2.4 Technical Cooperation

This Project responds to the request made by the IRE for its new research themes according to the the 6th Five Year Plan. For the equipment and apparatuses, there should be technical cooperation to start up their operation upon delivery. In the future, technical cooperation in the field of environment will be desirable so that the feedback of the research outcomes using the equipment and apparatuses could be made to put them into practice.

CHAPTER 3 BASIC DESIGN

CHAPTER 3. BASIC DESIGN

3.1 Design Policy

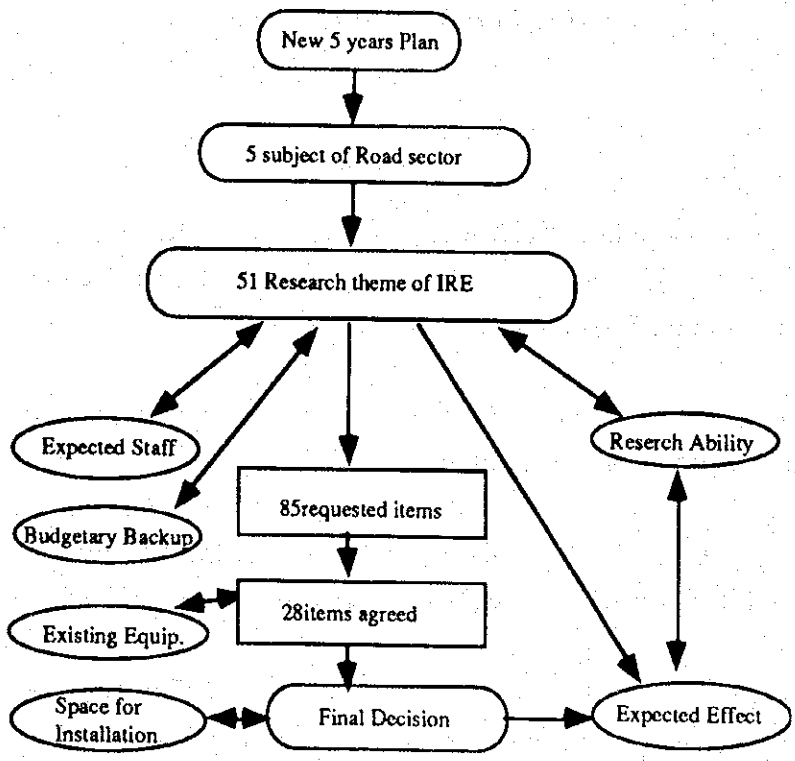
1) In order to address the five tasks imposed to the Road Sector in the 6th Five Year Plan, it is necessary to compare and identify the relations between these tasks and the 51-point research themes of the IRE.

2) The relevance between these research themes and the requested equipment and apparatuses should be clarified.

3) It should be studied whether staff required for the research themes is ensured, and if the researches are supported financially in the IRE budget.

4) Selection of the equipment and apparatuses should be made based on the on-the-site survey on whether the requested equipment and apparatuses will not duplicate with the existing testing equipment and apparatuses and whether there is enough space available for installing these materials.

5) In selecting the equipment and apparatuses, consideration should be given to whether they will be effectively used. Staff's technical competence and expected efficacy should also be taken into consideration.



Relationship among the targeted research themes, the Five Year Plan and the required equipment and apparatuses is illustrated in Appendix 9.

3.2 Study and Examination on Design Criteria

The equipment and apparatuses requested are covering all the six research department of the IRE.

For the testing equipment and apparatuses in the field of soil, pavement, material and structure, these shall be in conformity with ASSHOTO or JIS if the testing method of these equipment and apparatuses are prescribed. Regarding the automatic recording and analyzing equipment, study and examine the equipment of which information are available in Japan prior to other foreign equipment. Regarding the research for the road environmental problem, the equipment for air pollution and traffic noise, are requested. The design criteria are as follows :

3.2.1 Air Pollution

Measurement object is automobile exhaust gas. However, since the standard values and the regulatory standard have not been established in Indonesia, we regard the standard of the Automobile Exhaust Monitoring Station (the base station performs continuous pollution monitoring) described in "Air pollution continuous monitoring

manual, Air Quality Bureau, Environmental Agency in Japan, December, 1990, p.6, Table 2-2" as the measuring standard at the IRE.

