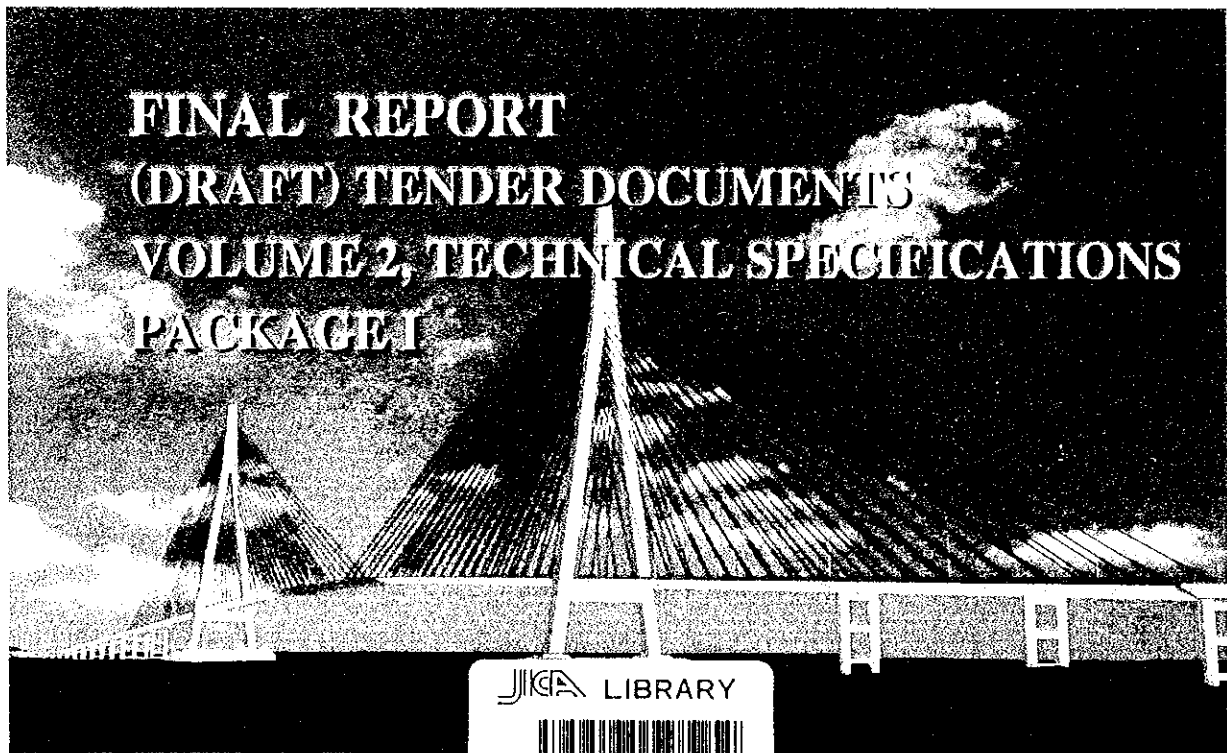


JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
MINISTRY OF TRANSPORT  
SOCIALIST REPUBLIC OF VIET NAM

THE DETAILED DESIGN  
ON  
THE CAN THO BRIDGE CONSTRUCTION  
IN  
SOCIALIST REPUBLIC OF VIET NAM

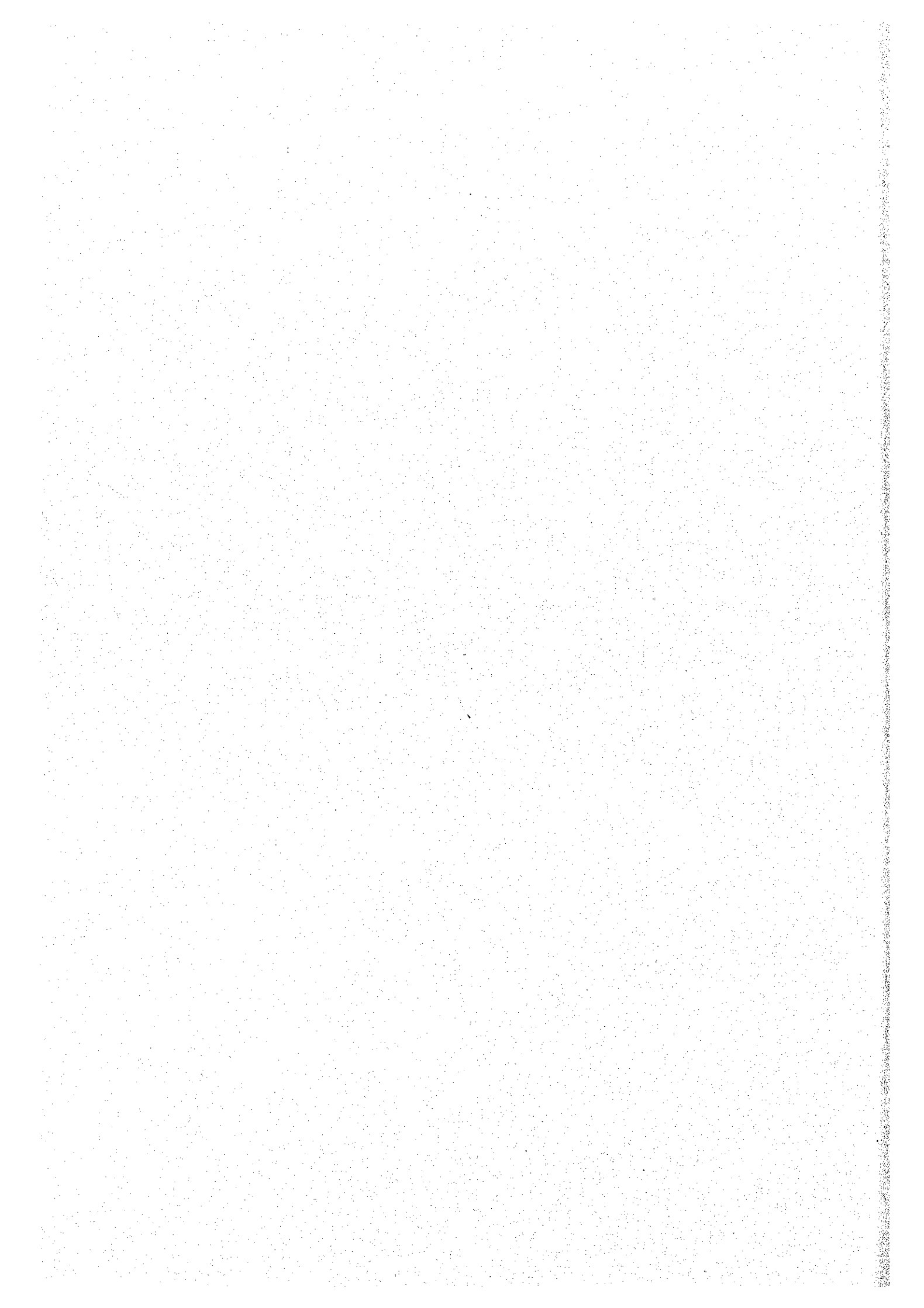


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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
MINISTRY OF TRANSPORT  
SOCIALIST REPUBLIC OF VIET NAM

**THE DETAILED DESIGN  
ON  
THE CAN THO BRIDGE CONSTRUCTION  
IN  
SOCIALIST REPUBLIC OF VIET NAM**

**FINAL REPORT  
(DRAFT) TENDER DOCUMENTS  
VOLUME 2, TECHNICAL SPECIFICATIONS  
PACKAGE I**

**OCTOBER 2000**

**NIPPON KOEI CO., LTD.**



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# 1. GENERAL

## 1.1 General

### 1.1.1 Abbreviations

In addition to the definitions stated in the General Conditions of Contract, the following abbreviations are used in the General Specifications and Tender Schedule and they shall be interpreted as follows:

AASHTO	-	American Association of State Highway and Transportation Officials
ASTM	-	American Society for Testing and Materials
AWS	-	American Welding Society
C.B.R	-	California bearing ratio
cm	-	Centimeter(s)
Cov.Pl.	-	Cover plate
cu.m or m <sup>3</sup>	-	Cubic meter(s)
Dia. or O	-	Diameter
Diaph.	-	Diaphragm
Drg. or Dwg	-	Drawing
Ea	-	Each
Guss.	-	Gusset
Hp	-	Horsepower(s)
JIS	-	Japanese Industrial Standard.
kg	-	Kilogram(s)
L.M. or m	-	Linear mete (s)
lt	-	Liter(s)
Max.	-	Maximum
Min.	-	Minimum
mm.	-	Millimeter(s)
No.	-	Number
P.C.	-	Prestressed Concrete
R.C.	-	Reinforced Concrete
VND	-	Dong(s) of the Socialist Republic of Vietnam.
Sht.	-	Sheet
Spl.	-	Splice
sq.cm or cm <sup>2</sup>	-	Square centimetre(s)
sq.m or m <sup>2</sup>	-	Square meter(s)
SSPC	-	Steel Structures Painting Council (U.S.A)
t or ton	-	Metric tonne (1000kg)
W or Wt	-	Weight

### 1.1.2 Construction Operations and Temporary Works

The Contractor shall execute the Works in a proper and workmanlike manner and in strict accordance with the working drawings, specification and the instructions of the Engineer.

