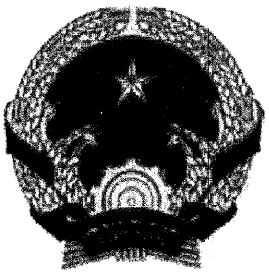
GOVERNMENT OF SOCIALIST REPUBLIC OF VIET NAM
MINISTRY OF TRANSPORT



Consulting Service for Detailed Design
for
Da Nang – Quang Ngai Expressway Development Project
IDA Credit No. 3843-VN

Contract
for
Engineering Geological Survey Works

Tunnel Section
(Km22+485 – Km23+037)

BETWEEN

JOINT VENTURE OF NK – NEC – CHODAI - TEC

AND

FUKKEN & MINAMI CONSULTANT CO., LTD.

Dated: 16 July 2012

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CONTRACT AGREEMENT
ON
ENGINEERING GEOLOGICAL SURVEY
FOR
CONSULTING SERVICES FOR DETAILED DESIGN FOR
DANANG - QUANG NGAI EXPRESSWAY DEVELOPMENT PROJECT
PROJECT ID NO. P.106235
IDA CREDIT NO. 3843-VN

This Contract made and entered into this 16 July 2012, by and between:

Joint Venture of NK – NEC – Chodai – TEC duly organized and existing under the laws of VietNam, with its principal office located at Unit 2, 11th floor, PVFC Building, Lot A2.1, 30 April Street, Hai Chau District, DaNang City (hereinafter referred to as the "Consultant") and Fukken Minami Consultant Co., Ltd., duly organized and existing under the laws of Vietnam, with its principal office located at 1st floor Green Building 540/1 Cach Mang Thang Tam Street, Ward 11, District 3, Ho Chi Minh City, Vietnam (hereinafter referred to as the "Sub-consultant")

WITNESS THAT the parties covenant, promise and agree as follows:

The Sub-consultant agrees to do and complete the Engineering Geological Survey (hereinafter referred to as the "Works") in accordance with the terms, conditions and requirements of this Contract.

The Consultant agrees to pay the Sub-consultant in consideration of the fulfillment of the Works, the Contract Price of Ninety Two Thousand Nine Hundred Fifty US Dollars only (USD92,950), including USD8,450 of VAT, in accordance with the terms and conditions specified in Clause 2.12 of General Conditions.

It is agreed that the terms, conditions and requirement of the Contract shall prevail to the extent that are expressly modified or altered by this Contract.

IN WITNESS WHEREOF, each of the parties hereto has caused this Contract to be executed in duplicate as of the date first above written by its duly authorized representative.

For and on behalf of the Consultant

Ichizuru ISHIMOTO
Project Manager
Joint Venture of
NK-NEC-CHODAI-TEC

For and on behalf of the Sub-consultant

Yasuhira MINAMI
General Director
Fukken & Minami Consultant Co., Ltd.

II. GENERAL CONDITIONS OF CONTRACT

2.1 Definitions

The following words and expressions shall have the meaning assigned to them except where the context otherwise requires:

(a) The "Client" shall mean Project Management No.85 (PMU85) under Ministry of Transport (MOT) of Government of Socialist Republic of Vietnam (GOV).

(b) The "Project" shall mean Da Nang – Quang Ngai Expressway Development Project, approximately 130 km long, in the central Vietnam.

(c) The "Service" shall mean the Consulting Services for Detailed Design for Da Nang – Quang Ngai Expressway Development Project to be carried out by the Joint Venture.

(d) The "Joint Venture" shall mean the Joint Venture of Nippon Koei Co., Ltd., Nippon Engineering Consultants Co., Ltd., Chodai Co., Ltd. and Thai Engineering Consultants Co., Ltd..

(e) "NK" shall mean Nippon Koei Co., Ltd., the prime consulting firm responsible for the implementation of the Service having an address of its head office at;

4, Kojimachi 5-chome,
Chiyoda-ku, Tokyo, 102-8539, Japan

(f) The "Project Manager" shall mean team leader of the Joint Venture approved by the Client.