The Standard of the Automobile Exhaust Monitoring Station described in "Air pollution continuous monitoring manual, Air Quality Bureau, Environmental agency in Japan"

Purpose of Installation	Measuring Equipment	Overall Dimension	Installation Area (m^2)	Power Consumption	Weight (kg)
For pollution monitoring of Automobile Exhaust	SO_2	54 x 48	1.0	1 - 2W	80 - 100
	NOx	50 x 49	0.9	2 - 4W	80 - 100
	CO	55 x 52	1.0	3 - 6W	60 - 160
	SPM	50 x 60	1.0	4 - 6W	60 - 140
	Non-Methane Hydrocarbon	62 x 45	3.0	5 - 12W	64 - 150
	Meteorological Equipment	40 x 48	0.8	1W	10 - 70
Traffic Flow Measuring Equipment	Traffic Counter				
Facilities	Cooler			20W	
	Ventilator			3W	
	Illumination			3W	
	Desk	90 x 60			
	Shelf	40 x 120			
	Gas Cylinder	180 x 100			
	Storage				
	Supplementary Power Supply			5KW	

3.2.2 Noise of Traffic

As there is no traffic noise standard in Indonesia, the Mission recommends a traffic noise measuring apparatus based on the JIS standard.

The IRE's research themes are roughly classified into the following three groups:

1) Multi-generated Noise Measurement

Noise measurement at multiple points in order to map noise distribution.

2) Sound Insulating Property Measurement

For research and development of the materials and structure of sound insulating walls.

3) Sound Absorbing Property Measurement

For research of the sound absorbing property of sound insulating walls and pavement materials.

Recognizing the need of defining the values to be regulated and the criteria for noise measurement methods, it is considered that 1) above, i.e., traffic noise measurement should be the focus of this project. The purposes of the measurement will be the following two, and the apparatus given is applicable for achieving these purposes.

1) Grasping the reality of noise along the roads

Mapping noise sources, and noise changes by various times of the day, by day, by season and by year will be observed and recorded, in order to collect data for monitoring environments along the roads.

2) Collecting basic data for predicting road-side traffic noise and for devising measures

Measurement of specific elements on the actual road. Data of the radiating properties of noise from vehicles including power level, directive property, speed dependence, and influence of pavement will be collected. Also, data for identifying noise transmission properties according to different road structures, influence from surrounding conditions will be gathered. In other words, fact-finding surveys need to be conducted in order to define a formula to predict noise based on the local condition, and to make theoretical calculations of the effectiveness of measures to be taken

Note: Traffic noise is irregularly changing noise. Except for the linear noise sources along very crowded roads, it is extremely difficult to identify noise emitted by individual cars separating it from unidentified noise sources. Also, it should be noted that traffic noise has a special noise property different from factory noise in that its noise levels observed are irregularly changing according to the time of the day.

3.3 Basic Plan

3.3.1 Equipment Plan

Upon studying the requested equipment and apparatuses in terms of their relevance to the IRE's research themes, specifications and efficacy, the following were selected as appropriate and urgent equipment and apparatuses to be prepared to the IRE from Japan. Regarding to the equipment and apparatuses which are new to the IRE, information on specification, and on the necessity of instruction for operation upon delivery is provided. The specification, selection policy, and maintenance service of each equipment and apparatuses are given in Appendix 10 and 11.