The Contractor's attention is drawn to the fact that it shall be solely responsible at all times for the sequences and methods, safeguards and supervision of the construction

of the Works and for the structural adequacy and stability of all necessary temporary works. As well as fulfilling the requirements of its Quality System, including proof checking, it shall supply detailed drawings and calculations relating to such temporary works and their stability to the Engineer for agreement. However, any agreement given shall in no way relieve the Contractor of its full responsibilities as described above.

The Engineer will advise the Contractor of the items of temporary works which it requires to review, and they shall include the temporary works associated with the following construction activities.

- Load-out platforms
- Lifting and handling pile casings
- Excavation, inspection and concreting of piles
- Formwork and falsework for pile caps, columns and towers for cable stays.
- Casting, handling, storage and erection of any precast elements, including approach span beams
- Installation of cable stays
- Temporary supporting systems during stage construction of deck
- Falsework for installation of joints and deck connections
- Temporary fixing arrangement for bearings
- Formwork and falsework for approach spans.

All information shall be submitted in duplicate at least 28 days before the Contractor proposes to put the work in hand. Unless required otherwise by this Specification or by the Engineer all temporary steelwork structures shall comply with the requirements of the Engineer.

### 1.1.3 Proprietary Articles

Where trade or proprietary names, brands, catalogue or reference numbers are specified in the Contract Documents or approved drawings, they are intended to set a minimum standard and sole preference to any particular material or equipment is not intended. The Contractor shall be at liberty to offer alternatives of similar characteristics of type, quality, appearance, finish, method of construction and/or performance for the approval of the Engineer.

Where such alternatives are offered for approval, the Contractor shall submit complete technical information on the material or equipment under consideration, including details of material, composition, method of application or fixing and all available information relating to compliance with Standards and the durability, serviceability, maintenance requirements, cleaning and protection of the materials or equipment to be considered.

When submitting an alternative proposal, the Contractor shall state any modifications to the detailed design or construction or other work, which will be required due to use of the substitute product and he shall accept full responsibility for the modified work.

If requested by the Engineer the Contractor shall also submit recent test reports on the substitute product or any tests carried out by a registered NATA, or other

approved, testing laboratory, or alternatively to arrange for such tests at its own cost, to the approval of the Engineer.

## 1.2 Quality System

### 1.2.1 Quality Manual

The Tenderer shall include or refer to in its firm's Corporate Quality Manual, as a minimum:

- the firm's quality policy and objectives
- the responsibilities, authorities and interrelationships of personnel who manage, perform, verify or review work affecting quality within the Contractor's organization
- a list of the firm's quality system procedures and instructions
- a statement of procedures for reviewing, updating and controlling the manual.

### 1.2.2 Procedures and Work Instructions

The Contractor shall utilise existing and proven procedures and work instructions wherever possible on this project.

The Contractor shall further identify, develop and implement project specific procedures wherever the absence of such procedures or work instructions could adversely affect quality.

The Conditions of Tendering require that a list of project-specific procedures and work instructions be provided as part of the draft Project Quality Plan at the time of tender. These shall be updated as necessary during the course of the project.

All procedures shall clearly identify who does what, and when, and what record is generated from that activity. In particular, procedures shall identify activities related to review, verification, inspection, test, approval, authorisation and certification.

Work instructions shall provide additional information related to how processes are to be carried out.

The Contractor shall make details of specific procedures available upon request for perusal during audits. The auditors shall ensure that confidentiality is maintained of any material regarded by the Contractor to be confidential.

### 1.2.3 Project Quality Plan

The Tenderer shall develop a draft Project Quality Plan and submit this at the time of tender. The draft Project Quality Plan shall contain an outline of the information set out in the Tender Schedule TS-17, so that the expectation of the final content of the Project Quality Plan is well understood.

Within 28 days of executing the Contract, the Contractor shall submit the first edition of the Project Quality Plan for approval. This shall contain the information set out in the schedule below to the extent that it is known. (For instance, where a

sub-contract has not yet been let at that stage, information specific to that contract should be omitted, and presented with a later revision.)

- Introduction
- Contents list
- Purpose - customer, contract title and number, quality system standard
- Scope - scope of work covered by this plan (i.e. are there other plans for this project?)
- Revision and Approval - methods for review, revision and approval of the plan
- Distribution - copy numbers and recipients, validity period
- Organisation and Authority:
  - Company and Project Organisation - organization charts, interface diagrams and the like
  - Responsibility and Authority - position descriptions, signature authority, activity/authority and responsibility and the like
- Process Planning and Control:
  - Quality Plans - design, procurement, fabrication, installation, construction, commissioning, maintenance, servicing
  - Check and Verification Documents - inspection and test plans, check lists, test sheets, review and verification, validation sampling plans and the like.
  - Procedures (System and Technical) - reference list of standard procedures, work instructions, safe working instructions, environmental control procedures and work instructions and the like.
  - List of all measuring and testing equipment required for the project.
- Project Schedules/Programs - sequence/time based schedules, activity summary list, document submission programs, work-lot breakdown and the like.
- Audit Schedules - internal, suppliers/subcontractors.
- Standards, codes and regulations - list of relevant technical standards, codes of practice or statutory regulations including, where applicable, those relating to Occupational Health and Safety and Environmental Protection.
- Resources:
  - Many of the resources required for the project may be identified as part of the process planning and control activities outlined above. Any unusual or specialised resources required for the project should be referenced as well:
  - Specialist Technical Facilities - test laboratories, environmental chambers, geotechnical services and the like.
  - Materials handling equipment - specialised handling equipment, heavy lifting plan, off-site handling and storage facilities, transportation and the like.
  - Personnel - specialists engaged on the project to perform, review, verify and/or validate a part of the work, eg. structural engineer, surveyor, environmental engineer, explosives expert and the like.
- Quality Records and Forms:
  - This section would typically include the following:
    - List of record types
    - Sample forms
    - Project filing system
    - Back-up schedule
    - Records retention/submission
    - Suppliers/Sub-Contractors Documents (as applicable)

The Project Quality Plan may reference or attach Project Quality Plans prepared by sub-contractors or suppliers who are nominated in that plan to be operating under their own Quality System.

The Contractor shall make available on request all material contained in the Project Quality Plans for perusal by the auditors. The auditors shall ensure that confidentiality is maintained of any material regarded by the Contractor to be confidential.

The Contractor shall review the Project Quality Plan(s) at least monthly and update and re-issue them as required.

#### 1.2.4 Records

The records to be kept for the project shall be identified in the Project Quality Plan. Sample forms shall be supplied with the first edition of the Project Quality Plan.

A detailed description of the Project Filing System shall also be incorporated in the Project Quality Plan. Generally, all quality records in any project office shall be filed in lever arch files in chronological order, each file being clearly marked and directly related to a filing system master. All records shall be identified by date, project, initiator.

The Contractor's conformance records shall include all those specified in ISO 9001. Survey records, as records of process parameters, shall be included.

Conformance records shall be stored and maintained such that they are readily retrievable in facilities that provide a suitable environment to minimise deterioration or damage, and to prevent loss. They shall be retained until the end of the project when they shall be delivered to the Engineer.

The Contractor shall make the conformance records available to the Engineer at all reasonable times, and provide copies within 24 hours of receipt of the test results.

#### 1.2.5 Progress Photographs and Equipment

Before the start of the works, and at the end of every month, the Contractor shall take photographs (approximately 70 in number) showing the progress of the works and also such particular areas of the Site, construction activities, plant etc., as directed by the Engineer. Three (150 x 100mm) unmounted prints marked with the date of exposure, an identification or reference number, and a brief description of the view, along with a 35 mm negative of each photograph, shall be submitted, in suitable albums, to the Engineer within 7 days after the photographs are taken.