(g) The "Consultant" shall mean a person or persons of the Joint Venture appointed by the Project Manager.

(h) The "Sub-consultant" shall mean the person whose bid has been accepted by the Consultant and approved by the Client.

(i) The "Contract" shall mean the agreement between the Consultant and the Sub-consultant, and include General Conditions, Term of Reference (TOR), Technical Specifications and Priced Bill of Quantities (BOQ) attached hereto.

(j) The "Site" shall mean the places of the area shown on the attached project location map in Appendix-A.

(k) The "Works" shall mean the works for the Engineering Geological Survey as shown in the Bill of Quantities attached in the Appendix E.

(l) The "Contract Price" shall mean the sum named in the Contract as the Contract price.

(m) The "Bill of Quantities" or "BOQ" shall mean the price schedule attached to the Contract.

(n) The "Unit Price" shall mean the unit price stated in the Bill of Quantities.

(o) The "Drawings" shall mean the drawings referred in the Contract and any modification of such figures and drawings approved in writing by the Consultant.

(p) "Day, Week, Month, Year" shall mean calendar day, calendar week, calendar month and calendar year.

(q) "Approval" or "Approved" shall mean approval or approved in writing by the Consultant.

(r) "Writing" shall mean any manuscript, typewritten or printed statement under seal or hand. Words importing the singular only also include the plural and vice versa where the context requires. The fact that the words defined in this Clause are or are not capitalised in the Contract shall not affect their meaning.

2.2 Sub-consultant to Inform Himself Fully

The Sub-consultant by bidding shall be deemed to have satisfied himself as to all the conditions and circumstances affecting the Contract price, and to have fixed these prices according to his own view for these as no additional allowances, except as otherwise expressly provided, will afterwards be made beyond the Contract Price. The Sub-consultant shall be responsible for any misunderstanding or incorrect information, whatsoever, obtained except information given in written by the Consultant. The Sub-consultant shall determine the presence of all services or ground facilities that may be affected by his work.

2.3 Time for Commencement and Completion

The commencement date of the Works is 1 August 2012 and the whole of the Works shall be completed not later than 31 October 2012.

2.4 Manner of Execution

1) The Works to be done under this Contract shall be executed in accordance with the Sub-consultant where not specified therein shall be in accordance with such instructions as the Consultant may issue, from time to time, as he considers necessary and appropriate. If something, which is not described in this Contract, occurred, the Sub-consultant shall consider and judge based on the conscience and justice of the engineership.

2) The Sub-consultant shall be responsible for observing all regulation and safety precautions required by authorities and/or through legislation.

3) The Sub-consultant shall keep good relation with concerned persons and organization of the Works and shall settle any conflict with them at his own responsibility and expense. The Consultant shall give the reasonable / appropriate assistance and/or support to the Sub-consultant in order to avoid such conflict.

2.5 Information and Official Permission

1) The Consultant shall make available to the Sub-consultant for the purpose of performing the Works which are listed in the Contract.

2) Official permission from the authorities concerned for the execution of the Works at the Site shall be arranged by the Sub-consultant at his own expenses.

2.6 Sub-consultant's Representative and Persons

1) The Sub-consultant shall make his own arrangements for the engagement of all the engineers, technicians and labours necessary for the execution of the Works. The Sub-consultant shall submit to the Consultant for approval a complete list of principal staff showing names, functions, personal histories and periods of assignments prior to commencement of the Works.

2) The Sub-consultant shall appoint one or more competent representatives from the Sub-consultant's engineers assigned to the Works to superintend the carrying out of the Works on the Site. The names, training and experience of the Sub-consultant's representatives shall be submitted to the Consultant for approval before they are appointed. The said representative, or if more than one shall be appointed, then one such representative shall be present on the site during working hours, and any orders or instructions which the Consultant may give to the said representative of the Sub-consultant shall be deemed to have been given to the Sub-consultant by the Consultant.