No.	Equipment name	Purpose	Research Theme	Qty	Composition/Spec.for each unit & their	Nos.	Re-marks
Pavement							
1	Multi-function High Speed Road monitor	Multi-purpose non-destructive test for damage	Pave. Design in hot area PSI and Live Load Damage of Rigid Pave	1	Vehicle with measuring devices and computer for data store / analysis		Install B.O.I
2	Automatic compact -ion machine for Marshall test	Mixture design for asphalt pavement	Pave. Design in hot area Recycling of Material Spec of hot Mixtures	1	for Marshall test		
3	Wheel tracking tester	Measuring deformation of asphalt mix	Spec of hot Mixtures Pave. Design in hot area	1	Tracking machine	1	Install
					Automatic recorder	1	Install
					Constant temperature room	1	Install
					Isolated mixer (20lts)	1	Install
4	Rotary vacuum evaporator	Extraction of Asphalt contents from solvent	Rubber asphalt Recycling of Material	2	Diagonal cooling	1	
					Freezer for testing of wax contents capacity:200ltr, cooling temp. -10 C	1	
5	Asphalt consistency apparatus	To analyze for basic characteristics of asphalt	Rubber asphalt As. Emulsion Spec of hot Mixtures	1	Automatic penetrometer	2	
					Softening point measure apparatus	1	
					Saybolt furol machine	1	
6	Scale Model Mobile Load Simulator	To accelerate damage to pavement by rotation of cast tires	Suporting Coefficient Overlay of As.Pave. PSI and Heavy Axle Load	1	As comply with ASTM STP 1225 1:10 scale		Instal B.O.I
7	Portable skid resistance tester	To measure skid resistance of road surface	Skid Resistance	2	TRL type with rubber tip	20	

Subbase						
8	CBR testing equipment	To measure the bearing capacity of soil	Cement/Lime Stabilizatiom	2	with automatic mechanical compactor	
9	Resilient modulus tester	For determination of dynamic modulus of guranular material	Subbase materials Grouting for Rock	1	as comply with AASHTO T274	Install B.O.I
Soft ground						
10	Triaxial test assembly with data acquisition	To measure soil strength	Grid Foundation Soft Ground	1	with computerize recorder cell size : 50 x 100 mm	Install B.O.I
11	Drilling Machine	To take soil sample from deep stratum	Grouting for Rock Soft Ground	1	Max. depth : approx. 80m Drilling diameter. : 2"	

Install: with Installation BOT: Beginning Operation Training

No.	Equipment name	Purpose		Q'ty	Composition/Spec.for each unit & their	No.	Re-marks
12	Water pressure tester	To measure the water pressure under the embankment	Geotextile in soft ground Pile slab methods	3	with 7 cells for each set		
13	Gradient Consolidation tester	By horizontal drainage	Grid foundation Soft ground	1	Rowe-type Cell size : D76mm x H30mm and D151mm x H50mm		Instal B.O.I
14	Geographical Information System equipment	To store/analyze the geotechnical data	Slope stability Soft ground	1	Computer : 80486CPU software : ARC/INFO Digitizer : approx. 36" x 48" Pen plotter : A3 size		Install B.O.I
Structure					(continued)		
15	Impact-Echo Test System	Non-destructive test for flaws in concrete	Residual strength of Brg Conc.Slab on steel brg. Maintenace of Brg.	1	Senser, Cables, Transducers, Analyzer(Note book computer)		Install B.O.I
Traffic and Enviroment							
16	Mobile Laboratory for Traffic Noise	To measure of Noise	Economical cost of Noise Noise Barrier	1	High roof Type, 2500cc with Extra battery, AC converter and Equipment for research		Install B.O.I
17	Mobile Laboratory for Air Pollution	To measure of Air Pollution	Economical cost of pollusion	1	Bus Type, 140PS about 7m length with Equipment for research		Install B.O.I

18	Automatic classified data logger	Detect/record/process traffic condition (at Intersection / Road)	Life road provision Geometrical design Road safety	4	Traffic flow detector (half set: tube type & remain : loop type) Data retrieval unit (IBM PC compatible) Data analyzer Unit	1 1 1
19	Speed meter gun	To measure speed of traffic	Traffic Control	2	up to 180 kph speed	
20	Vehicle accelero -meter & fuel consumption measuring apparatus	To measure the running condition of sample car	Transportation Plan	1	Attached type to the car on the road with normal speed	Instal B.O.I

Install: with Installation BOT: Beginning Operation Training

3.3.2 Installation of Equipment

All the equipment and apparatuses will be installed within the IRE's premise. There is ample vacant space in the IRE's premise, and there is no problem as to the delivery and installation of the said materials.

In the following, the equipment and apparatuses and their proposed locations are listed.

