

## **CHAPTER 5 PROJECT EVALUATION AND CONCLUSION**



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### 5-1 Expected Effects of the Project

The Division of Biomedical Engineering Services (BES) currently performs medical equipment maintenance and management tasks, ranging from the purchase to the disposal of medical equipment, under the control of the Laboratory Services of the Ministry of Health and Women's Affairs. However, BES is presently confronted with an absolute shortage of facilities and repair equipment, and it is unable to expand its staff in order to cope with repair needs. Therefore, BES finds it difficult to expand the scope of its work, or to meet the ever-increasing demand for its medical equipment repair services. This project is aimed at remodeling part of BES's existing facilities and providing BES with necessary repair equipment, thereby helping the Government of Sri Lanka complete its plan to improve BES's facilities and equipment. As such, this project can be expected to have the following effects:

#### (1) Improvement of BES's Repair Workshops

In 1990, 4,355 pieces of medical equipment were repaired at BES Colombo Centre's repair workshops. However, that figure accounts for only about 34 percent of the total number of pieces which needed repair. It often takes a long time to repair medical equipment, and BES's workshops are unable to efficiently handle the hospital's requests for repairs. As a result, much medical equipment is left unused, while some is used despite being considered out of order. This obviously damages efficiency, reliability, and safety. The total floor area of BES's repair workshops is 1,015m<sup>2</sup>, which is very small, and the existing facilities, which used to serve as coconut fibre warehouses, are quite outdated. Therefore it is impossible to increase the number of repair workers, or to repair sophisticated electronic equipment and precision components. When new workshops

with a total floor area of 1,211m<sup>2</sup> are constructed, and the number of repair workers is increased from 73 to 105 persons under this project, as many as 4,000 pieces of middle level medical equipment, which requires high level repair technologies, such as X-ray machines and ultrasonic devices, will be repaired at BES's repair workshops every year. On the other hand, up to 2,700 pieces of basic level medical equipment which do not require high level repair technologies, such as sphygmomanometers, suction units and instrument sterilisers, will be repaired at the workshops every year. In other words, about 93 percent more than the 4,300 pieces of middle level equipment which needed repair at public medical institutions in 1990, and about 32 percent more of the total amount of damaged basic level equipment for the same year will be repaired at the workshop annually.

With regard to basic level medical equipment, about 2,500 pieces will be repaired through BES's two mobile workshops, and together with about 3,500 pieces of in-house repair, 6,000 repairs will be handled by BES's repair workshops. This means that BES will be able to meet about 70 percent of the total demand for repair of basic medical equipment in 1990. As a result, BES's repair workshop's repair capabilities, which have so far been able to meet only about 23 percent of the total demand for repair of basic level medical equipment and about 55 percent of the total demand for repair of middle level medical equipment, will be drastically increased. Moreover, it will become possible for these workshops to confirm the safety of the medical equipment repaired. This will contribute directly to an improvement in the quality of the health services where such equipment is used.

## (2) Improvement of the Provincial Repair Workshops

The Government of Sri Lanka's written request included the establishment of eight provincial workshops as regional bases for

repairs of basic level medical equipment. As a result of the basic design study team's discussions with representatives of the Government of Sri Lanka, it was concluded that as the first step of such a project, a provincial workshop should be set up as a test case in the Galle Teaching Hospital, Southern Province.

At the proposed provincial workshop, about 800 pieces of basic level medical equipment will be repaired per year. In addition, the scope of work will be gradually expanded to include maintenance and inspection of medical equipment, adjustment of middle level medical equipment, and troubleshooting. The establishment of this provincial workshop is expected to greatly contribute to the improvement in the quality of the regional health services.

### (3) Improvement of the Handling Facilities

In principle, medical equipment purchased by the Government of Sri Lanka for use at the country's public medical institutions is first transported to BES from ports of disembarkation. However, large-sized equipment is transported directly to hospitals where it is to be installed. Unfortunately, BES's existing warehouses have a total floor area of only 348m<sup>2</sup>. This shortage of area has caused a part (floor space: 35m<sup>2</sup>) of the administration building to be used as a storage to store purchased medical equipment, and, even garages are being used for storage. Relatively heavy medical equipment is handled manually, which is very likely to damage this equipment. In this project, therefore, the floor area of the proposed warehouse to store purchased medical equipment is set at 432m<sup>2</sup>, which is equivalent to the largest space occupied by medical equipment purchased in 1990. As the city of Colombo is situated in an environment of high temperatures and high humidity, with relative humidity often reaching 80 percent to 100 percent, dehumidifying work will be carried out at night when

relative humidity is higher. This will minimise the cost for operating the warehouse.

Inspection of medical equipment should be conducted for quantity, compliance with specifications, and performance, as soon as it arrives to the warehouse. Approved equipment should be immediately delivered to the hospitals. However, such inspection has never been conducted at BES due to lack of necessary facilities and equipment. As a result, there have been many reports of inefficient handling of equipment, breakdown after its delivery to hospitals, and of poor complaint handling during the term of warranty. For this reason, a handling space, an inspection/testing room, and a packing room are included in this project. This arrangement will result in establishment of an efficient handling system -- from acquisition to inspection and delivery. Thus, these facilities are expected to greatly contribute to an improvement in BES's medical equipment maintenance and management capabilities. If administration and record management systems are developed through technical cooperation, the improvement will be ever greater.

#### (4) Improvement of the Facilities Required for Management of Spare Parts

Spare parts are all purchased and managed by BES. As of March 1991, BES had 300,000 spare parts of 3,200 items in stock. As BES's current record management system is not efficient enough, it takes a great deal of time to retrieve specific items. There have also been cases where "not in stock" was reported despite the fact that the parts were in stock. It is therefore essential to establish a viable inventory management system. The existing spare parts storage has a floor area of 635m<sup>2</sup>. Its maximum storage capacity is 308m<sup>3</sup>. If this project is implemented, the amount of middle level medical equipment repaired will be increased by 1.7 times, and basic level medical equipment by 3.1 times. As the required number of spare parts will increase by 20

to 25 percent for every doubling of the total amount of equipment repaired, a maximum storing volume will be 400m<sup>3</sup> for the projected total number of about 10,000 items of medical equipment repaired. The floor area for the storage will be 648m<sup>2</sup> - the minimum permissible space for a repair staff of 105 persons. Both the warehouse and the storage will be equipped with dehumidifiers. Those reagents and parts which are likely to deteriorate in an environment of high temperature will be stored in a large-size refrigerator.

In working out the ground plan for the facilities, special attention was paid to the possibility of integrating the spare parts management operations (now carried out in three different sections) by developing a comprehensive component management system through the technical cooperation. These arrangements are expected to reduce the time required for retrieving necessary parts and to optimise the level of inventory, which in turn will increase operational and economic efficiency.

## 5-2 Appropriateness of the Implementation of the Project

Appropriateness of the implementation of this project was examined in terms of the operation system, budgetary appropriations, and the maintenance and management system. It was concluded that this project can be implemented smoothly.

### (1) Operation System

Presently, BES's operation system consists of Director's Office, Administration Section, Accountant Section, Technical Section No.1, Technical Section No.2, and Technical Section No.3. The director and three engineers manage nine subsections consisting of seven Workshops, a Storage Sub-section, and a Training Sub-section. A Storage Sub-section operates under the control of the Accountant Section. There are no sections or sub-sections to take charge of inventory control for spare parts, acquisition and inspection for purchased medical equipment, and management of the records of medical equipment owned and its repairs. These facts are not in line with the functions BES is supposed to fulfill. However BES will restructure itself, before the implementation of this project, in order to take charge of the medical equipment's purchase through their disposal. The existing technical sections will be divided into three departments: Maintenance/Repair, Training, and Procurement/Supply. Six workshops will be under the control of the Maintenance/Repair Department. The size of BES Colombo Centre's staff will be increased to 164 persons. Furthermore, the number of staff members at the provincial workshops will be increased to 6 persons since the provincial workshop to be established in the Southern Province will employ 4 repair workers. This staffing plan places utmost emphasis on increasing the number of technicians to take charge of inspection and repair, and is therefore considered rational and necessary. As the operations to be carried out in the new facilities will be almost the same as those now being



carried out at BES's existing facilities, there will be no problem with BES's operation system.