3) The Sub-consultant shall be responsible for observation of all regulation and safety precautions imposed by labour legislation and authorities in Vietnam. The Sub-consultant shall prepare a safety policy document for submission to the Consultant for approval prior to starting work on the site. No work will be allowed to proceed until this document has been submitted and approved. Any costs delay due to the late submission of this document will be at the Sub-consultant's expense.

4) The Consultant shall be at liberty by notice in writing to the Sub-consultant to object to any representative or other person employed by the Sub-consultant in the execution of the Works who shall, in the opinion of the Consultant, misconduct himself of be incompetent

or negligent or be sick and the Sub-consultant shall remove such person from the Works and provide an acceptable replacement for such person at the Sub-consultant's expense.

2.7 Working Days and Hours

The Sub-consultant shall carry out the Works on the Site continuously during the normal working hours generally recognised in Vietnam. The Sub-consultant may, with the arrangement of the Consultant, carry out work at other time if it shall be practicable in the circumstances for work to be so done.

2.8 Materials, Equipment and Facilities to be provided by the Sub-consultant

The Sub-consultant shall, at his own expense, supply and provide all the equipment, materials, labors and other things or every kind required for the execution and completion of the Works.

2.9 Program to be Furnished

1) The Sub-consultant shall submit to the Consultant for his approval his proposed time schedule and field operation program for each section of the Works.

2) After approval by the Consultant of such time schedule and field operation program, the completion time for the Works stipulated in the same time schedule shall be considered as "Guaranteed Time for Completion of the Works", and the Sub-consultant shall adhere to the order of procedure method and time schedule unless he obtains the written permission of the Consultant to vary such order or method or time schedule.

3) Such time schedule and field operation program shall be supplemented by the Sub-consultant in weekly progress reports indicating the actual state of progress of all items during the course of the Works at the Site. The form and substance of such weekly reports shall be satisfactory to the Consultant. The weekly progress report shall be submitted by Monday of the following week to which it applies.

4) In the course of the Works, when the Consultant calls the Sub-consultant for a meeting, the Sub-consultant and/or his representatives shall at any time and at his own expense attend the meeting and shall report the actual state of Works.

2.10 Insurance

1) The Sub-consultant shall at his expense effect accident and insurance for engineers, technicians and labours employed by the Sub-consultant for the execution of the Works, and shall indemnity the Consultant from any claim for the compensation of such accident and injury, damage to property and third parties caused in undertaking the duties and all claims whatsoever.

2) The Sub-consultant shall, at his expense, insure the equipment, materials and facilities to be provided by the Sub-consultant and keep each part thereof insured for its full value against loss, damage and fire.

2.11 Force Majeure

1) If either party is temporarily unable by reason of force majeure or the law or regulation of to meet any of its obligation under the Contract, and if such party gives to the other party written notice of the event within fourteen (14) days after its occurrence, such obligations of the party, as it is unable to perform by reason of the event, shall be suspended for as long as the inability continues.

2) Neither party shall be liable to the other party for loss or damage sustained by such other party arising from any event referred to in Clause 2.11 1) or delay arising from such event.

3) The term "Force Majeure" as employed herein shall mean Act of God, strikes, lock-outs or other industrial disturbances, acts of the public enemy, wars, blockades, earthquakes, storm, lighting, floods, washouts, civil disturbances, explosion, curfews, and any other similar event, beyond the control of either party.

2.12 Terms of Payment

1) This is a unit rate contract.

2) As soon as the Works has been started, the Sub-consultant shall submit to the Consultant, the invoices of amount payable. After checking the invoices, the Consultant shall pay the Sub-consultant in respect of the Works. The Consultant reserves the right to exclude such items that are not considered to be authenticated, from the payment.

3) First payment equivalent to Forty percent (40%) of the Contract Price shall be made to the Sub-consultant after approval by the Consultant for both of the following items:

- Completion of mobilization of personnel and equipment at the Site,
- Approval of the work plan by the Client.

4) Second payment equivalent to Forty percent (40%) of the Contract Price shall be made to the Sub-consultant upon acceptance of the outcome by the Consultant.