Layout plan for the procured equipment

No.	Equipment Name	Quantity	Necessary Space	Building No.	Location
1	Multifunction High Speed Road Monitor	1	2x8m	6	Parking
2	Automatic Comaction	1	0.4x0.4m	6	
3	Wheel Tracking Tester	1	1.8x3.0m	6	
4	Rotary Evaporator	2	2x2m	6	
5	CBR Testing Machine	2	2x3m	7	
6	Dynamic Triaxial Tester	1	5x1.5m	7	
7	Triaxial Tester	1	4x1.5m	7	
8	Boring Machine	1	3x3m	7	Site
9	Gradient consolidation	1	0.5x1m	7	Desk top

10	Geographical information system	1	1x0.5m	7	Desk top
11	Impact-Echo Test Machine of unvisible concrete cracks	1	-	9	Portable
12	Traffic Noise Research Car	1	2x6m	8	Parking
13	Air Pollusion Research Car	1	2x8m	8	Parking
14	Traffic Data logger	1	2x8m	8	Site
15	Speed Gun	2	-	8	Portable
16	Asphalt Consistency Tester	1	2x0.5m	6	Desk top
17	Internal water Pressure tester	3	-	7	Site
18	Traffic Simulator	1	2x0.5m	8	
19	Fuel Consumption Measurement	1	1x1m	8	Site
20	Portable Skid Resistance Tester	2	1x0.5m	6	Portable

Note : Building No. are shown on P2-6.

3.4 Implementation Plan

3.4.1 Implementation Policy

The implementation has the following 4 phases, i.e., procurement, transportation, installation and instruction on handling.

1) Procurement

Many of the testing apparatuses are made in industrialized countries. However, market research should be conducted and if there are some apparatuses purchasable or procurable in Indonesia, they should be purchased or procured in Indonesia, provided it is allowed within the Japan's Grant Aid system. In particular, the procurement of consumable parts and spare parts is important after the equipment and apparatuses are put in use. Trading firms specializing test machines have their offices in Jakarta, and they confirmed their readiness to facilitate the supply of such parts.

2) Transportation

Surface transportation from Yokohama to Tanjungpriok and land transportation from Tanjungpriok to Bandung are planned for the transportation of the materials.

The three research cars (high speed road monitor, traffic noise and air pollution) are planned to be carried by ship for vehicles. The rest will be carried in containers, depending on the period required for fabrication, and the delivery time.

Since 13 items out of 20 are precision apparatuses, and many of them are not bulky, the use of containers is recommended to pack them altogether, as considering to protect the them from being stolen before they are duly installed and kept under watch.

The equipment and apparatuses will be transported at two separate times due to different periods of time required for preparation, and the need of sending instructors for operation.

The first delivery will carry things that could be made in one to three months altogether. For the second delivery, things requiring four to five months to be made will be carried.

3) Installation Work

The equipment, which are required to be installed, are the 8 items stated as below. They shall be installed by Japanese side.

1. Wheel Tracking Tester
2. Scale Model Mobile Load Simulator
3. Resilient Modulus Tester
4. Triaxial Test Assembly with Data Acquisition
5. Gradient Consolidation Tester
6. Geographical Information System Equipment
7. Impact-Echo Test System
8. Vehicle Accelerometer & Fuel Consumption Measuring Apparatus

4) Instruction

The newly introduced machines shall be initially instructed, and shall be used for research without delay. The machines are these 10 items below.

1. High Speed Mobile Pavement Survey
2. Scale Model Mobile Load Simulator
3. Resilient Modulus Tester
4. Triaxial Test Assembly with Data Acquisition
5. Gradient Consolidation Tester
6. Geographical Information System Equipment
7. Impact-Echo Test System
8. Mobile Laboratory for Traffic Noise
9. Mobile Laboratory for Air Pollution
10. Vehicle Accelerometer & Fuel Consumption Measuring Apparatus

3.4.2 Supervisory Plan

Based on the contract signed between the Government of Indonesia, the Consultant agency will undertake the following supervisory services with regard to the procurement of the equipment and apparatuses.

1) Execution of bidding of the bidding for the parties concerned.
2) Attendance and advice at negotiation meetings on the contract for the bidding between the Indonesian party and the bid winner.
3) Attendance at the times of inspection during the manufacturing process and delivery.
4) Reporting

The personnel required for the supervisory services, and periods are as follows:

Design & Supervisory Work Schedule

Personnel	Periods (months)	Supervisory Works
General	2.0	- Attendance in inspection in manufacturing processes - Attendance in inspection at delivery - Reporting
Design of Testing Equipment	1.0	- Attendance in inspection in manufacturing processes
Total	3	

3.4.3 Procurement Plan

Among the 20 items planned to be prepared, the CBR Testing Machine and the Boring Machine are manufactured in Indonesia. And Marshall Apparatus is readily available in Indonesia at all times.