The Contractor shall also supply the following photographic and video equipment to the Engineer for the exclusive use of the Engineer's staff:-

1 No. video camera/projector system, with zoom and wide angle lenses, suitable for taking, and projecting on a large screen, video film of project activities during construction, with tripod. One 120 minute duration video film cassette tape shall be provided to the Engineer for its use each month.

1 No. Camera (Nikon F 401S, or equivalent) with wide angle and telephoto lenses, with 1 No. 36 exposure 35 mm films each month.

#### 1.2.6 Industrial Health and Safety

The Industrial Health and Safety Plan shall form part of the Project Quality Plan, and a draft of this plan shall be submitted with the draft Project Quality Plan.

#### 1.2.7 Environmental Management

The planning, management, verification and inspection and tests required for Environmental Management as specified in this Specification shall be controlled by this Project Quality System.

The Environmental Management Plan shall form part of the Project Quality Plan and a draft of this plan shall be submitted with the draft Project Quality Plan.

#### 1.2.8 Project Policy and Objectives

In the Quality Manual the Contractor shall state the project policy and the objectives it intends to achieve during the course of the project. In addition to corporate policy matters all project specific objectives shall be set out against which performance can be measured.

#### 1.2.9 Management Review

The Contractor (and all subcontractors, consultants and suppliers who operate their own Quality System) shall not only demonstrate compliance with ISO 9001 requirements at corporate level, but also at the project level.

#### 1.2.10 Organisation

Responsibility and authority and the interrelation of all personnel who manage, perform and verify work affecting quality shall be defined and documented for the Contractor and all subcontractors, consultants and suppliers.

In particular, the responsibility and authority for all personnel who review, approve, authorise, certify, inspect, test, calibrate, review, verify and validate activities carried out in this project shall be defined and documented.

#### 1.2.11 Resources

The Contractor shall prepare a Resources Plan as part of the Project Quality Plan. This shall cover all resources, including subcontractors, suppliers, personnel, labour, plant, equipment, materials and supplies

Furthermore, the Resources Plan shall identify the number of personnel allocated to the following activities in relation to the Quality System and the time allocated for each:

- Project Management Representative
- Quality Manager (Quality Management Representative)



- Project procedure and work instruction preparation
- Auditors
- Project management review
- Project training

The Quality Management Representative shall have experience of on-site work of similar magnitude and complexity and be familiar with the requirements of ISO 9001, 1994.

#### 1.2.12 Management Representative

The Contractor shall nominate in the Project Quality Plan the person who will be the management representative at project level for the project. This person shall be a member of the management team with executive responsibility for the project.

#### 1.2.13 Design Plan

The design plan for all temporary works, or Contractor's alternative designs of any part of the permanent Works, shall form part of the Project Quality Plan, and shall contain a schedule of activities indicating who has authority and responsibility for each, and especially those who have responsibility for review, verification, approval, certification and validation.

#### 1.2.14 Document Control

The Project Quality Plan or procedures shall identify the way in which documents shall be controlled on the project and in related offices, including head office. In particular, the Project Quality Plan shall identify the document registers intended to be kept in each location, those who are entitled to sign documents of approval, authorisation and certification, and the way in which changes to documents will be controlled.

These requirements shall also apply to sub-contractors, consultants and suppliers as necessary.

#### 1.2.15 Purchasing

The Project Quality Plan shall contain a procurement plan which shall set out the program for procurement of all sub-contracts, and identify the project controls applicable to each sub-contract

#### 1.2.16 Customer Supplied Product

The customer supplied products for this project are limited to the Contract Documentation (where it relates to the pre-tender design), plus the provision of local electrical power services, and the supply of bore water at the site, on both banks of the river.

#### 1.2.17 Process Control

A Process Control Plan shall form part of the Project Quality Plan. Typical contents for the Process Control Plan, are given in Schedule 9 of the General Conditions of Contract.

#### 1.2.18 Inspection and Test Plans

All inspections and tests shall be identified in the Inspection and Test Plans, including those carried out off-site, in laboratories and by sub-contractors and suppliers. Each inspection and test shall be referenced to the applicable reference documents, standards and acceptance criteria, as applicable.

The Inspection and Test Plans shall cover all inspection and testing required by the Contract and shall include surveying and measuring verification processes, as well as sampling procedures. All quality control laboratory tests undertaken by the Contractor shall be performed by laboratories conforming to the standards of the National Association of Testing Authorities (NATA) or other standards approved in writing by the Engineer for the relevant test. Test reports shall be certified by a signatory approved by the Engineer.

The Inspection and Test Plans shall clearly state the times within which each activity will be completed. All test reports shall be made available to the Engineer immediately they are produced.

#### 1.2.19 Calibration Plan

The Project Quality Plan shall contain or reference a Calibration Plan which shall list all items of equipment to be used on the project on and off site and in laboratories, including those of sub-contractors and suppliers and which require calibration. The method of calibration, acceptance criteria and frequency of calibration shall be nominated.

#### 1.2.20 Product Identification, Control and Traceability and Nonconformance

The project-specific methods of identifying materials and components shall be set out in the Project Quality Plan, including the identification of:

- inspection and test status
- nonconforming product
- items to be segregated
- scrap

Traceability is required for special materials as follows:

- Concrete batches used for structural purposes when the required 28 day strength of the concrete is 32 Mpa or higher. The trace shall start at the batching plant and finish at the location of the concrete in the Works. Appropriate testing records shall be kept.

- All prestressing steel, stay cables, and anchorage components. The trace shall start at the steelworks and finish at the location of the prestressing steel or stay cables in the Works. Appropriate testing records shall be kept.
- All structural bearings and roadway expansion joints. The trace shall start at the place of manufacture and finish at the location of the bearings or joints in the Works. Appropriate testing records shall be kept.
- All reinforcement. The trace shall start at the place of manufacture and finish at the incorporation of the reinforcement in concrete.
- All cement. The trace shall start at the place of manufacture and finish at the incorporation of the cement in concrete, mortar, or cement stabilised pavement material.
- All admixtures. The trace shall start at the place of manufacture and finish at the incorporation of the admixture in concrete.
- All electrical, mechanical and telecommunications equipment, fittings and supplies. The trace shall start at the place of manufacture and finish at the location of the equipment in the works.
- All structural steelwork. The trace shall start at the steelworks and finish at the location of the structural steel in the Works. Appropriate testing records shall be kept.
- Geotextiles, wick drains, drainage blanket material, asphaltic concrete, select fill and all such synthetic and natural materials imported for the earthworks on this contract. The trace shall start at the manufacturer or quarry/borrow source and finish at the location of the materials in the works. All appropriate testing and batch records shall be kept on site.

#### 1.2.21 Complaints Handling

A copy of the contractor's procedure for complaints handling shall be submitted with the draft Project Quality Plan.

#### 1.2.22 Corrective and Preventive Action

A copy of the contractor's form for the control of corrective and preventive action shall be submitted with the draft Project Quality Plan.

#### 1.2.23 Audit Schedule

The Contractors (and sub-contractors, where applicable) schedule of audits shall be included in the Project Quality Plan.

The Contractor shall carry out a program of regular Quality Assurance Audits to ensure that the Contractor's (and sub-contractors, consultants and suppliers) Quality Systems are satisfying both the customer's requirements and the requirements of ISO 9001. A copy of the results of each audit shall be submitted to the Engineer within 7 days after the completion of each material audit.

#### 1.2.24 Training Plan

The Contractor's (and sub-contractors', as applicable) plan for training of personnel working on the project shall form part of the Project Quality Plan.

This plan shall identify training needs for the project, including:

- quality system training
- technical and skills training
- staff training (technology transfer)
- management training.

The Training Plan shall set a program for this training and identify personnel assigned to prepare, review and approve the training materials and execute the training program.

#### 1.2.25 Standards of Workmanship

All workmanship shall be the best of its particular kind, and shall be carried out to the satisfaction of the Engineer.

#### 1.2.26 Protection of Works from the Weather

The Contractor shall, at his own expense, carefully protect all work and materials from injury by the weather.

#### 1.2.27 Specifications

Where any material or equipment is specified as being in accordance with a non-Vietnamese standard it should be understood that these should automatically be substituted by such equivalent by the Vietnam Standards Institute (VSI) if this is available at the time of tendering. In the case where application of VSI publications are found unsuitable from a technical point of view at the implementation stage, the Employer will take appropriate measures based on the recommendation of the Engineer.

The Contractor shall obtain copies of all VSI publications relevant to the Contract and relevant to materials or equipment specified, and provide translations in the English language.