5) Final payment equivalent to Twenty percent (20%) of the Contract Price, with adjustment of performed work quantities, shall be made to the Sub-consultant upon issuance of "Work Completion Certificate" by the Consultant after receiving the acceptance letter by PMU85.

6) No extra payments in respect of overtime, holiday work, additional equipment, materials and facilities, or special conditions of hardship shall be claimed by the Sub-consultant beyond the Contract price, unless such arrangement is required under the circumstance which is beyond the Sub-consultant's responsibilities or control.

7) Payment procedure is provided in Appendix-B. Remittance charge shall be paid by the Sub-consultant.

8) The Sub-consultant shall issue VAT invoice for each payment. The amount in the VAT invoice shall be made in VND (Vietnamese Dong) equivalent to USD (United States Dollar) with the interbank exchange rate of Vietnam State Bank at the date issued VAT invoice by bank transfer.

2.13 Taxes and Related Charges

All the income and other taxes, levies, imposes, deductions, charges, fees and similar assessments whatsoever imposed, assessed, levied or collected by the Government of Vietnam or any subdivisions thereof or any taxing authority therein, upon the Sub-consultant and his staff shall be paid and/or borne by the Sub-consultant.

2.14 Variations and Omissions

1) The Sub-consultant shall not alter any of the Works except as directed in writing by the Consultant. The Consultant shall have full power, from time to time, during the execution of the Contract, to direct the Sub-consultant to alter, amend, omit, add to or otherwise vary any of the Works, by notice in writing, and the Sub-consultant shall carry out such variations. In case the Consultant asks the Sub-consultant, on the spot, to change the areas to be investigated from the originally proposed areas, the Sub-consultant shall at that instance obey such directions and later obtain written confirmation from the Consultant.

2) If a decrease in the Works is ordered by the Consultant, such orders shall not constitute any ground for claim for damage or loss of anticipated profits on the Works. All extra additional Works shall be performed with the same materials and workmanship as employed for the Works of similar character in the original one as far as they are applicable thereto.

3) In any case there such a direction involves an increase or decrease in the Contract Price, the difference in cost to the Contract, if any, occasioned by such variations, shall be adjusted from the Contract Price as the case may require, unless otherwise specified. The amount of such difference shall be ascertained and determined in accordance with the unit prices specified in the BOQ, so far as the same may be applicable, and where the unit

prices are not contained therein, such amount shall be reasonably agreed between the Consultant and the Sub-consultant in writing.

4) In case some modification and/or variation are requests made by Consultant and/or Client, those works shall be paid by Consultant basing on the unit price in BOQ and the actual quantity. In case such modifications and/or variations requested are not included in the BOQ, both Parties will discuss to make a supplementary agreement to the Contract.

2.15 Sub-consultant's Default

1) If the Sub-consultant shall neglect to execute the Works with the diligence and expedition or shall refuse or neglect to comply with any reasonable instructions or orders given in writing by the Consultant in connection with the Works, or shall contravene the provisions of the Agreement, the Consultant may give notice in writing to the Sub-consultant to make good the failure, neglect or contravention complained of.

2) In case, the Sub-consultant fail to comply with the notice within a reasonable time from the date thereof, then and in such case the Consultant shall be at liberty to employ other workmen and forthwith execute such part of the Works as the Sub-consultant may have neglected to do, or, if the Consultant shall think fit, it shall be lawful for him, without prejudice to any other right he may have under the Contract, to make the Works wholly or in part out of the Sub-consultant's hands and re-contract with any other person or persons to complete the Works or any part thereof.

3) The Consultant shall be entitled to retain and apply any balance which may be otherwise due by him to the Sub-consultant, or such part hereof as may be necessary to payment of the cost of executing the said part of the Works of completing the Works as the case may be. If the cost of completing the Works or executing part thereof as aforesaid shall exceed the balance due to the Sub-consultant, the Sub-consultant shall pay such excess upon request writing from the Consultant.