The Multifunctional High Speed Road Monitor, Traffic Noise Research Car and Air Pollution Research Car require assembling appliances before shipment. The assembly and test run for these three vehicles will be implemented in Japan.

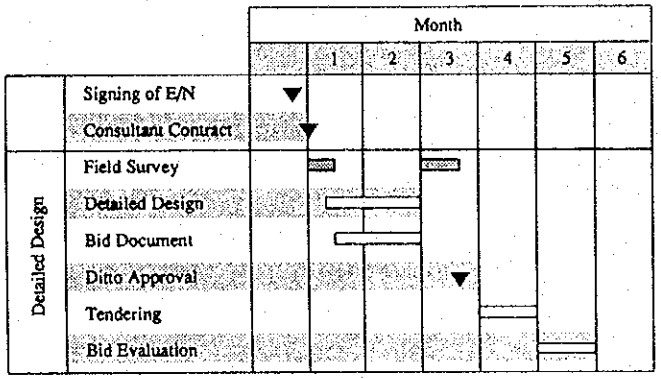
Other apparatuses are procurable in third countries. However, in order to avoid troubles caused from poor adjustment and regulation, it is considered more economical to collect all the materials in Japan, in principle, and be shipped in containers altogether after due inspection of the quality and function.

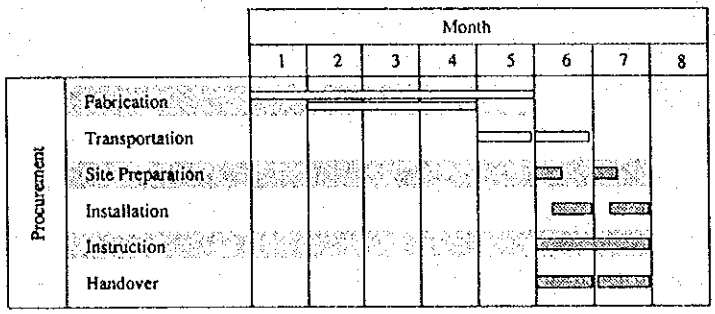
Installation is required at the IRE site for 8 items, i.e., Wheel Tracking Tester, Traffic Simulator, Dynamic Triaxial Tester, Triaxial Tester, Gradient Consolidation Testing Machine, Geographical Information System, Impact-Echo Test Machine, Fuel Consumption Measurement. Among them, initial operation training will be given for 10 newly introduced types.

The materials that are to be delivered only are 9 items, i.e.,Rotary Evaporator, Asphalt Consistency Tester, Portable Skid Resistance Tester, and CBR Testing Machine, etc.

3.4.4 Implementation Schedule

A total period of 12 months will be required for the implementation of the project; 2.6 months for implementation planning, 2.4 months for bidding and contract businesses, and 7 months for manufacturing/assembling, transportation, installation, and initial training.





3.4.5 Scope of Work

1) Japan's Share

- Procurement and transportation of the testing equipment/apparatuses to be provided.
- Despatch of Japanese technicians for initial training of operating the equipment/apparatuses.
- Design and supervisory services for the project including the despatch of technicians.

2) Indonesia's Share

- Execution of the project from the beginning to the completion.
- Assurance the personnel and covering the expenses for required for the execution of the project.

- Procurement and bearing the expenses for purchasing the apparatuses required for the project which are not provided by this cooperation-in-grant project from Japan.
- Assurance of land and the right to entry required for implementation of the project.
- Tax-exempt arrangements for the provided equipment and apparatuses to be landed in Indonesia.
- Tax-exempt arrangements for the Japanese technicians and the materials that they bring into Indonesia in relation to the project.
- Security of the Japanese technicians
- Facilitation of immigration and re-immigration procedures for the Japanese technicians visiting Indonesia in relation to the project.
- Payment of bank commissions
- Maintenance of the provided equipment and apparatuses.