Except for material specified by VSI, any materials specified by Japanese standards may be substituted by the equivalent from the United States of America, and vice versa, subject to approval by the Employer. Any request relating to such substitution must be made within 30 days of the Notice of Award of contract, and before any orders have been placed for laboratory testing equipment.

1.2.28 In this Specification materials or tests specified as being in accordance with VSI, AASHTO, ASTM or Japanese Standard shall refer to the last revision of this Specification or method of test at the time of project tendering, unless otherwise nominated.

#### 1.2.29 Setting Out and Construction Levels

The Contractor shall make all surveys and measurements required for the construction of the work. The Contractor shall be responsible for the accuracy of all surveys or measurements made by his employees.

Any marks made by the Engineer or the Contractor shall be carefully preserved and, if disturbed or destroyed, shall be immediately replaced by the Contractor to the satisfaction of the Engineer. No work shall be carried out in any section until the necessary setting out in that section has been approved by the Engineer.

The bridge geometry given on all Design Drawings is based on a mean deck temperature of 27 degree C, and at a Reference Time which is 10 years after the opening of the bridge to traffic. The Contractor shall achieve this bridge geometry at the Reference Time, to within the construction tolerances specified in Clause 8.76.

The Contractor shall be aware of the fact that direct exposure to the sun on the sides or parts of the main bridge (towers, stays and bridge deck) will have a significant effect on the deflections which might be far greater than the specified construction tolerances. The Contractor shall therefore in general conduct global profile surveys and associated measurements at times when solar irradiation has negligible effects and also provide values of the influence coefficients for critical deflections due to the temperature gradients which might be anticipated.

#### 1.2.30 Construction Tolerances

All work executed under this Contract shall be carried out in accordance with the tolerances given in the Specifications, and such other tolerances as are given elsewhere.

The construction tolerance on the finished deck profile immediately after completion but before installation of wearing surface and bridge furniture shall be +30mm.

The maximum deviation from the theoretical deck profile shall not exceed +100mm for any construction stage.

The maximum deviation in any direction shall not exceed + 5 mm in 3 metres.

Local thickness tolerances are: beams + 10 mm, slabs + 5 mm.

The construction tolerances for the towers are as follows:

Global, horizontal - longitudinal: + 1 mm per metre height above pile cap, to a maximum of + 50 mm

Global, horizontal - transverse: + 1 mm per metre height above pile cap, to a maximum of + 25mm.

Local, in any direction:	+ 5 mm in 3 metres.
Local, thickness of each member:	+ 10 mm

Guide pipes for cable anchorages at the tower top and at deck level shall be installed to the following tolerances:

Global, vertical at anchorage workpoints:	+ 10 mm relative to the theoretical level at time of construction according to the Contractor's Construction Engineering.
Local at anchorage workpoints, in any direction:	+ 5 mm.
Local, anchor plate:	refer to Stay Cable Section
Local, guide pipe:	refer to Stay Cable Section.

Should the deck profile lie outside the specified tolerance upon completion of the superstructure construction, adjustment of all stays may become necessary as a corrective measure to achieve the required deck profile. In that event, the Contractor shall submit a full proposal for approval by the Engineer.

#### 1.2.31 Notice of Operations

The Contractor, at all times, shall supply in writing full information regarding the locations in which the materials are being obtained and in which the work is being prepared.

No permanent work shall be undertaken without the Engineer's approval. Full and complete notice in writing shall be given to the Engineer at least 48 hours in advance of the time of the proposed operation for them to be able to make such arrangements as he may deem necessary for its inspection. Requests shall be prepared in triplicate and submitted to the office of the Engineer. Requests shall not be given to field staff.

### 1.3 Safety

#### 1.3.1 Contractor's Responsibility

The Contractor shall be responsible for the safety of the public legitimately passing through the site. All excavations, plant or items of potential danger to the public must be barricaded and signposted to the satisfaction of the Engineer and the Contractor must provide sufficient watchmen to ensure the safety of the public at all times. All existing pedestrian routes shall be maintained in a safe condition unless an alternative route is provided to the satisfaction of the Engineer.

All work must be carried out in such a way as to minimize danger to the public or the workmen on the site.

### 1.3.2 Filling in Holes and Trenches

The Contractor, upon completion of any part of the work, shall immediately, at his own expense fill up all holes and trenches, or carry out the work to them as required by the Engineer, that he may have dug or excavated and are no longer required for the project, and he shall clear away all rubbish and material that is no longer required for the execution of the work.

### 1.3.3 Contractor's Responsibility for Work

Where the approval of the Engineer is required under this Specification, approval shall not relieve the Contractor of his duties or responsibilities under the Contract.

## 1.4 Mobilization and Temporarily Yard

### 1.4.1 Mobilization

The Contractor shall prepare, submit and obtain the Engineer's approval of a Mobilization Programme. The mobilization shall be completed within a period of 120 days, of executing the Contract except as otherwise specified.

Freight, insurance and any other incidental expenses in connection with the shipping, air freight, sea surface and inland transportation of plants, equipment and materials from the place of their origin to the site in Viet Nam and cost for their returning, if required, after completion of the work shall be calculated.

The above prices quoted by the Contractor shall be firm and fixed; no additional payment will be made for any additional mobilization of plants, equipment and materials.

If some installations or items of plant or equipment not otherwise designated to be handed over to the Employer, should be requested by the Employer at the end of the works, these may be handed over against payment to be agreed upon between the parties. Such agreed payment shall take account of any reduction in the cost of demobilization.

### 1.4.2 Temporarily Yard

#### (1) Description

This work shall consist of the construction temporarily yard by required construction plant placing, compacting and shaping the suitable materials of acceptable quality obtained from approved sources in accordance with the Specifications, and as required by the Consultant.

#### (2) Materials

Materials for the construction camp yard shall be the same as the embankment materials from Hau River.

(3) Construction Method

- 1) Prior to placing the material on any area, all clearing and grubbing operations shall have been completed.
- 2) The surface shall be adequately sloped to allow rain water to drain in a neat and acceptable condition.
- 3) Temporary Fencing

Details of the fencing of the temporary yard which is required to be provided, and of other fencing of the Site proposed by the Contractor shall be submitted to the Engineer for approval within 28 days after the commencement of the Works on Site, and prior to commencement of its erection. The approved standard and general dimensions of the temporary fencing shall be at least equivalent to the following:-

A fence constructed of new 2440mm high chainwire with 61mm mesh of 10 gauge, with the chainwire being either plastic coated (or galvanised), and reinforced top and bottom with three intertwined wires of 8 gauge woven into the barbed selvage and also in the middle and at the bottom of the chainwire, and with barb selvage of three strands of barb wire at the top.

- Three strands of barbed wire strung above the chain wire.
- Posts of 63.5mm diameter galvanised pipes not more than 3 m apart.
- Lockable gates of 63.5mm diameter galvanised pipes and chainwire, with the width of gateway at least 5 m.

The Contractor shall remove the temporary fence when directed by the Engineer during the Defects Liability Period.

- 4) The temporarily yard compound shall be maintained by the Contractor during the period of the Contract.

**1.5 Maintenance of Traffic**

**1.5.1 Maintenance and Protection of Traffic**

The Contractor shall keep open to traffic existing roads during the performance of the Works, provided that when approved by the Engineer the Contractor may bypass traffic over a detour. The Contractor shall at all times keep roads and footpaths, affected by his operations, free from soil and material spillage.

The Contractor shall take necessary care at all times during the execution of the works to ensure the existing convenience and safety of residents along and adjacent to the road, and any public highway or port facility that may be affected by the Works. Street lighting shall be relocated as necessary to maintain the same standard of lighting during the course of the works until new lighting facilities are brought into operation.

Any failure of the Contractor to meet these requirements will entitle the Engineer to carry out such works as he deems to be necessary and to charge the Contractor with



the full cost thereof plus ten percent of such cost, which sum shall be deducted from any money due or which may become due to the Contractor under the Contract.

#### 1.5.2 Temporary Traffic Ramps

In cases where it is necessary or required by the Engineer, the Contractor shall construct and maintain temporary traffic ramps, and furnish all the labour and materials required therefor.

#### 1.5.3 Traffic Control

In order to facilitate traffic through or around the Works, or wherever ordered by the Engineer, the Contractor shall erect and maintain at prescribed points on the work and at the approaches to the work, traffic signs, lights, flares, barricades, rubber cones with traffic lamps and other facilities as indicated in the Drawings or required by the Engineer for the direction and control of traffic.

Where required, or where directed by the Engineer, the Contractor shall furnish and station competent flagmen whose sole duties shall consist of directing the movement of traffic through or around the work.