2.16 Rejection

If at any time before the Works are accepted by the Consultant, the Consultant shall decide that any work done by the Sub-consultant is defective or not in accordance with the Sub-consultant or that the Works or any portion thereof are defective or do not fulfill the requirements of the Contract, then the Sub-consultant shall with all speed and at his own expense make good defects so specified. In case the Sub-consultant shall fail so to do, the Consultant may, provided he does so without undue delay, take at the cost of Sub-consultant, such steps as may in all the circumstances be reasonable to make good such defects.

2.17 Time for Completion

1) The whole of the Works shall be completed with the time guaranteed by the Sub-consultant or such extended time as may be allowed under the following paragraph.

2) The Sub-consultant shall not be held responsible for failure to carry out his obligations in case of force majeure, such as embargo, blockade, war, natural disasters or any disaster or any circumstances beyond his reasonable control.

3) The Sub-consultant shall notify the Consultant in writing within seven (7) days of the commencement of force majeure conditions. Depending on the production of satisfactory evidence and if the existence of force majeure conditions is accepted by the Consultant, the Consultant will grant extension of the Guaranteed Time for Completion of the Works sufficient to compensate for delay due to force majeure without penalty.

2.18 Delay in Completion

If the Sub-consultant fails to complete the Works in accordance with the Contract within the time fixed by the Contract, there shall be deducted from the Contract Price as and for liquidated and ascertained damages a sum of money equal to a half percent (0.5%) of the Contract Price for each day between the Guaranteed Time for Completion of the Works and the actual date of completion but the amount so deducted shall not in any case exceed five percent (5%) of the Contract Price. Such deduction shall be in full satisfaction of the Sub-consultants liability for the said failure. The Consultant may request the Sub-consultant to employ additional labour or use additional equipment and materials and the Sub-consultant will do so at his expense in case a delay in the completion of the works has to be expected.

2.19 Suspension of the Works

The Sub-consultant shall, on the written order of the Consultant, suspend the progress of the Works or any part thereof for time or times and in such manner as the Consultant may consider necessary and shall be doing such suspension properly protect and secure the works so far as is necessary in the opinion of the Consultant. All expenses incurred by the Sub-consultant by reason of the suspension of the Works by the Consultant will be at the sole responsibility of the Sub-consultant if the suspension is:

(a) Otherwise provided for in the Contract

(b) Necessary for the proper execution of the works or by reason of whether conditions affecting the safety or the quality of the Works or by some defaults on the part of the Sub-consultant, or

(c) Necessary for the safety of the Works or any part thereof, except such case / condition is NOT caused by the Sub-consultant.

2.20 Certificate or Completion of the Works

As soon as in the opinion of the Consultant, the whole of the Works shall have been satisfactory completed, the Consultant shall issue a Certificate of Completion of Works after receiving a written application thereof. Upon issuance of such Certificate of Completion of Works, the Sub-consultant shall cease to be under further obligation under the Contract.

When whole the Work completed, a Certificate of Completion of Works shall be issued to terminate the Contract after receiving the acceptance letter from PMU85.

2.21 Bankruptcy

If the Sub-consultant shall become bankrupt or insolvent or have a receiving order made against him, or compound with his creditors, or being a corporation, commence to be wound up, not being a member's voluntary winding up for the purpose of amalgamation or reconstruction, or carry out its business under a receiver for the benefit or its creditors or any of them, NK shall be at liberty:

1) To terminate the Contract forthwith by notice in writing to the Sub-consultant or to the receiver, or liquidator, or to any person in whom the Contract may become vested, and to act in the manner provided in Clause 2.15 of the Sub-consultant's Default, as though the last mentioned notice has been the notice referred to in such Clause and the Works has been taken out of the Sub-consultant's hand, or

2) To give such receiver, liquidator or other person the opinion of carrying out the Contract subject to his providing a guarantee for the due and faithful performance or the Contract up to an amount to be agreed.

2.22 Assignment and Sublet the Contract

The Sub-consultant shall not, without the prior consent in writing of the Consultant, assign or transfer the Works or the benefits or obligations thereof or any part thereof to any other persons. The Sub-consultant shall not, without the prior consent in writing of the Consultant, which shall not be unreasonably withheld, sublet the Sub-consultant any part thereof or make any sub-contract with any person or persons.