## (2) Budgetary Appropriations

The cost for the implementation of this project is to be paid out of the annual budget of the Ministry of Health and Women's Affairs following its approval in a Cabinet meeting. The government of Sri Lanka stands ready to take necessary measures immediately after the signing of the Exchange of Notes. The budgeted annual total cost for the operation and management of the projected facilities for the first year is 8.33 million rupees, of which about 5.61 million rupees is for personnel expenses and 2.72 million rupees is for facility maintenance expenses. There will be no particular problem with the personnel expenses since they will be budgeted after the project is approved in a Cabinet meeting. As for the maintenance expenses, which make up only a fraction of a percent of the Ministry of Health and Women's Affairs' annual budget, it is considered possible to include them in the Ministry's annual budget judging from similar facilities which operate under the jurisdiction of the Ministry.

## (3) Maintenance and Management

This project is designed to make it easy to maintain and manage the facilities. Highly durable building materials will be used in the construction of the facilities, and priority will be given to the use of locally available materials. Also, in the selection and procurement of the equipment utmost emphasis will be placed on the availability of manufacturer's local maintenance services. In addition, the facilities are designed to make effective use of natural lighting and ventilation to save energy costs. Thus, it is concluded that maintenance and management of both the facilities and the equipment will be not be difficult.

Furthermore, the Ministry of Health and Women's Affairs has a department to maintain and manage the facilities that operate under its control, and BES is essentially an organisation of engineers and technicians. Therefore, it will be possible for BES to manage its incidental facilities on its own.

## 5-3 Conclusion and Recommendations

### (1) Conclusion

The strengthening of the country's system for maintenance and management of medical equipment through the implementation of this project is expected to improve the country's support services for the engineering aspects of the country's health services. This will contribute to an improvement in the quality of the country's health services. Moreover, it will also contribute to the people's recovery and good health. The Sri Lankan system for the operation and management of the proposed facilities is not yet satisfactory in terms of the size of staff and financial resources, but this will not pose any serious problem to the implementation of this project.

### (2) Recommendations

The following recommendations are made to ensure the quick implementation of the project and the smooth and effective operation of the proposed facilities.

#### 1) Implementation of the Project

- a) As this project is to be implemented within the framework of the grant aid programme from the Government of Japan, there are time limitations on the implementation of the project. It must be completed before the expiration of the term as set forth in the Exchange of Notes, or the end of the fiscal year of the Government of Japan. For this reason, prompt action is required in certain necessary procedures, such as conclusion of an agreement for consultant services, and construction and equipment procurement/ installation work.

b) It will be necessary for the Government of Sri Lanka to secure the funds necessary for procedures such as customs clearance, tax exemption, and transportation to insure the smooth implementation of the construction and equipment work.

2) Operation, Maintenance, and Management

In order to operate the proposed facilities effectively, it will be essential for the Government of Sri Lanka to secure the necessary number of staff members as set forth in the staff plan. Also, budgetary appropriations for the maintenance and management of the facilities and equipment should be planned carefully.

3) Technical Cooperation of the Government of Japan

The Government of Sri Lanka is in need of a transfer of technology and experience from Japan through the implementation of this project, and they hope to obtain technical cooperation from the Government of Japan. In order to support the improvement of the country's medical equipment maintenance and management technologies, it is strongly desirable that technical cooperation be implemented by the Government of Japan in conjunction with this project.

**ANNEX**



## 1. Member List of the Field Study Team

### (1) Basic Design Study Team (March 17~April 20, 1991)

Dr. Hiroshi Amemiya	Team Leader	Director, Department of Surgical Research, National Cardiovascular Center Research Institute
Mr. Satoru Watanabe	Project Coordinator	Second Basic Design Study Division, Grant Aid Study and Design Dept., JICA
Mr. Jun Sakuma	Technical Cooperation	Multilateral Cooperation Division, Experts Assignment Dept., JICA
Mr. Ken Majima	Project Manager, Architect	Yamashita Sekkei Inc.
Mr. Hiroyuki Kimura	Medical Equipment Specialist, Operation Management	Yamashita Sekkei Inc.
Mr. Satoshi Okamoto	Architectural Design, Architect	Yamashita Sekkei Inc.
Mr. Norio Ishioka	Facility Engineer	Yamashita Sekkei Inc.
Mr. Kazuhiro Ajiki	Medical Equipment Specialist, Repair	Yamashita Sekkei Inc.

(2) Explanation of Draft Final Report (July 21~August 1, 1991)

Mr. Hideo Yasuki	Team Leader	Resident Representative, Sri Lanka Office, JICA
Mr. Mitsuyoshi Kawasaki	Project Coordinator	Sri Lanka Office, JICA
Mr. Ken Majima	Project Manager, Architect	Yamashita Sekkei Inc.
Mr. Hiroyuki Kimura	Medical Equipment Specialist, Operation Management	Yamashita Sekkei Inc.
Mr. Satoshi Okamoto	Architectural Design, Architect	Yamashita Sekkei Inc.
Mr. Kazuhiro Ajiki	Medical Equipment Specialist, Repair	Yamashita Sekkei Inc.



## 2. Survey Schedule

### (1) Basic Design Study (March 17 ~April 20, 1991)

No.	Date	Schedule
1	March 17 (Sun)	<ul style="list-style-type: none"> <li>● Lv. Tokyo (Messrs. Watanabe, Sakuram)</li> <li>● Survey on HMS in Manila</li> </ul>
2	March 18 (Mon)	<ul style="list-style-type: none"> <li>● Lv. Tokyo (Dr. Amemiya, Mr. Majima)</li> </ul>
3	March 19 (Tue)	<ul style="list-style-type: none"> <li>● Ar. Colombo (Dr. Amemiya, Messrs. Watanabe, Sakuma, Majima)</li> </ul>
4	March 20 (Wed)	<ul style="list-style-type: none"> <li>● Meeting at JICA</li> <li>● Courtesy call on Embassy of Japan</li> <li>● Meeting at Department of External Resources</li> <li>● Meeting at MOH and BES</li> </ul>
5	March 21 (Thu)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Survey on MRI</li> </ul>
6	March 22 (Fri)	<ul style="list-style-type: none"> <li>● Survey on Colombo General Hospital</li> <li>● Lv. Tokyo (Messrs. Kimura, Okamoto, Ishioka, Ajiki)</li> </ul>
7	March 23 (Sat)	<ul style="list-style-type: none"> <li>● Arrangement of survey data</li> <li>● Ar. Colombo</li> </ul>
8	March 24 (Sun)	<ul style="list-style-type: none"> <li>● Lv. Colombo</li> <li>● Survey on Batapala Peripheral Unit</li> <li>● Survey on Matara Base Hospital</li> </ul>
9	March 25 (Mon)	<ul style="list-style-type: none"> <li>● Survey on Galle Teaching Hospital</li> <li>● Ar. Colombo</li> </ul>
10	March 26 (Tue)	<ul style="list-style-type: none"> <li>● Discussion on the Minutes</li> <li>● Survey on BES</li> <li>● Survey on Sri Jayawardenapura General Hospital</li> </ul>
11	March 27 (Wed)	<ul style="list-style-type: none"> <li>● Survey on Homagama Hospital</li> <li>● Discussion on the Minutes</li> </ul>
12	March 28 (Thu)	<ul style="list-style-type: none"> <li>● Signing of Minutes of Discussions at MOH</li> <li>● Reporting to JICA</li> </ul>
13	March 29 (Fri)	<ul style="list-style-type: none"> <li>● Survey on Peradeniya Teaching Hospital</li> <li>● Lv. Colombo for Tokyo (Dr. Amemiya, Messrs. Watanabe, Sakuma)</li> </ul>
14	March 30 (Sat)	<ul style="list-style-type: none"> <li>● Survey on Kandy Teaching Hospital</li> <li>● Survey on construction industry (Mr. Ishioka)</li> </ul>