In addition to the requirements of (1) and (2) above, the Contractor shall furnish and erect, within or in the vicinity of the project area, such warning and guide signs as may be ordered by the Engineer.

In order to minimize disruption to traffic flows the Contractor shall enclose the Site with temporary fence to provide a visual barrier between his work and adjacent traffic. The temporary fence shall be of 2.0 m height as indicated in the Drawings and the movement of men, materials and plant into and out of the barriered area shall be controlled by flagmen.

#### 1.5.4 Number of Lanes for Traffic Control

The existing number of traffic lanes on roads at the project site must be maintained at all times during the work and if diversions are provided these must be of the same traffic capacity as the original road. Notwithstanding the above, the Engineer may give approval to reductions in traffic capacity if the Contractor can show that these will not cause excessive delay to traffic. If such approval is given, the Engineer may specify the hours during the day when the reduction in capacity may be applied and it should be anticipated that these hours may not include the peak period for the traffic movement under consideration.

The Contractor shall cooperate with the pertinent agencies regarding traffic control and all details shall be subject to the Engineer's approval.

#### 1.5.5 Extraordinary Traffic

The Contractor shall observe the requirements of Clause G30 of General Conditions of Contract and is responsible for carrying out any necessary investigations and the obtaining of approvals, licences, escorts and any other necessary facilities in order to enable extraordinary traffic to be moved on the roads in the project area.

## **1.6 Accommodation for Engineer's Staff**

### **1.6.1 Housing Accommodation**

The Contractor shall provide housing accommodation (which may be rented) for the use of the Engineer and staff within an acceptable distance from the site office. The housing accommodation shall be fully furnished, completely ready to live in, and shall be subject to the approval of the Employer. The buildings, furnishings and equipment shall be in good condition, walls and woodwork fresh or newly painted.

The Contractor shall be responsible for all repairs, servicing and maintenance of the buildings, furniture, equipment, fitting and household effects.

#### **(1) Expatriate Staff Accommodation**

Air conditioned housing accommodation shall be provided at a location and to a standard and quality suitable for the expatriate Project Manager in Hanoi and a Resident Engineer at a site location yet to be determined. This shall include families if applicable.

The accommodation shall include at a minimum three (3) bedrooms (2 of which shall be double bed size rooms), dining room, living room, kitchen, storage room, bathroom with shower and toilet, servants quarters, garage or car port, garden and patio. The usable enclosed floor area shall be a minimum of 150 m<sup>2</sup>.

#### **(2) Local Staff Accommodation**

Housing accommodation shall be provided at a location and to a standard suitable for local professional staff. Each housing unit shall include at a minimum three (3) bedrooms, dining/living room, kitchen, storage room, washroom and toilet, servants quarters. The usable enclosed floor area shall be minimum 90 m<sup>2</sup>.

The following equipment and fittings shall be included.

Table A2-1

## Furnishings and Equipment for Housing Accommodation

Item/Description	Expatriate Staff Accommodation Buildings (8 Number)	Local Staff Accommodation Building (12 Number)
Expatriate staff housing accommodation with air conditioning and utilities. Floor area (minimum)	150 m <sup>2</sup>	-
Local staff housing accommodation with utilities. Floor area, (minimum)	-	90 m <sup>2</sup>
Double Bed with mattress	2	3
Single Bed with mattress	1	-
Wardrobe	4	3
Chest of Drawers	4	3
Dressing Table with mirror and stool	3	3
Bedside cabinet with reading light	5	6
Set of pillows/sheets/blankets/pillow cases for each bed	2	2
Dining Table with 8 chairs	1	1
Floor rug	2	-
Sideboard	1	1
Cupboard	2	1
Book Shelves	4	2
Writing desk	1	-
Sitting set (minimum 1 sofa, 2 easy chairs, 2 low tables)	1	1
Occasional chairs	4	2
Table fans	2	3
Curtain sets	All windows	All windows
2 Door Refrigerator/ Freezer minimum capacity 320 l	1	1
Drinking water dispenser (hot/cold)	1	-
4 burner gas stove with 2 gas bottles	-	1
4 burner gas stove with oven grill and 2 -gas bottles	1	-
Water heater	1	-
Plates, cups, glasses, utensils, etc. for 10 people	1	1
Pots, pans, utensils for cooking	1	1
Washing machine	1	1
Ironing board with iron	1	1
Garden chair set with table	1	-
Telephone	1	-

## (3) Housing for the Employer, the Engineer and their Staff

The Contractor shall provide and maintain for the duration of the Contract, housing for the use of the Employer, the Engineer and their staff, all as specified and to the satisfaction of the Engineer.

The housing as detailed hereunder shall be handed over to the Engineer not later than 120 days after the Commencement Date.

All housing, fixtures and fittings will be returned to the Contractor within 60 days after the issue of the Taking Over Certificate.

Until the housing is returned to the Contractor, the Contractor shall be responsible for all repair, servicing and maintenance works for all buildings,

roads, facilities, equipment, fittings and household effects, including any existing facilities utilized, and including those rendered unserviceable by fair wear and tear.

The Contractor's responsibility for servicing of houses and offices shall include the provision of and payment for, all telephone, gas, water, and electricity and telephone charges for the relevant housing units.

After return of the housing to the Contractor, the Contractor shall dismantle and remove them and restore the site to its original condition.

Obtaining all building permits or other approvals required shall be the responsibility of the Contractor.

#### 1.6.2 Engineer's Vehicular Transport

The Contractor shall provide, service, maintain and keep available at all times the following left hand drive vehicular transport complete with licensed and experienced drivers for the exclusive and personal use of the Engineer's staff. All vehicles shall be new and shall be fitted with seat belts, air conditioners, fire extinguishers, radio-cassette players, and antennae and fittings as required to suit the specified radio communications requirements

- 10 Seat Mini-bus - Mitsubishi Urvan, or Toyota Hi-Ace, or equivalent 1 No.
- LWB 4 Wheel Drive wagon - Toyota Landcruiser, or equivalent 4 No.
- 4 Wheel Drive pickup, with lockable 'Carryboy' hard cover 4 No.
- 4 door, 4 seater, medium engine capacity station wagon or hatchback saloon cars. 3 No.

The Contractor shall also provide, service, maintain and keep available at all times the following motor cycles, including safety helmets, for the exclusive and personal use of the Engineer's staff.

- 100 cc Suzuki, or equivalent. 2 No.
- Suzuki 125, or equivalent, with wet weather tyres. 2 No.

The Contractor shall provide with these vehicles all registrations, fuel, oils, lubricants, tyres etc., and shall regularly clean, service, maintain and repair them to a high standard.

Vehicles shall be provided within 28 days of the Commencement Date until the expiration of the Defects Liability Period or such earlier date as advised by the Engineer in writing, after which they will revert to the Contractor. Details of the actual vehicles proposed by the Contractor shall be submitted to the Engineer for approval within 14 days of the Commencement Date.

The Contractor shall make available alternative suitable equivalent transport until the specified vehicles are delivered and during the periods when the vehicles are under repair or maintenance or cannot be used for any reason.

The vehicles shall be insured against all risks to the driver, all passengers, and third

parties (persons and property). These insurances shall be valid for any licensed driver authorised by the Engineer including the Engineer's staff.

### 1.6.3 Engineer's Site Offices

The Contractor shall design, supply, erect and equip furnished offices for the sole use of the Engineer as follows:-

#### (1) Engineer's Main Office

The Engineer's Main Office shall be erected at a location to be nominated by the Engineer in the Works Area, near the Contractor's main site office. The office shall consist of not less than twelve rooms, plus toilets, kitchen, bathroom and reception areas, and be not less than 400 sq m in useable area. The layout, furnishings, fittings, equipment and materials of the main site office shall be as indicated in the office layout given in the drawings.

The office structure shall be of wooden, brickwork, or concrete blockwork construction, with cement sheet or zinalume sheet roofing. External walls shall be plastered with cement mortar plaster or clad with durable weatherproof sheeting, depending on the form of construction proposed, and shall be painted with a suitable weatherproof paint treatment. The flooring shall be either of suspended timber construction or be a concrete slab on PVC sheeting damp-proof coursing on a crushed rock base. A suitable heavy duty tile or carpet floor covering shall be provided.

The office shall have a false ceiling and be adequately ventilated and insulated, and shall be fitted with openable but lockable windows. Windows shall be provided with suitable curtain or blind coverings. All outer doors shall be fitted with suitable keyed alike locks and shall be provided with adequate electric lighting and heating, at least two power points and a direct, independent, telephone installation. Six keys for the keyed alike locks to the external doors shall be provided and two keys for each other lock. All doors and windows shall be fitted with mosquito screens and approved internal sunblinds.