Any such consent if given shall not relieve the Sub-consultant from his obligations under the Contract. The Sub-Sub-consultant shall be regarded as employee of the Sub-consultant. The Sub-consultant shall be solely responsible for the performance of the Sub-Sub-consultant and for all payments to the Sub-Sub-consultant.

2.23 Arbitration

1) If any dispute or difference of any kind whatsoever shall arise between NK and the Sub-consultant in connection with the interpretation or application of the Contract, it shall be settled as much as possible by amicable arrangement between both parties. If such arrangement cannot be realised, the dispute of difference shall be settled by arbitration as provided herein.

2) All questions, disputes or differences arising out of or in relation to the interpretation of the Contract which cannot be settled by manual accord shall be submitted to a committee for arbitration consisting of three arbitrators, one to be nominated by NK, another by the Sub-consultant and the third as chairman by the two mentioned arbitrators above, and shall be finally settled in conformity to the rules and procedures or Conciliation and Arbitration of the International Chamber of Commerce. Such arbitration shall be held at such place and time as the arbitrators may decide. Any decision, opinion, direction, certificate or valuation given by the arbitrators shall be obeyed by both parties and be final.

2.24 Notice and Correspondence

Any notice to be given to the Sub-consultant shall be served by sending the same by post, facsimile, email, or leaving the same at the Sub-consultant's principal place of business, or to the address of his representative at the Site. Any notice to be given to the Consultant shall be served by sending the same by post, facsimile, email, or leaving the project office of the Consultant in Danang:

Danang Project Office:

Unit 2, 11th floor, PVFC Danang Building, Lot A2, April 30 Street, Hai Chau District, Danang City, Vietnam

Telephone: +84-(0)511-379-7961 Facsimile: +84-(0)511-379-7962

2.25 Documents

1) All the correspondences, figures, drawings and other documents shall be made in both English and Vietnamese.

2) The several documents have to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be adjusted in accordance with the provisions of Clause 2.23 thereof.