No.	Date	Schedule
15	March 31 (Sun)	<ul style="list-style-type: none"> <li>● Lv. Kandy</li> <li>● Ar. Anuradhapura</li> </ul>
16	April 1 (Mon)	<ul style="list-style-type: none"> <li>● Survey on Anuradhapura Provincial Hospital</li> <li>● Survey on the existing facilities at BES (Mr. Ishioka)</li> </ul>
17	April 2 (Tue)	<ul style="list-style-type: none"> <li>● Lv. Anuradhapura</li> <li>● Survey on Kurunegala Provincial Hospital</li> <li>● Ar. Kandy</li> <li>● Survey on the existing facilities at BES (Mr. Ishioka)</li> </ul>
18	April 3 (Wed)	<ul style="list-style-type: none"> <li>● Survey on Kandy Teaching Hospital</li> <li>● Survey on construction industry (Mr. Ishioka)</li> <li>● Lv. Kandy Lv. Bandarawela</li> </ul>
19	April 4 (Thu)	<ul style="list-style-type: none"> <li>● Survey on Badulla Provincial Hospital</li> <li>● Lv. Badulla Ar. Rathapura</li> <li>● Survey on construction industry (Mr. Ishioka)</li> </ul>
20	April 5 (Fri)	<ul style="list-style-type: none"> <li>● Survey on Ratnapura Provincial Hospital</li> <li>● Lv. Ratnapura Ar. Colombo</li> <li>● Survey on construction industry (Mr. Ishioka)</li> </ul>
21	April 6 (Sat)	<ul style="list-style-type: none"> <li>● Survey on construction industry</li> <li>● Arrangement of survey data</li> <li>● Lv. Colombo for Tokyo (Mr. Ishioka)</li> </ul>
22	April 7 (Sun)	<ul style="list-style-type: none"> <li>● Arrangement of survey data</li> <li>● Team meeting</li> </ul>
23	April 8 (Mon)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Survey on MSD Central storage</li> </ul>
24	April 9 (Tue)	<ul style="list-style-type: none"> <li>● Survey on Colombo General Hospital</li> <li>● Survey on the existing facilities at BES (Mr. Okamoto)</li> <li>● Preparation of additional questionnaire (Mr. Majima)</li> </ul>
25	April 10 (Wed)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Survey on activities of BES</li> </ul>
26	April 11 (Thu)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Meeting at Colombo Municipal Council</li> <li>● Reporting to JICA and Embassy of Japan</li> </ul>
27	April 12 (Fri)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Survey on construction industry (Mr. Okamoto)</li> </ul>
28	April 13 (Sat)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Lv. Colombo for Tokyo (Mr. Majima)</li> </ul>

No.	Date	Schedule
29	April 14 (Sun)	<ul style="list-style-type: none"> <li>● Arrangement of survey data</li> <li>● Team meeting</li> </ul>
30	April 15 (Mon)	<ul style="list-style-type: none"> <li>● Survey on construction industry (Mr. Okamoto)</li> <li>● Survey on medical equipment suppliers (Messrs. Kimura, Ajiki)</li> </ul>
31	April 16 (Tue)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Survey on Japanese grant aid projects</li> </ul>
32	April 17 (Wed)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Survey on Nawaloka Hospital</li> </ul>
33	April 18 (Thu)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Meeting at CMC (Mr. Okamoto)</li> <li>● Meeting at CECB (Mr. Okamoto)</li> <li>● Meeting at MRI (Messrs. Kimura, Ajiki)</li> </ul>
34	April 19 (Fri)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Reporting to JICA</li> <li>● Lv. Colombo for Tokyo (Messrs. Kimura, Okamoto, Ajiki)</li> </ul>
35	April 20 (Sat)	<ul style="list-style-type: none"> <li>● Ar. Tokyo</li> </ul>

(2) Explanation of Draft Final Report (July 21~August 1, 1991)

No.	Date	Schedule
1	July 21 (Sun)	<ul style="list-style-type: none"> <li>● Lv. Tokyo</li> <li>● Ar. Colombo</li> </ul>
2	July 22 (Mon)	<ul style="list-style-type: none"> <li>● Meeting at JICA</li> <li>● Courtesy call on Embassy of Japan</li> <li>● Meeting at Department of External Resources</li> <li>● Meeting at BES (submission of Draft Final Report)</li> </ul>
3	July 23 (Tue)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Meeting at MOH</li> </ul>
4	July 24 (Wed)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> </ul>
5	July 25 (Thu)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> </ul>
6	July 26 (Fri)	<ul style="list-style-type: none"> <li>● Lv. Colombo Ar. Galle (Messrs. Majima, Okamoto)</li> <li>● Survey on medical equipment agencies (Messrs. Kimura, Ajiki)</li> </ul>
7	July 27 (Sat)	<ul style="list-style-type: none"> <li>● Survey on the construction site in Galle Teaching Hospital</li> <li>● Lv. Galle Ar. Colombo (Messrs. Majima, Okamoto)</li> <li>● Survey on mechanical equipment agencies (Messrs. Kumura, Ajiki)</li> </ul>
8	July 28 (Sun)	<ul style="list-style-type: none"> <li>● Team meeting</li> </ul>
9	July 29 (Mon)	<ul style="list-style-type: none"> <li>● Meeting at BES</li> <li>● Meeting at CMC</li> <li>● Meeting with the Follow-up Survey Team</li> </ul>
10	July 30 (Tue)	<ul style="list-style-type: none"> <li>● Meeting with the Follow-up Survey Team at BES</li> <li>● Signing of Minutes of Discussions at MOH</li> </ul>
11	July 31 (Wed)	<ul style="list-style-type: none"> <li>● Survey on Automobile Engineering Training Institute</li> <li>● Reporting to JICA and Embassy of Japan</li> <li>● Lv. Colombo</li> </ul>
12	Aug 1 (Thu)	<ul style="list-style-type: none"> <li>● Ar. Tokyo</li> </ul>

### 3. Member List of Governing Party

#### Department of External Resources, Ministry of Finance

Mr. S. Weerapana Deputy Director, Dep. of External Resources

#### Ministry of Health and Women's Affairs

Dr. Joe Fernando Secretary  
Dr. George Fernando Director General  
Dr. Sanath Goonesekera Deputy Director General  
Dr. Lalith Mendis Deputy Director General of Health Services

#### Biomedical Engineering Services

Ms. Indira Jayawardena Director  
Mr. J. L. M. K. Jayatilaka Engineer  
Mr. P. M. J. T. Fernando Engineer  
Mr. J. M. Wickramarachchi Engineer  
Mr. R. D. Liyanage Technologist (Electronics)  
Mr. T. A. L. Fonseka Technologist (Dental)  
Ms. A. M. Herath Foreman (Electronics)  
Mr. C. D. Khemadasa Foreman (Operation Theatre)  
Mr. P. L. Perera Foreman (Operation Theatre)  
Mr. A. G. A. De. Silva Foreman (Operation Theatre)  
Mr. K. D. N. Perera Foreman (Operation Theatre)  
Mr. W. L. T. Fernando Mechanic (Workshop)  
Mr. S. A. Vipulasena Foreman (Sterilisation)  
Mr. C. Nimal Foreman (Sterilisation)  
Mr. K. K. D. Premedasa Foreman (Sterilisation)  
Mr. W. D. Gunasiri Foreman (Dental)  
Mr. J. Pathiratna Foreman (Dental)  
Mr. K. P. Gunaratna Foreman (Dental)  
Mr. E. L. Wickramaratna Foreman (X-ray)  
Mr. Nimal Hendavitharana Foreman (X-ray)  
Mr. K. D. Wilbert Foreman (X-ray)  
Mr. W. A. A. Weerakkody Foreman (X-ray)  
Mr. PA. Wiratunga Foreman (Lab)  
Mr. H. D. Reginold Foreman (Lab)  
Mr. S. Kuladevan Foreman (Lab)

#### Matara Base Hospital

Mr. P. D. Yapa District Medical Officer

#### Galle Teaching Hospital

Dr. Nimal Edirisinghe Director

Dr. P. L. Gunawardene	Acting Director
Mr. N. Devarajan	Chief Engineer, Dept. of Housing Construction
Mr. M. G. B. Amarasens	Administrative Officer
Mr. M. Wimalasend	Administrative Officer
Mr. J. L. Athula Wijesinghe	Senior Medical Laboratory Technologist
Ms. G. Hevavidhamana	Matron
Ms. Y. G. Palliyguvu	Matron
<b>Sri Jayawardenapura General Hospital</b>	
Dr. J. Nalin Radrigo	Chairman
Dr. R. C. Rajapakse	Director
<b>Peradeniya Teaching Hospital</b>	
Dr. J. Jayawardana	Director
Ms. L. S. Weerakkody	Matron
<b>Kandy Teaching Hospital</b>	
Dr. Nihal Karunaratne	Chairman, Hospital Committee
Dr. A. W. L. Beligaswatte	Director
Dr. H. S. B. Tennakoon	Deputy Director
Mr. A. T. Bandusena	Administrative Officer
<b>Anuradhapura Provincial Hospital</b>	
Dr. S. A. Udatenne	Medical Superintendent
Dr. W. L. K. Caldera	
<b>Kurunegala Provincial Hospital</b>	
Dr. Jupiter Moonamile	Medical Superintendent
Ms. Somasena	Matron
Mr. P. M. Podirathna	Pharmacist
<b>Badulla Provincial Hospital</b>	
Dr. W. Karaudagoda	Principal Director of Health Services
Dr. Neil Fernando	Medical Superintendent
Ms. Ahara Desilva	Matron
Mr. A. M. N. Suriyakavdara	Pharmacist
Mr. Y. G. Jinadaic	Administrative Officer
Mr. W. D. Aleysinaaden	Engineer of Provincial Construction Services
<b>Ratnapura Provincial Hospital</b>	
Dr. G. Sankaranarayana	Medical Superintendent
Dr. V. P. E. Ranafune	
Mr. P. N. P. Karalaseru	Administrative Officer

Colombo General Hospital

Mr. Q. C. Fernando                      Senior Radiographer  
Mr. Y. C. Jayasinghe                      Medical Physicist

Nawaloka Hospital

Mr. Tosith Silva                              Paramedical Officer

Medical Supplies Division (MSD)

Mr. K. Kanagratwam                      Assistant Director  
Mr. Wasantha Abensekava                System Analyst

Colombo Municipal Council (CMC)

Mr. Raja Samadwickrama                Architect (Town Planning)

Central Engineering Consultancy Bureadu (CECB)

Mr. D. S. Withanage                      Project Manager  
Mr. A. W. G. Kasrunaratra               Project Manager

Ceylon Electricity Board

Mr. J. K. B. Ekamayake                 Electrical Engineer (Colombo City Office)

Colombo Gas and Water Co., Ltd.