The main entrance door shall have a suitable weather porch. A 2.5 m wide covered balcony or verandah is required to be constructed adjacent to the conference room. The office shall be provided with adequate electric lighting, and power points, and shall be airconditioned throughout, using split airconditioners of a capacity appropriate to the spaces being airconditioned. An equipped kitchen and toilet and washing facilities shall be provided in the office complex.

Five direct independent telephone lines for the exclusive use of the Engineer or its representative shall be provided. Telephone handsets shall be provided in each room with an approved distribution type system.

In addition to the fixed telephone lines provided for telephone and facsimile transmissions the Contractor shall provide for the use of the Engineer four mobile cellular telephone services including hand sets, and two extended

capacity rechargeable batteries per handset. Connection to a reliable Internet server is required for E-mail correspondence from the Engineer's Main Office. Lighting, power and telephone points shall be at approved locations. Covered car parking for 8 vehicles shall be provided adjacent to the office. The road approaches, car parking and trafficked areas around the office shall be paved construction as for an all weather road with a single coat bituminous seal, and be maintained. Areas adjacent to the office and road verges shall be suitably landscaped with grassed areas, and with suitable amenity planting of shrubs and trees.

The furniture and fittings to be provided for the office shall be appropriate to suit the purpose of the building and the individual rooms. The main items of furniture and equipment, and certain special items required to be provided, are listed follows:-

1) Furniture, Fittings and Equipment List for Engineer's Main Office

Notes

- a) All chairs shall have padded seats.
- b) All desk chairs shall be of pedestal type with wheels and height adjustment.
- c) All filing cabinets and desk drawers shall be lockable and provided with two keys per lock.
- d) Waste paper baskets shall be provided in all rooms.

- Conference and Display Room (10 x 6m)
  - White board with pen tray under (1500 x 1000 mm)
  - Folding room divider
  - Conference table (10 No 900 x 1500 mm flush tables)
  - 24 No chairs without arms
  - 6 No chairs with arms
  - Projector screen (white) 2500 x 1500 mm
  - Metal stand and display for bridge model (approx. 2m x 1m)
  - Video player/recorder (VHS), 60cm colour TV with stand
- Sitting Area (4 x 4 m)
  - 6 Lounge chairs (without arms)
  - Low table polished top (1200 x 800 mm)
  - Cupboard with drawer and 3 shelves with doors (1200 x 450 x 900 mm high)
- Entrance (4 x 3 m)
  - 6 No low chairs (without arms)
  - Small low table
  - Boot scraper
  - Large door mat
  - Clothes pegs
  - Bench boot box 2000 x 450 x 550 mm high (with hinged top in 2 sections - padlocked)

- Kitchen (4 x 2.5 m)
  - Stainless steel, sink and draining board with cupboard below (with rubbish bin storage)
  - Hot and cold water taps and hot water system
  - Wall mounted cupboards with 2 shelves above 3000 x 600 mm
  - Bench and cupboards below (2 shelves with doors)
  - Refrigerator 250 litre
  - 1 Cold drinking water dispenser
  - 1 First Aid kit
  - 1 Chair (without arms)
  - 1 Towel rail
  - 1 Paper towel dispenser
  - Exhaust fan above sink
  - Electric hot water boiler
  
- Bathroom (4 x 2 m)
  - 2 No hand basins set in bench top, with cupboards under, all taps and fittings
  - Shower cubicle with fittings, and screen.
  - Mirror 600 x 600 mm minimum
  - Glass shelf and cabinet above basin with wall light
  - Bench and seat
  - Towel racks and clothes pegs.
  - Hot water system
  
- Female Toilet (3.5 x 1.5 m)
  - 1 No water closet
  - Hand basin
  - Mirror 600 x 600 mm minimum
  - Glass shelf and cabinet above basin with wall light
  - Paper towel dispenser
  
- Male Toilet (3.5 x 2 m)
  - 1 No Water closet
  - 1 Hand basin with mirror, cabinet and wall light
  - Paper towel dispenser
  - 1 Urinal
  
- Store (4 x 1.5 m)
  - Storage shelving 200 wide (open)
  - Storage shelving 1200 high 300 wide (closed), with 200 shelving (open) over
  - 2 No vertical storage cabinets
  - 50 No. safety helmets
  
- Drivers' Room (4 x 3 m)
  - Table 1500 x 900 mm
  - 6 Chairs (without arms)
  - Fitted benches

- 2 Clothes lockers
- Reception/Administration (4 x 2 m)
  - Reception Desk (with drawers)
  - Receptionist's Chair (with arms)
  - Computer table
  - Typist's chair (without arms)
  - Bench 750 x 2000 mm with stationery cupboard under
  - Desk 1500 x 750 (with 3 drawers)
  - Vertical shutter for clear opening of 2000 x 1500 mm
  - Desk chair (with arms)
  - 2 No 4 Drawer filing cabinets
  - A3 Photocopier (RICOH FT 6750 or equivalent)
  - Counter 1500 x 450 mm
  - Notice board
  - Plain paper facsimile/answering machine with telephone handset, to separate telephone line
  - Telephone distribution system
  - 2 No chairs (without arms)
  - Binding Machine for A4 reports (GBC Image Maker 2000, or equivalent)
- Office Manager's Office (4 x 3 m)
  - 1 No Desks 1700 x 850 mm (2 drawer including file drawer at bottom)
  - 1 No Desk chairs (without arms)
  - 2 No Chairs (without arms)
  - Book shelves
  - Telephone
  - 1 Lockable steel cupboard
  - Heavy duty insulated safe, with combination lock, and fixed to structure
- Meeting Room (6 x 4 m)
  - Conference table (4 No 1500 x 900 mm flush tables)
  - 12 No chairs (without arms)
  - White Board with pen tray under (1500 x 1000 mm)
  - Lockable cupboard with 2 shelves (1200 x 600 x 900 mm high)
- Engineer's Representative's Office (5 x 4 m) - RE
  - 1 No desk 1850 x 900 mm (6 drawers)
  - 1 Clothes hanger cupboard with 2 shelves at top (lockable)
  - 1 No. 2 drawer filing cabinet
  - 1 No Desk chair (with arms)
  - 2 No Chairs (without arms)
  - 2 No Lounge chairs (with arms)
  - 1 Low circular table
  - 1 No White board with pen tray under (1500 x 1000 mm)
  - 1 No book shelves in glass fronted cabinet



- 1 No Layout table 2 m x 900 mm
- Plan Hanger
- Telephone
- Vietnamese RE Counterpart Office (5 x 4 m)
  - As for RE's Office
- Deputy RE's Office (4 x 4 m)
  - 1 No Desk 1850 x 900 mm (6 drawers)
  - 1 No Desk chair (with arms)
  - 2 No Lounge chairs (with arms)
  - 1 Layout table 2000 x 900 mm
  - 1 No. 2 Drawer filing cabinet
  - Book shelves
  - Small low table
  - 1 Plan Hanger
  - Telephone
  - White Board with pen tray under (1500 x 1000 mm)
  - Clothes locker (lockable)
- Counterpart Deputy RE's Office (4 x 4 m)
  - As for Deputy RE's Office
- Bridge Engineers' Office (6 x 4 m)
  - 2 No Desk 1700 x 850 mm (3 drawers)
  - 2 No Desk chair (with arms)
  - 2 No Lounge chairs (with arms)
  - 2 No chairs (without arms)
  - 1 Layout table 2000 x 900 mm
  - 2 No. 2 Drawer filing cabinet
  - Book shelves
  - 1 Plan Hanger
  - Telephone
  - White Board with pen tray under (1500 x 1000 mm)
  - Clothes locker (lockable)
- Structural/Geotechnical Engineer's Office (10 x 4.5 m)
  - 4 No Desks 1700 x 850 mm (2 drawer including file drawer at bottom)
  - 4 No Desk chairs (without arms)
  - 4 No Chairs (without arms)
  - 4 No 1800 x 900 wide layout tables
  - 2 No Plan Hanger
  - Book shelves
  - 2 No Telephone hand sets
  - 2 Clothes lockers

2) Computer and Special Equipment

The following ten computer systems and server shall be provided by the Contractor