Mr. Rohan Amarasinghe                 Chief Engineer

National Water Supply and Dranage Board

Mr. A. Hemapala C. Silva               Assistant Manager  
Mr. Visaka Dias                             Engineer (House Connection)

Department of Telecommunication

Mr. Dunstan Fernando                   Engineer

Embassy of Japan to Sri Lanka

Mr. Ei Kubota                                First Secretary  
Mr. Hiroyuki Kinomoto                    Third Secretary

JICA Sri Lanka Office

Mr. Hideo Yasuki                          Resident Representative  
Mr. Kiichiro Kuno                          Deputy Director  
Mr. Mitsuyoshi Kawasaki  
Mr. Toshiro Yamashita  
Mr. Hiroshi Shinnou

4. Minutes of Discussions

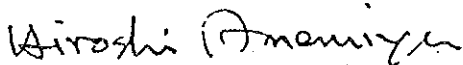
(1) Basic Design Study

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR REHABILITATION OF BIOMEDICAL ENGINEERING SERVICES IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

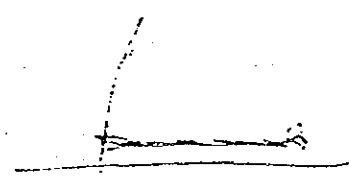
In response to the request made by the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a Basic Design Study on the Project for Rehabilitation of Biomedical Engineering Services. (hereinafter referred to as "the Project") and Japan International Cooperation Agency (JICA) has sent the Basic Design Study Team headed by Dr. Hiroshi Anemiya, Director, Department of Surgical Research, Research Institute, National Cardiovascular Center, from March 18th to April 20th, 1991. The Team had a series of discussions with the authorities concerned of the Government of the Democratic Socialist Republic of Sri Lanka and conducted a field survey.

As the result of the discussions and the field survey, both parties confirmed the main articles described on the attached sheets. The Team will proceed the works and prepare the Basic Design Study Report on the Project based on the articles.

Colombo, March 28, 1991.



.....  
Dr. Hiroshi Anemiya  
Leader,  
Basic Design Study Team  
JICA



.....  
Dr. Joe Fernando  
Secretary,  
Min. of Health & Women's Affairs  
Sri Lanka



## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to assist strengthening the capability of the Division of Biomedical Engineering Services (BES) of the Ministry of Health and Women's Affairs. The achievement of the objective will contribute to strengthen the system of supply and maintenance of biomedical equipment in Sri Lanka, to support the public medical facilities and to promote the medical services for Sri Lanka.

### 2. Executing Agency

Ministry of Health and Women's Affairs is responsible for execution and administration of the Project.

### 3. Items requested for the Implementation of the Project

The necessary items for realization of the Project will be determined in the Basic Design by the Team as first step to strengthen the capability of BES, based on the request made by the Government of Sri Lanka, after the field study conducted by the Team.

Major items tentatively selected are shown in Annex I, reflecting on priority .

However, the final list of items to be provided may differ from the above items, if modifications are judged necessary after determined analysis back in Japan and further discussions with the Sri Lankan representatives.

### 4. Site of the Project

The site of the Project is located in Colombo as shown in Annex II and the site for the Provincial Workshop is located at new Galle Teaching Hospital.

Sri Lankan side promised Japanese side that a part of function of BES will remove to the Storage of Medical Supply for the period of construction.

### 5. Grant Aid Programme

- (1) The Government of Sri Lanka has understood the Japan's Grant Aid System explained by the Team including principle of use of a Japanese Consultant Firm and a Japanese Contractor for the implementation of the Project.
- (2) The Government of Sri Lanka will take necessary measures as listed in Annex III on condition that the Grant Aid by the Government of Japan would be extended to the Project.

6. Schedule of the Study

- (1) JICA will prepare the draft report and dispatch a mission in order to finalize the contents of the report around June 1991.
- (2) In case that the contents of the report is accepted in principle by the Government of Sri Lanka, JICA will complete the Basic Design Study Report and submit it to the Government of Sri Lanka by September, 1991.

7. Technical Cooperation

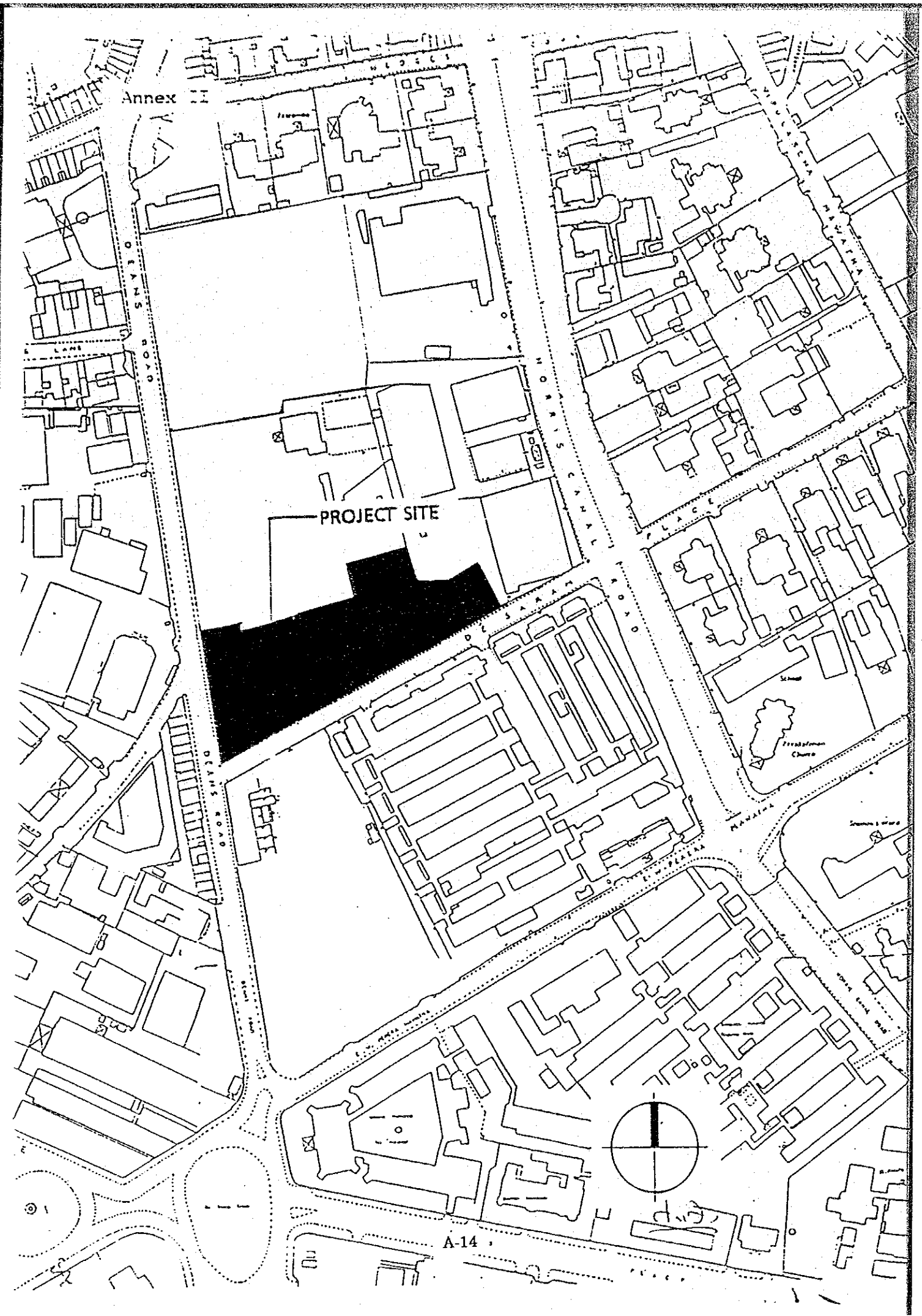
Sri Lankan side requested technical cooperation in order to upgrade the ability of management and technique of BES.

Japanese side recognized the significance of the technical cooperation and promised Sri Lankan side to convey the requirement to related organizations and to make necessary effort for realization.

W.A.

Annex I

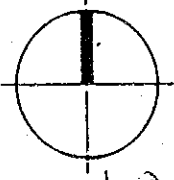
1. Workshop in Colombo:
  - 1) Radiology Equipment Section
  - 2) Electronic Equipment Section
  - 3) Sterilisation Section
  - 4) Laboratory Equipment Section
  - 5) Operation Room Equipment Section
  - 6) Refrigeration Section
  - 7) Dental Equipment Section
  - 8) Mechanical Workshop Section
  
2. Warehouse in Colombo for:
  - 1) Spareparts for Biomedical Equipment
  - 2) New Equipment before installation
  
3. Equipment for Maintenance and Repairment of Biomedical Equipment
  
4. Provincial Workshop  
Provincial Workshop at Galle Teaching Hospital as model  
(The Provincial Workshop will be managed by BES directly.)
  
5. Vehicle



Annex

PROJECT SITE

A-14



### Annex III

1. To secure the site.
2. To clear the existing building(s) which would hinder to construct the Project facilities before the commencement of the construction.
3. To undertake incidental works such as planting, fencing and constructing gates in and around the site.
4. To provide facilities for the distribution of electricity, water supply, drainage, telephone and other incidental facilities before the commencement of the Project.
  - 1) Electricity distribution line to the site
  - 2) City water distribution main to the site
  - 3) Drainage city main to the site
  - 4) Telephone trunk line to the main distribution panel in the facilities.
5. To provide general furniture.
6. To obtain the building permit prior to the commencement of the construction.
7. To ensure prompt unloading, tax exemption, customs clearance at ports of disembarkation and prompt internal transportation of the equipment purchased under the Grant Aid.
8. To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
  - (1) Advising commission of authorization to pay (A/P) (about ¥3,000 for each A/P)
  - (2) Payment Commission
9. To exempt Japanese Nationals involved in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in the Democratic Socialist Republic of Sri Lanka with respect to the supply of the products and services under the Verified Contractors.

H. D.

10. To accord Japanese Nationals whose services may be required in connection with the supply of the products and the services under the Verified Contracts such facilities as may be necessary for their entry into the Democratic Socialist Republic of Sri Lanka and stay therein for the performance of their work.
11. To bear all the expenses, other than those to be born by the Grant, necessary for the execution of the Project.
12. To ensure the proper and effective operation and maintenance of facilities and biomedical equipment improved under the Grant.

(2) Explanation of Draft Final Report .

MINUTES OF DISCUSSIONS  
ON  
THE BASIC DESIGN STUDY ON THE PROJECT  
FOR  
REHABILITATION OF BIOMEDICAL ENGINEERING SERVICES  
IN  
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA  
(CONSULTATION ON DRAFT REPORT)

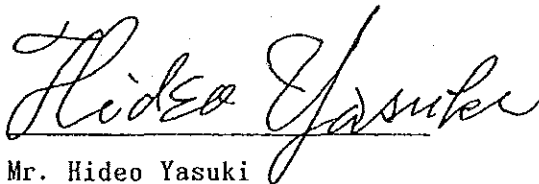
In January 1991, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Rehabilitation of Biomedical Engineering Services (hereinafter referred to as "Project " ) to the Democratic Socialist Republic of Sri Lanka and has prepared the draft report of study, through discussions with the officials concerned of the Government of Sri Lanka, the field survey on the Project site, and technical examination on the results in Japan.

In order to explain the components of the draft report to the Government of Sri Lanka as well as to consult with Sri Lanka side on the contents of the report, JICA sent a study team to Sri Lanka which is headed by Mr. Hideo Yasuki, Resident Representative, JICA Sri Lanka Office.

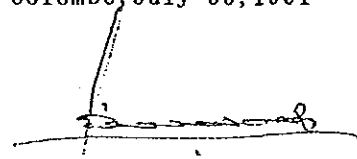
The team commenced its study in Colombo from July 21, 1991 and will terminate it on July 31.

As a result of discussions, both parties confirmed the main items as described on the attached sheets.

Colombo, July 30, 1991



Mr. Hideo Yasuki  
Leader  
Draft Report Explanation Team  
JICA



Dr. Joe Fernando  
Secretary,  
Min. of Health & Women's Affairs  
Sri Lanka

## ATTACHMENT

### 1. Components of Draft Report

The Government of Sri Lanka has agreed and accepted in principle the components of the Draft Report proposed by the team.

### 2. Japan's Grant Aid system

(1) The Government of Sri Lanka has understood the system of Japan's Grant Aid explained by the team.

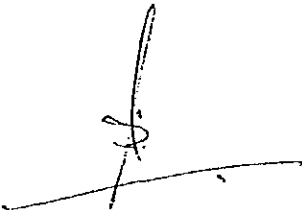
(2) The Government of Sri Lanka will take the necessary measures, described in Annex I, for smooth implementation of the Project on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

### 3. Technical Cooperation

Both parties confirmed that it is necessary to extend the technical cooperation being composed of, especially assignment of Japanese long-term and short-term experts for upgrading the ability of management techniques and repair technologies of BES.

### 4. Further schedule

The team will make the Final report in accordance with the confirmed items, and send it to the Government of Sri Lanka by the end of September 1991.





Annex I : Necessary measures to be taken by the Government of Sri Lanka in case Japan's Grant Aid is executed.

1. To secure the site.
2. To clear the existing buildings which would hinder to construct the Project facilities before the commencement of the construction.
3. To undertake incidental works such as planting, fencing and constructing gates in and around the site.
4. To provide facilities for the distribution of electricity, water supply, drainage, telephone and other incidental facilities before the commencement of the Project.
  - 1) Electricity distribution line to the site.
  - 2) City water distribution main to the site.
  - 3) Drainage city main to the site.
  - 4) Telephone trunk line to the main distribution panel in the facilities.
5. To provide general furniture.
6. To obtain the building permit prior to the commencement of the construction.
7. To ensure prompt unloading, tax exemption, customs clearance at ports of disembarkation and prompt internal transportation of the equipment purchased under the Grant Aid.
8. To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement:
  - 1) Advising commission of Authorization to Pay (A/P).
  - 2) Payment commission.
9. To exempt Japanese Nationals involved in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in the Democratic Socialist Republic of Sri Lanka with respect to the supply of the products and services under the Verified Contracts.
10. To accord Japanese Nationals whose services may be required in connection with the supply of the products and services under the Verified Contacts such facilities as may be necessary for their entry into the Democratic Socialist of Sri Lanka and stay therein for the performance of their work.
11. To bear all expenses, other than those to be borne by the Grant, necessary for the execution of the Project.
12. To ensure the proper and effective operation and maintenance of facilities and biomedical equipment improved under the Grant.

5. Letter Regarding Staff Employment



දේශීය ආදායම් මෙහෙයුම් මධ්‍යස්ථානය,  
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කොළඹ 02.  
உள்ளநாட்டு இறைவரிக் கட்டடம்,  
சேர் சிற்றம்பலம் ஏ. காடினர் மாவத்த,  
கொழும்பு 02.  
Inland Revenue Building,  
Sir Chittampalam A. Gardiner Mawatha,  
Colombo 02.

තැපැල් පෙට්ටිය  
අලුත් බෙදුම } 513  
P. O. Box  
මගේ අංකය  
எமது இல. }  
My No.  
ඔබේ අංකය  
உமது இல. }  
Your No.

සෞඛ්‍ය හා ව්‍යාපාරික කටයුතු අමාත්‍යාංශය  
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MINISTRY OF HEALTH & WOMEN'S AFFAIRS

දිනය }  
මිසි } .....  
Date }

24 July 1991

Mr. Hideo Yasuki,  
Resident Representative,  
Japan International Cooperation Agency,  
175, New Bullers Road,  
Colombo 3.

Dear Mr. Yasuki,

Project for Rehabilitation of Biomedical Engineering Services

I am pleased to note that the Japanese Government has given priority for the project of Biomedical Engineering Services and appreciate very much the cooperation extended by you for this project.

The Sri Lankan Government has accepted the above project as necessary to ensure patient care services, and therefore when the approval of the Committee of Secretaries was granted for a new building complex to be funded by a donor agency the treasury accepted that there would have to be an increase in the technical staff and a budget for same would have to be provided.