- Server, 1 off  
Pentium III – 450 Mkhz, 256Mb SDRAM, 1.44MB FDD, 12Gb HDD, 40x CD ROM, NIC 10/100 TX, 14" SVGA, Mouse
- Workstations, 10 off  
Pentium III – 450 Mkhz, 64Mb SDRAM, 1.44MB FDD, 8.4Gb HDD, NIC 10/100 TX, 15-17" SVGA,  
Video Accelerator w/4MB Video RAM, Mouse
- UPS 1500 VA (For Server), 1 off
- UPS 500 VA (For workstations), 10 off
- Plotter, 1 off  
LaserJet 5000, A3 Size, 1200 dpi resolution, Jet Direct Network Card
- Printer, 1 off  
LaserJet Printer 1100, A4 Size, 600 dpi resolution, Jet Direct Ex. Printer server
- Plotter, 1 off  
A1-A0, Any Branch, should be COLOR (HP, Calcomp), Network Connection
- LAN Network:  
Hub, Network Cable, Connect Station, Installation
- Software  
Windows 2000 Operating System, with compatible versions of Word, Excel, Timeline, MS Project Manager and AutoCad R14

The Contractor shall also supply all cables and adaptors necessary to install the equipment

(2) Engineer's Subsidiary Office

A subsidiary site office may be required by the Engineer on the other side of the river to the location of the Engineer's Main Office. A decision, to be made after the Commencement of the Works, as to whether this office is needed and, if so its location, will be made after consideration of the Contractor's final proposals for its own site management, and the locations of its site offices. If so directed by the Engineer this subsidiary office and facilities will be provided under the Provisional Item allowed in the Schedule of Prices for the Engineer's Subsidiary Office. The subsidiary office, which will be required to be designed and constructed by the Contractor, shall be to a similar layout and to the same standards of materials and workmanship as specified in (a) above for the Engineer's Main Office. It shall consist of an office and facilities, and be equipped and furnished as follows:

The office shall be of no less than 4 airconditioned rooms, plus toilets. Two

direct independent telephone lines shall be provided. Covered parking for 4 vehicles shall be provided adjacent to the office. Fittings and furniture shall be as listed below.

1) Furniture, Fittings and Equipment List for Engineer's Subsidiary Site Office

Notes

- a) All chairs shall have padded seats.
- b) All desk chairs shall be of pedestal type with wheels and height adjustment.
- c) All filing cabinets and desk drawers shall be lockable and provided with two keys per lock.
- d) Waste paper baskets shall be provided in all rooms.

- Reception/Administration/Waiting Area (6 x 4 m)
  - Reception desk (with drawers)
  - Receptionist's chair (with arms)
  - Computer table
  - Typist's chair (without arms)
  - Bench 2000 x 750 mm with stationery cupboards under
  - Desk 1500 x 750 mm (with 3 drawers)
  - Vertical shutter with clearing opening of 2000 x 1500 mm
  - Desk chair (with arms)
  - 1 No Drawer filing cabinet
  - Notice Board
  - Telephone distribution system (Telecom commander T series or equivalent)
  - 2 No chairs (without arms)
- Engineers' Office (6mx4m)
  - As for Bridge Engineers' Office at Engineer's Main Office
- Supervisor/Assistant Engineer's Office (6 x 4m)
  - 2 No Desks 1700 x 850 mm (2 drawer including file drawer at bottom)
  - 2 No Desk chairs (without arms)
  - 2 No Chairs (without arms)
  - 2 No 1800 x 900 wide layout tables
  - 1 No Plan Hanger
  - Book shelves
  - 1 No Telephone hand set
  - 1 No Clothes lockers
- Female Toilet (2 x 2 m)
  - 1 No Water closet
  - Hand basin with cabinet and mirror above
  - Paper towel dispenser
- Male Toilet (2 x2 m)
  - As for Main site office

The Contractor shall provide an independent telephone line (or approved alternative) across the river between the two offices for the Engineer's sole use.

The Contractor shall maintain the buildings, furniture and equipment and shall keep all offices, toilets and washing facilities, and the adjacent paved and landscaped areas, adequately and regularly cleaned and maintained.

Designs of the two offices, with adequate drawings giving full details, shall be submitted by the Contractor to the Engineer for approval within 14 days of the date of the signing of the Contract.

The offices are to be available for occupation not later than 56 days after the Commencement Date

On completion of the Works, the offices and furniture and fittings therein which the Contractor has supplied shall revert to the Contractor's ownership. On direction by the Engineer that their use is completed, they shall promptly be removed from the site and the site made good to the Engineer's satisfaction.

All costs incurred for the above items shall be borne by the Contractor.

(3) Miscellaneous

Miscellaneous items shall include materials laboratory consumables, shovels, pick axes, hammers, bush knives, pegs, poles, nails, paints, brushes, typing papers, writing pads, field books, level books, pencils, ball pens, erasers, carbon papers, consumable for photocopying, toilet papers, box files, correspondence files, strings, selotapes, scales (metric), envelopes, staples, clips and the like disposable item of the number and quantity as required by the Engineer's Representative from item to time.

1.6.4 Radio Communication System

The Contractor shall provide a communication system for the Engineer's exclusive use for the duration of the works. The system shall be of a range and frequency which will ensure good reception with minimal interference everywhere within the site of the works and within the required operating range specified below for radios fitted to vehicles.

The base station set shall be located in the Engineer's office at the site and shall include telephone controllers with talk through facility for direct contact between all sets, as specified below, including portable handsets.

Sets shall be fitted in the two boats specified in Clause 1.6.5 and all vehicles, except motor cycles, specified in Clause 1.6.2. The sets shall be capable of easy removal, if necessary, for security reasons. The operating range for the radios fitted to vehicles shall be a minimum of 150 km.

An additional 4 No. lightweight portable handsets, with spare batteries, rechargers, and protective cases are required to be provided for the Engineer's use on site.

The Contractor shall obtain any necessary licences, and permission to use the operating frequency, for the radio equipment.

Details of the equipment proposed and the frequency shall be submitted by the Contractor for the Engineer's approval within 28 days of the Commencement of the Works.

#### 1.6.5 Engineer's River Transport

The Contractor shall provide for the exclusive use of the Engineer, three approved fast personnel boats with a rain proof cover and minimum capacity for 20 persons, and two fast speedboats with a minimum capacity of 6 persons, for the rapid and safe conveyance on the river of the Engineer's staff, and of other passengers accompanying the Engineer's staff.

Both boats shall be operated by a competent boatman and shall be available at all times. The Contractor shall provide all fuel, oil, servicing, insurances and maintenance that may be required, and allow for alternative river transport until the specified boats are delivered and during the periods when the boats are under repair or maintenance.

The boats shall be of new construction, with a high strength wooden, steel or aluminium hull, and be powered by either an inboard or outboard marine engine. Engine power capacity shall be at least 50HP. They shall each be fitted with an auxiliary emergency outboard motor of adequate capacity, and all navigation lights and flags, lifebelts, fire fighting equipment, and flares, that are required by the appropriate marine regulations. The boats shall be insured against all risks to all passengers, and third parties (persons and property).

Details of the boats proposed by the Contractor shall be submitted to the Engineer for approval within 14 days of the Commencement Date. The boats shall be made available within 28 days of the Commencement Date and shall revert to the Contractor at the end of the Defects Liability Period or at such earlier date as the Engineer may advise the Contractor in writing.

### 1.7 Temporary Works

#### 1.7.1 Notice Boards

Two notice boards 5m x 3m in size shall be supplied and erected by the Contractor adjacent to the site in positions directed by the Engineer. The required wording will be provided by the Engineer.

Each board shall be erected on the site within 28 days after the commencement of the Works on Site and shall be constructed with approved hardwood framing and posts, and 20mm waterproofed plywood. The posts shall be coated with coal tar up to 150 mm above ground level.

All remaining surfaces shall be given one coat of primer and three coats of oil based

paint in the colour detailed. All words shown plus the Contractor's name shall have the letters painted by an approved signwriter.

During the course of the Contract the Contractor shall maintain the notice boards in good condition and shall re-erect them in new locations if so required by the Engineer as a result of interference with the boards or the progression of the works.

The Contractor shall remove the notice boards on completion of the project or when directed and shall make good any excavation or disturbance to the site. No other signboards, panels or placards bearing the names of contractors or suppliers are to be erected on the site without the written agreement of the Engineer.

#### 1.7.2 Temporary Road and Bridge Works

The Contractor shall finish, maintain, and remove on completion of the work for which they are required, all temporary roads and bridge works such as sleeper tracks and staging over roads, access and service roads, temporary crossings or bridges over streams or unstable ground, and shall make them suitable in every respect for carrying Constructional Plant required for the work, for providing access for traffic for himself or others, or for any other purpose. Such temporary road works shall be constructed to the satisfaction of the Engineer, but the Contractor shall nevertheless be responsible for any damage done to or caused by such temporary road works.