Budget for recruiting staff for existing vacancies has already been granted by the treasury for 1992 and this Ministry has made plans to recruit sixteen technical staff members in early 1992 and twenty three technical staff members by 1993. The Ministry is confident that the additional staff of three senior engineers and twelve mechanics and eight recruits of other categories required by Biomedical Engineering Services for this project would also be approved by the treasury and the funds for their salaries provided in 1993. The Ministry would be able to recruit the engineers from graduates of the University of Moratuwa and University of Peradeniya the Foremen from the Diploma Holders of University of Moratuwa and the Open University and the mechanics from the Craft Apprentices from the National Apprenticeship Board.

Therefore I do not foresee any constraints in recruiting the staff and budgetary provision for them by the time the project is completed in 1993 to ensure that optimum use is made of the facilities provided by the Japanese Government.

Thanking you for your cooperation.

Dr. Joe Fernando,  
Secretary/Health & Women's Affairs.

cc - Dr. Kubota, Second Secretary Embassy of Japan  
Director, External Resources

6. Soil Investigation Data



# NATIONAL BUILDING RESEARCH ORGANISATION

99/1, JAWATTA ROAD, COLOMBO - 5, SRI LANKA. TELEPHONE: 588946

OUR REF: 30/90437



YOUR REF :

5th June, 1991

Director-General of Health Services  
Ministry of Health & Women's Affairs  
Inland Revenue Building  
Sir Chittampalam A. Gardiner Mawatha  
Colombo 2.

Dear Sir,

## SOIL INVESTIGATION AT THE DIVISION OF BIOMEDICAL ENGINEERING SERVICES

Field work in connection with the above project is now completed. Laboratory testing and analysis of test data are currently in progress. In the meantime, we are pleased to submit preliminary recommendations on foundation design for your initial planning.

A total of 5 boreholes were advanced at the site at locations shown in Fig.1. Of these, 3 boreholes (BH1, BH2 and BH3) were advanced in the area allocated for three storeyed building while the remaining two boreholes were done in the area allocated for the two storeyed building. These boreholes were terminated after encountering a hard stratum of weathered rock found at depths varying from 18.65m to 23.0m depths.

Borehole investigation reveals that the subsoils at this site are predominantly sandy down to termination depths. However, layers of compressible peaty-soils and clays are generally found at depths varying from 6.5m to 11.45m. SPT N-values of the sand layers are considerably high and in the range of 15 to values exceeding 50. SPT N-values of the peaty soils and clay layers are considerably low and in the range of 0-9. Structural details of the proposed buildings were not available at the time of preparation of this preliminary recommendations. Therefore, for the purpose of analysis, it is assumed that the columns are spaced at 5m intervals and accordingly the maximum column loads for three storeyed and two storeyed structures are in the order of 1200 kN and 700 kN respectively.



MINISTRY OF POLICY PLANNING AND IMPLEMENTATION

## NATIONAL BUILDING RESEARCH ORGANISATION

98/1, JAWATTA ROAD, COLOMBO - 5, SRI LANKA. TELEPHONE: 588946

OUR REF :



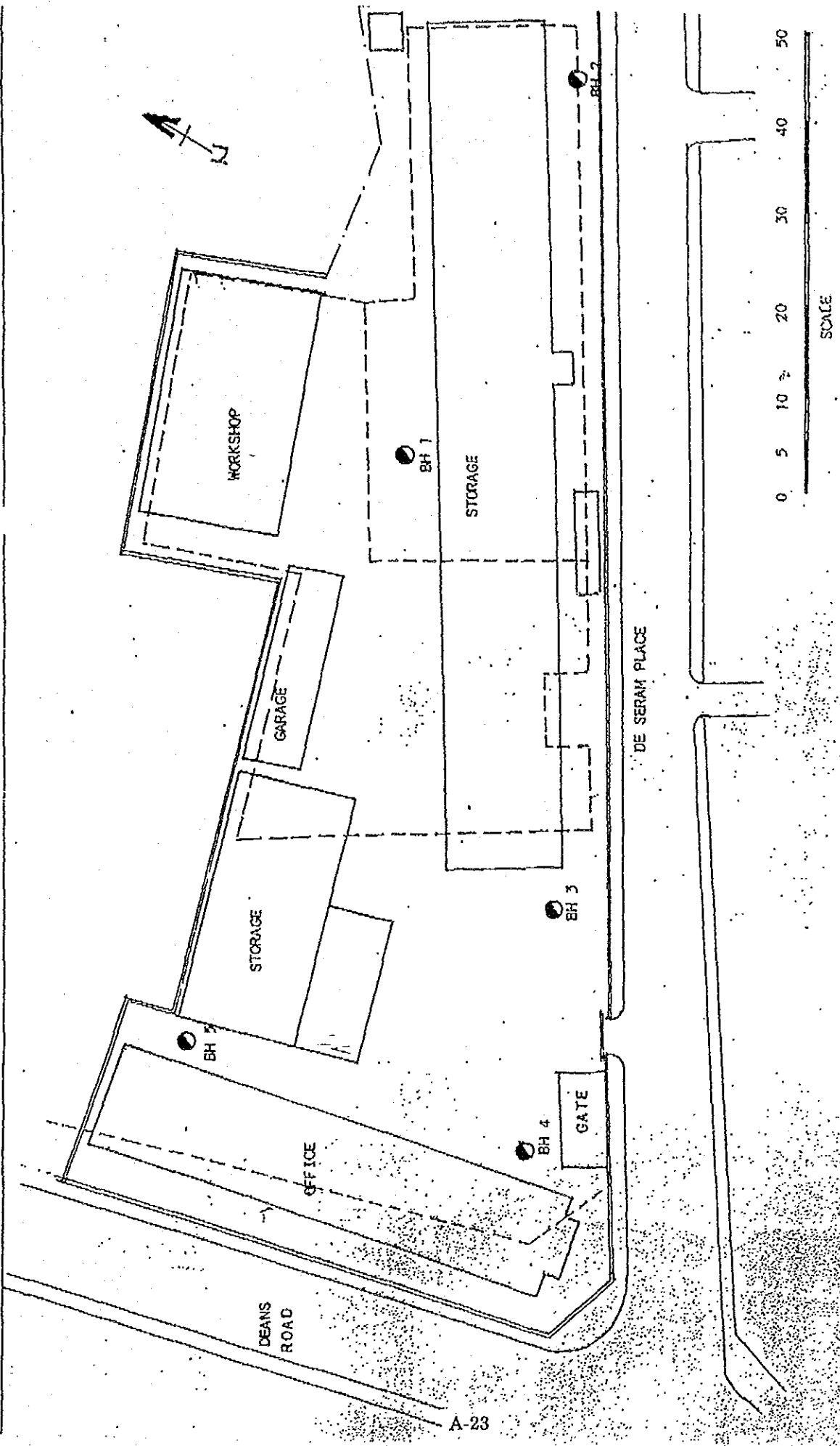
YOUR REF :

Considering the type of structures proposed and the subsoil conditions at the site, it is recommended to support the building on Pad foundations located at 1.5m below the existing ground level. For three storeyed structure, allowable bearing capacity for a footing (width not more than 2.5m) placed at this depth can be taken as  $200\text{kN/m}^2$  for a tolerable settlement of 25mm. Similarly, for the two storeyed structure, allowable bearing capacity for a footing of width not more than 2m can be taken as  $175\text{kN/m}^2$  for a tolerable settlement of 25mm.

Thanking you.

Yours faithfully,

Nimal W. Herath  
Head, Geotechnical Engineering Division  
for Director-General, NBRO.



BOREHOLE LOCATIONS FOR SOIL INVESTIGATION AT THE BIOMEDICAL ENGINEERING SERVICES  
THE SERAM PLACE

# LUG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio Medical Engineering Services					Bore Hole		BH 1	
Location : De Saran Place					ground elevation			
Location : De Saran Place			depth of bore hole		21.38		m	
boring method : Wash boring		commenced on : 25.04.1991			Water struck at GL		m	
drilling mud : Bentonite		completed on : 30.04.1991			GWL on completion of bore hole		GL -2.20 m	
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA				
				number of blows				
				per 15cm			N-value	
				1	2	3	for 30cm	graphical presentation
0.00	SM	Loose, brown medium to fine grained silty sand with aggregates.						0 20 40
0.40								
1.00			DS 1.00	1.00	2	10	9	19
	SM	Medium dense, to dense brown to black, medium to fine grained silty sand.		1.45				
2.00			DS 2.00	2.00	14	32	19	>50
				2.35				5
								refusal to penetration
3.00			DS 3.00	3.00	7	13	19	32
				3.45				
4.00			DS 4.00	4.00	8	13	22	35
				4.45				
4.50	SM	Medium dense, greyish fine grained silty sand.						
5.00			DS 5.00	5.00	4	8	11	19
				5.45				
5.50								
6.00	III	Dense, grey, medium to fine	DS 6.00	6.00	6	16	30	46
				6.45				
6.50	SM	Loose, grey medium to fine grained silty sand with plastic fines.						
7.00			DS 7.00	7.00	8	5	3	8
				7.45				
7.75								
8.00	III	Loose grey, medium to fine	DS 8.00	8.00				
				8.45				
9.00			DS 9.00	9.00	5	2	6	8

LOGGED BY :

GEOTECHNICAL ENGINEERING DIVISION  
NATIONAL BUILDING RESEARCH ORGANISATION

DATE :

# LOG OF BOREHOLE

ANNEXE 1

NAME OF PROJECT : Soil Investigation at the Division of Bio Medical Engineering Services					Bore Hole: BH 1 Contd.				
Location : De Seron Place					ground elevation				
boring method : Wash boring			commenced on : 25.04.1991		depth of bore hole		21.38 m		
drilling mud : Bentonite			completed on : 30.04.1991		Water struck at GL -		m		
					GWL on completion of bore hole		GL - 2.20 m		
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	STANDARD PENETRATION TEST DATA						
			depth tested GL m	number of blows per 15cm			N-value for 30cm graphical presentation		
				1	2	3			
10.00	SC	DS 10.00	10.00	2	2	3	5	20	40
10.50		10.45							
11.00	CH Soft, grey high plasticity clay.	UDS 11.00	11.00						
		11.45							
11.50									
12.00		DS 12.00	12.00	1	0	1	1		
		12.68							
13.00	OH Very soft, blackish, organic clay.	DS 13.00	13.00	1	0	1	1		
		13.52							
14.00		UDS 14.00							
		14.45							
14.50									
15.00	OH Pt Medium stiff, blackish, organic clay with pockets of partially decomposed vegetation. (recovery nil)	DS 15.00	15.00	2	4	5	9		
		15.45							
		UDS 15.50							
		15.90							
16.00		DS 16.00	16.00	1	2	5	7		
		16.45							
16.76									
17.00	SM Medium dense coarse to medium grained silty sand. (recovery nil)	DS 17.00	17.00	3	8	6	14		
		17.45							
18.00		DS 18.00	18.00	2	4	10	14		
		18.45							
18.95									
19.00	SM Medium dense, to very dense, blackish with bands of white, medium to fine grained silty sand. (Highly weathered biotite gneiss rock)	DS 19.00	19.00	3	9	16	25		
		19.45							

LOGGED BY :

GEOTECHNICAL ENGINEERING DIVISION  
NATIONAL BUILDING RESEARCH ORGANISATION

DATE :

# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio Medical Engineering Services					Bore Hole   BH 1 Contd.				
Location : Dg Seram Place					ground elevation				
boring method : Wash boring			commenced on : 25.04.1991		depth of bore hole   21.38 m				
drilling mud : Bentonite			completed on : 30.04.1991		Water struck at GL - m				
					GWL on completion of bore hole   GL - 2.20m				
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA					
				number of blows					
				per 15cm			N-value		
				1	2	3	for 30cm	graphical presentation	
20.00	SM	DS 20.00	20.00	5	11	16	27	20.00 AD	
21.00		DS 21.00	21.00	5	23	33	> 50		
21.38	Borehole terminated at 21.38m depth.		21.38	refusal to penetration					

LOGGED BY : \_\_\_\_\_ GEOTECHNICAL ENGINEERING DIVISION NATIONAL BUILDING RESEARCH ORGANISATION DATE : \_\_\_\_\_



LOG OF BOREHOLE

NAME OF PROJECT : Soil Investigation at the Division of Bio Medical Engineering Services						Bore Hole   BH 2		
Location : De Seram Place						ground elevation		
boring method : Wash boring			commenced on : 30.04.1991.			depth of bore hole   22.40 m		
drilling mud : Bentonite			completed on : 05.05.1991			Water struck at GL - m		
						GWL on completion of bore hole   GL 2.35 m		
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling <sup>10</sup>	depth tested GL m	STANDARD PENETRATION TEST DATA				
				number of blows				
				per 15cm			N-value	
				1	2	3	for 30cm	graphical presentation
0.00	SM Loose, blackish grey medium to fine grained silty sand.							20 40
0.75								
1.00	SM Medium dense, brownish to brownish grey, medium to fine grained silty sand.	DS	1.00	6	12	9	21	
			1.45					
2.00		DS	2.00	5	10	12	22	
			2.45					
3.00		DS	3.00	4	9	10	19	
			3.45					
4.00		DS	4.00	7	9	12	21	
			4.45					
4.50	SM Medium dense, blackish grey, fine grained silty sand.							
5.00		DS	5.00	2	7	15	22	
			5.45					
5.50	SW Very dense, blackish grey, medium to fine grained sand.							
6.00		DS	6.00	4	31	22	50	
			6.37			10		
6.75				Refusal to penetration				
7.00	OH Very soft blackish grey, organic clay.	DS	7.00	1	0	0	0	
			7.45					
7.50								
8.00	SC Loose grey, medium to fine grained clayey sand.	UDS	8.00					
			8.45					
9.00		DS	9.00	1	2	3	5	
			9.45					
9.90								

LOGGED BY :

GEOTECHNICAL ENGINEERING DIVISION  
NATIONAL BUILDING RESEARCH ORGANISATION

DATE :

# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio Medical Engineering					Bore Hole   BH 2 Contd.			
Location : De Seram Place					ground elevation			
boring method : Wash boring			commenced on : 30.04.1991		depth of bore hole   22.40 m			
drilling mud : Bantonite			completed on : 06.05.1991		Water struck at GL - m			
					GWL on completion of bore hole   GL 2.35 m			
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	STANDARD PENETRATION TEST DATA					
			depth tested GL m	number of blows per 15cm			N-value for 30cm graphical presentation	
				1	2	3		
10.00	SC Dense grey, coarse to medium grained clayey sand.	DS 10.00	10.00	8	14	19	33	20 40
		10.45						
11.00	SP Very dense, grey, medium to fine grained ssnd.	DS 11.00	11.00	20	26	34	50	
		11.45						
11.83	OH Very soft, blackish grey, organic clay.	DS 12.00	12.00	1	1	1	2	
12.00		12.45						
13.00		UDS 13.00						
		13.45						
13.50	OH Pt Medium stiff, blackish grey, organic clay with pockets of peat.	DS 14.00	14.00	1	2	5	7	
14.00		14.45						
14.50	SM Medium dense, to very dense, grey fine grained silty sand with plastic fines.	DS 15.00	15.00	2	5	7	12	
15.00		15.45						
16.00		DS 16.00	16.00	19	34	17	> 50	
		16.35		Refusal to penetration				
16.95	SM Very dense, grey, medium to fine grained silty sand.	DS 17.00	17.00	38	52	-	> 50	
17.00		17.30		Refusal to penetration				
17.55		DS 18.00	18.00	1	3	5	8	
18.00	SC Loose, dark grey, clayey sand. (Recovery nil)	18.45						
18.90		DS 19.00	19.00	2	7	14	21	
19.00	ML Medium dense, grey, with bands of white clayey silt. (Highly weathered garnet biotite gneiss rock).	19.45						

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# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio Medical Engineering					Bore Hole   BH 2 Contd				
Location : De Seram Place					ground elevation				
boring method : Wash boring			commenced on : 30.04.1991		depth of bore hole 22.40 m				
drilling mud : Bentonite			completed on : 06.05.1991		Water struck at GL - m				
					GWL on completion of bore hole GL - 2.35 m				
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA					
				number of blows					
				per 15cm			N-value		
				1	2	3	for 30cm	graphical presentation	
20.00	SM Medium dense, to very dense, grey with thin bands of white clayey silt.  (Highly weathered garnet biotite gneiss rock).	DS 20.00	20.00	4	9	15	24		
		-							
21.00		DS 21.00	21.00	4	10	19	29		
		-							
		21.45							
22.00		DS 22.00	22.00	20	25	27	>50		
		-				10			
22.40		22.40		Refusal to penetration					
	Borehole terminated at 22.40 meter depth.								