Before constructing temporary road works, the Contractor shall make all necessary arrangements, including payment if required, with the public authorities or landowners concerned, for the use of the land and he shall obtain the approval of the Engineer. Such approval shall be dependent on the Engineer being satisfied with the Contractor's proposals for items such as signing, lighting and riding quality of the temporary road together with the proposed maintenance arrangements. Such approval shall not, however, relieve the Contractor of his responsibilities under the Contract. Upon completion of the works the Contractor shall clean-up and restore the land to the satisfaction of the Engineer.

The Contractor, when required by the Engineer, shall submit for the Engineer's approval drawings giving full details of temporary Roads. Such details shall include alignment, profile, pavement construction, signing, lighting and the duration of the temporary road.

The Contractor shall make all arrangements necessary to permit the passage along the road section relating to this Contract of the Constructional Plant, materials and employees belonging to other Contractors engaged in the construction of contiguous stretches of road. For this purpose the Contractor and the Contractors concerned in the construction of the stretches contiguous to those through which they must pass shall, when necessary and with at least 15 days notice, request the Engineer for permission to pass and submit a schedule for such passage. After the Engineer has granted such permission and approved the schedule submitted, both the Contractors permitting the passage and those requesting it shall undertake to observe the schedule approved by the Engineer for the passage along the site without having any right to extra payment in consequence of the restrictions on passage or the necessary temporary suspension of works due to the aforesaid schedule.

### 1.7.3 Electricity

The installation of a metered power supply to the Construction Zone boundary on each bank, at the locations and to the extent as shown on the drawings, will be provided by the Government of Vietnam. The Contractor shall pay all costs of connections from this installation to the Contractor's site electrical system, all power charges, and for disconnection. The Contractor shall make its own arrangements for any additional power supplies that it may require and shall provide within and maintain a temporary electric light and power supply sufficient for executing the work under the Contract and shall disconnect and clear away on completion.

### 1.7.4 Water Supply

Contractor will provide a supply of well-water within the Construction Zone on each bank, the Contractor shall carry out its own tests to determine what uses can be made of this supply for the purposes of the contract. If the quality of water from this source is unsatisfactory or the supply is inadequate or unreliable the Contractor shall provide and maintain an alternative treated water supply sufficient for executing the work under the Contract, and which the Contractor shall disconnect and clear away on completion of the Works. Adequate supplies of potable water shall be provided at suitable and convenient locations for all persons on site.

### 1.7.5 Telephone

The Contractor shall provide in its site office a telephone service and facsimile facilities and shall pay all costs of installation, connection, rental, calls and removal.

### 1.7.6 Site Amenities/Sanitation

The Contractor shall provide all statutory and necessary amenities, including the provision of proper sanitary accommodation and adequate washing facilities at convenient locations on the site, and arrange for the proper disposal of sewage.

### 1.7.7 Laboratory

The Contractor shall supply equip and maintain for the duration of the Contract, an approved fixed laboratory with facilities, furniture, equipment, personnel, apparatus, and installations for his own use and that of the Engineer. The laboratory shall conform to the standards of the National Association of Testing Authorities (NATA) or other standards approved in writing by the Engineer for the relevant test.

The laboratory shall be operated by the Contractor under the supervision of the Engineer or his staff.

The laboratory shall be equipped with all the necessary apparatus and materials for the performance of all the standard tests required by the Specifications except those tests detailed below which may be carried out at an external laboratory approved by the Engineer. If the Contractor elects not to supply equipment for the undernoted tests, then all charges payable to third parties for transportation and testing of the samples shall be at the Contractor's expense.

Tests which may be carried out off site:

- Tests on Penetration Graded Asphalt Cement (M20)
- Tests on Portland Cement (M85)
- Tests on Concrete Drains and Pipes (M86)
- Compressive Strength of Concrete Specimens (J22)
- Abrasion of Aggregate by Los Angeles Machine (T96)
- Extraction of Bitumen (T164)
- Effect of Water on Bituminous Mixtures (T165)
- Marshall Resistance to Flow (T245)

All other apparatus and materials necessary, for tests required under the Contract shall be supplied by the Contractor and installed in the laboratory. This shall include as a minimum that listed below:

(1) List of Laboratory Equipment

ITEM	Quantities
<b>SOIL TESTING</b>	
<b>Compaction Test:</b>	
Standard Proctor mould	1
Standard Proctor hammer	1
Modified compaction mould	1
Modified compaction hammer	1
Straight edge	1
Sample ejector	1
Mixing spoon	1
Mixing trowel	1
Spatula	1
Mixing pan	1
Aluminium pan 25 cm diameter	1
Wash bottle	1
Moisture cans	36
<b>Laboratory CBR:</b>	
Mechanical loading press 6000 lbs capacity	1
Proving ring	1
CBR moulds	6
Spacer disk	1
Swell plate surcharge plate	3
Tripod attachment	3
Swell dial indicator	3
Surcharge weight	6
Slotted surcharge weight	6
Steel cutting edge	1
<b>Specific Gravity:</b>	
Pycnometer bottles of 100 cc capacity	3
Porcelain mortar and pestle	1
Hot plate, 1000 watts, 220 volts/50 cycle	1



ITEM	Quantities
<b>Atterberg Limits:</b>	
Standard liquid limit device	1
ASTM grooving tool	1
Evaporating dish	3
Flexible spatula	2
100 cm graduated cylinder	4
Cassagrande grooving tool	1
Plastic limit glass plate	1
<b>Grain Size Analysis:</b>	
Hydrometer jars	3
Mechanical stirrer, electric powered 220 V/50 cycle	1
Dispersion cups with baffles	2
Hydrometer, scale 0-60 gr	1
Set brass sieves, 8 inches diameter, 75 mm, 50,38,25,19,12.5,11.2,9.5,8,	
No.4,8,10,16,25,30,50,60,100,170 incl. cover and pan	1
No. 200 brass sieves	2
Wet washing sieve	1
50 ml. graduated cylinder	4
Sieve brushes for fine sieves	2
Sieves brushes for coarse sieves	2
<b>Field Density Test, Sand Cone Method:</b>	
Sand cone	1
Replacement jug	1
Field density plate	1
Spoon	1
Steel chisel, 1 inch	1
Rubber mallet	1
Sand scoop	1
1 gallon field cans	6
<b>Moisture Content:</b>	
'Speedy' moisture tester, 26 grams capacity	1
Cans 'Speedy' reagent	6
Los Angeles Abrasion:	
<b>Test machine complete with steel spheres</b>	1
<b>BITUMINOUS TESTING</b>	
<b>Extraction Test, Centrifuge Method:</b>	
Centrifuge extractor, 1500 gram capacity, 220 V/50 cycle	1
Boxes filter paper rings (100/box)	10
Extractor bowl	1
Bowl cover	1
Bowl nut	1

ITEM	Quantities
<b>Extraction Test, Reflux Method:</b>	
Reflux. Extractor set, 1000 gram capacity	1
Boxes filter paper (50/box)	1
<b>Specific Gravity of Coarse Aggregates:</b>	
Density Basket	1
Sample Splitter 1"	1
Sample Splitter 1/2"	1
<b>Specific Gravity of Fine Aggregates:</b>	
Cone mould	1
Tamper	1
Pycnometer	1
Thermometer (Glass), 0- 150°C	3
Desiccator	1
<b>Mix Air Voids Content, (Accurate Method):</b>	
2000 cc Conical Flask with neck large enough to admit 25 mm aggregate, with airtight ground glass stoppers	2
Vacuum Pump (+ special oil)	1
Rubber tubing	1
Warm air fan	1
<b>Core Drilling:</b>	
Core drill machine, 7 Hp, 4 cycle.	1
9" extension shaft	1
18" strap wrench	1
Diamond cutting bit 4" diameter (resettable)	2
Expanding adaptor	1
<b>Metal Thermometer</b>	
0- 100°C Metal Thermometer	2
0-250°C Metal Thermometer	2
<b>Accessories and Tools:</b>	
Heavy duty balance complete with set of weights scoop and counterweight	1
Triple beam scale complete with set of weights	1
Double wall oven, 1600 W 240 volt/50 cycle	2
Plastic funnels	3
Sodium hexametaphosphate	11b
Pairs asbestos gloves	2
Laboratory tongs	2
<b>CONCRETE TESTING</b>	
<b>Compressive Strength:</b>	
Power operated compressive strength testing machine	1
Cylinder mould 150 mm diameter	16