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LOG OF BOREHOLE

NAME OF PROJECT : Soil Investigation at the Division of Bio-Medical Engineering Services					Bore Hole   BH 03				
Location : The Seram Place					ground elevation				
boring method : Wash boring			commenced on : 07.05.1991		depth of bore hole   19.45 m				
drilling mud : Bentonite			completed on : 09.05.1991		Water struck at GL - m				
					GWL on completion of bore hole   GL -2.15 m				
Depth below GL m	Classification & Description of Soil		Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA				
					number of blows				
					per 15cm			N-value	
				1	2	3	for 30cm	graphical presentation	
0.00	SM	Dark brown, fine grained silty sand, with building debris. (Fill).						20	40
0.55									
1.00	SW	Loose grey medium to fine grained sand.	DS 1.00	1.00	1	1	4	5	
1.50				1.55					
1.50	SW	Loose yellow, medium to fine grained sand.							
2.00			DS 2.00	2.00	2	3	4	7	
2.50				2.45					
2.50	SW	Medium dense to dense, brown medium to fine grained sand.							
3.00			DS 3.00	3.00	4	8	14	22	
3.50				3.45					
4.00			DS 4.00	4.00	9	14	20	34	
4.50				4.45					
4.50	SW	Medium dense, grey fine grained silty sand.							
5.00			DS 5.00	5.00	5	9	14	23	
5.50				5.45					
5.50	SW	Dense to very dense grey, medium to fine grained sand.							
6.00			DS 6.00	6.00	7	20	25	45	
6.50				6.45					
7.00			DS 7.00	7.00	13	28	24	>50	
7.50				7.40			10		
7.60									
8.00	SC	Loose to very loose grey medium to fine grained clayey sand.							
8.00			DS 8.00	8.00	1	2	6	8	
8.50				8.45					
9.00			DS 9.00	9.00	2	1	1	2	
9.00				9.45					

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# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Bio-Medical Engineering Services					Bore Hole		BH 03 Contd.	
Location : The Seran Place					ground elevation			
boring method : Wash boring			commenced on : 07.05.1991		depth of bore hole		19.45 m	
drilling mud : Bentonite			completed on : 09.05.1991		Water struck at GL		-	
					GWL on completion of bore hole		GL 2.15 m	
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA				
				number of blows				
				over 15cm			N-value	
				1	2	3	for 30cm	graphical presentation
10.00	SC	UPS 10.00		-	-	-	-	20, 40
10.50		10.45						
11.00	SM	DS 11.00	11.00	2	9	12	21	
		11.45						
11.90								
12.00	OH Pt	DS 12.00	12.00	5	4	3	7	
		12.45						
12.70								
13.00	DS	DS 13.00	13.00	1	1	2	3	
		13.45						
14.00		UPS 14.00						
		14.40						
15.00	SM	DS 15.00	15.00	30	53	-	-	
		15.25			10			
15.50								
16.00	SM	DS 16.00	16.00	36	30	9	39	
		16.45						
17.00	SM	DS 17.00	17.00	3	7	9	16	
		17.45						
18.00								
18.55								
19.00	SM	DS 19.00	19.00	11	27	36	63	
		19.45						
19.45		Borehole terminated at 19.45m depth.						

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# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio-Medical Engineering Services					Bore Hole   BH 4			
Location : The Seram Place					ground elevation			
boring method : Wash boring			commenced on : 09.05.1991		depth of bore hole   14.30 m			
drilling mud : Bentonite			completed on : 13.05.1991		Water struck at GL - m			
					GWL on completion of bore hole   GL 2.20 m			
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA				
				number of blows				
				per 15cm			N-value	
				1	2	3	for 30cm	graphical presentation
0.00								0
0.40	SM							20
1.00		DS	1.00	3	2	2	4	
1.50			1.45					
2.00	SW	DS	2.00	6	6	10	16	
2.50			2.45					
3.00	SW	DS	3.00	5	11	15	20	
3.50			3.45					
4.00	SM	DS	4.00	8	10	18	28	
4.50			4.45					
5.00		DS	5.00	7	13	17	30	
5.50			5.45					
6.00	SW	DS	6.00	6	14	21	35	
6.50			6.45					
7.00		DS	7.00	7	15	20	35	
7.50			7.45					
7.85								
8.00	Pt	DS	8.00	1	1	3	4	
8.50			8.45					
8.95								
9.00	SC	DS	9.00	1	2	4	6	
			9.45					

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# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio-Medical Engineering Services					Bore Hole		BH 4 Contd.			
Location : The Seran Place					ground elevation					
boring method : Wash boring			commenced on : 09.05.1991		Water struck at GL		m			
drilling mud : Bentonite			completed on : 13.05.1991		GWL on completion of bore hole		GL 2.20 m			
Depth below GL m	Classification & Description of Soil			Type and Depth of Sampling m	STANDARD PENETRATION TEST DATA					
					depth tested GL m	number of blows				N-value graphical presentation
						per 15cm			for 30cm	
					1	2	3			
10.00	SC		DS 10.00	10.00	2	2	4	6	20-40	
10.50				10.45						
11.00	CH	Medium stiff, grey high plasticity clay.	DS 11.00	11.00	2	4	4	8		
11.90				UDS 11.45	11.90					
12.00	SP	Medium dense to very dense grey, coarse to medium grained sand with occasional sub angular gravelly size quartz.	DS 12.00	12.00	7	11	18	29		
13.00					12.45					
13.50			DS 13.00	13.00	17	40	18	>50		
14.00				13.35			5			
14.50			DS 14.00	14.00	29	51	-	>50		
14.50		Borehole terminated at 14.30m depth.		14.30						
15.00										
16.00										

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# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio-Medical Engineering Services.				Bore Hole / BH 5				
Location : The Serem Place				ground elevation				
boring method : Wash boring		commenced on : 14.05.1991		depth of bore hole   19.35 m				
drilling mud : Bentonite		completed on : 16.05.1991		Water struck at GL -- m				
				GWL on completion of bore hole   GL 2.05 m				
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m	depth tested GL m	STANDARD PENETRATION TEST DATA				
				number of blows				
				per 15cm			N-value	
				1	2	3	for 30cm	Graphical presentation
0.00	SM Loose blackish fine-grained silty sand with aggregates (fill).							0 - 20 - 40
0.40								
1.00	SP Very loose to dense, greyish medium to fine grained sand.	DS 1.00	1.00	1	1	2	3	
2.00		DS 2.00	2.00	3	11	26	37	
2.50								
3.00	SW Dense, brown, medium to fine grained sand.	DS 3.00	3.00	10	17	25	42	
4.00		DS 4.00	4.00	8	13	19	32	
4.50	SM Medium, dense, brownish grey fine grained silty sand.	DS 5.00	5.00	4	6	15	21	
5.00								
5.50	GM Medium dense, to dense, greyish brown medium to fine grained silty sand.		5.45					
6.00		DS 6.00	6.00	5	13	16	29	
7.00		DS 7.00	7.00	14	19	25	44	
7.65			7.45					
8.00	CH Soft, light grey, high plasticity clay with traces of sand.	DS 8.00	8.00	1	1	3	4	
9.00		DS 9.00		Recovery nil				
			9.45					

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# LOG OF BOREHOLE

ANNEXE I

NAME OF PROJECT : Soil Investigation at the Division of Bio-Medical Engineering Services					Bore Hole   BH 5 Contd.					
Location : The Serum Place					ground elevation :					
boring method : Wash boring			commenced on : 14.05.1991		depth of bore hole   19.35 m					
drilling mud : Bentonite			completed on : 16.05.1991		Water struck at GL _ m					
					GWL on completion of bore hole   GL 2.05 m					
Depth below GL m	Classification & Description of Soil	Type and Depth of Sampling m		STANDARD PENETRATION TEST DATA						
				depth tested GL m	number of blows					N-value graphical presentation
					per 15cm			for 30cm		
				1	2	3	for 30cm			
10.00		DS	10.00	10.00	1	0	2	2	20-40	
			10.45							
			10.55							
			10.95							
11.00	CI	DS	11.00	11.00	1	1	2	3		
			11.45							
11.95										
12.00	Pt	DS	12.00	12.00	2	3	14	17		
			12.45							
12.60										
13.00	CH	DS	13.00	13.00	1	2	4	6		
			13.45							
14.00		DS	14.00	14.00	1	1	3	4		
			14.45							
14.50										
15.00		DS	15.00	15.00	1	2	3	5		
			15.45							
16.00	CI	DS	16.00	16.00	1	2	4	6		
			16.45							
17.00		DS	17.00	17.00	1	5	10	15		
17.25			17.45							
18.00	ML	DS	18.00	18.00	3	5	11	16		
			18.45							
18.95										
19.00	SM	DS	19.00	19.00	17	45	20	>50		
19.35			19.35	19.35	Refusal to penetration					
Borehole terminated at 19.35m depth.										

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