2.26 Inspection of Work

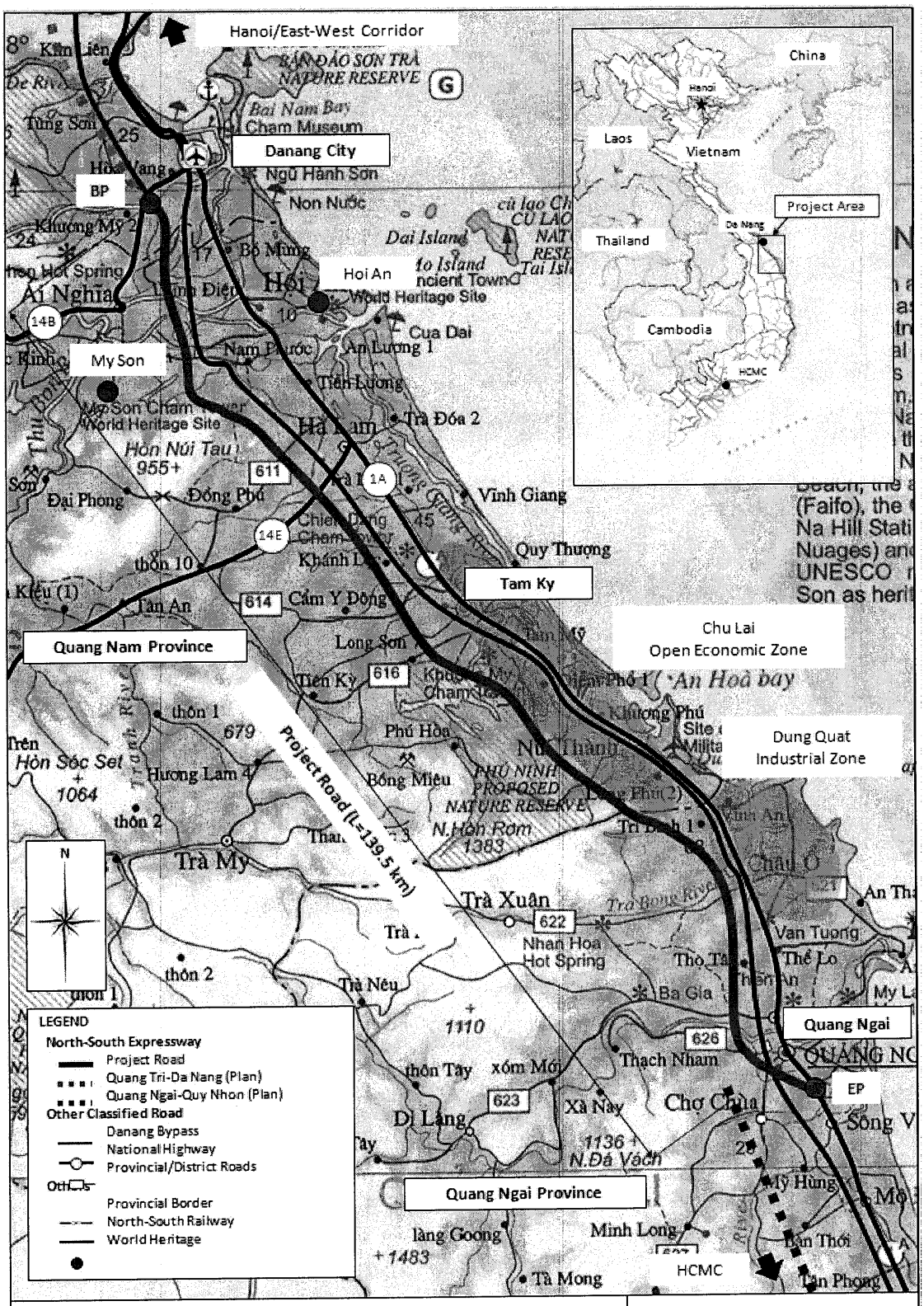
The Consultant shall, at all times, have access to the Works wherever it is in preparation or progress and the Sub-consultant shall provide necessary facilities for such access and for inspection. Where the specifications require any work to be specially tested or approved, the Sub-consultant shall give the Consultant timely notice of his readiness for inspection and, if the inspection is by an authority other than the Consultant, of the date fixed for such inspection.

2.27 Maintenance of Security

Without obtaining the Consultant's prior written approval, the Sub-consultant shall not disclose, not only during the effective period of this Contract, but also after the termination or completion of this Contract, any information and/or data, etc., which has been made known to the Consultant in executing the Work.

2.28 Emergency Communication Network

The Sub-consultant shall submit to the Consultant an emergency communication network which includes contact numbers and addresses in both case of usual and emergency response.



Consulting Services for Detailed Design for Danang Quang Ngai Expressway Development Project (DQEDP-DD)	Project Location Map

Appendix-B: Mode of Payment

A. The Sub-consultant shall submit an invoice for services performed by him/her. A sample invoice form is attached hereto.

B. The above invoices shall be submitted to NK with the following particulars:

Address : Mr. Ichizuru Ishimoto
Project Manager

Detailed Design for Danang-Quang Ngai Expressway Development Project

Unit 2, 11th floor, PVFC Danang Building, Lot A2, April 30 Street, Hai Chau District, Danang City, Vietnam

Project Code : JA08O1057

C. The payment shall be made in US Dollar of telegraphic transfer to the account mentioned below within one (1) month from the date of the receipt of the invoice. The Sub-consultant shall confirm in advance the reliability of transferring to this account.

Bank Name	:	
Branch Name	:	
Account Name	:	
Account Number	:	
Bank Address	:	
Country (where the bank exists):		Vietnam

D. Remittance charges shall be deducted from the amount of each payment.

No. (your ref. No.)

INVOICE

Mr. Ichizuru ISHIMOTO
Project Manager
Detailed Design for Danang-Quang Ngai Expressway Development Project
Unit 2, 11th floor, PVFC Danang Building, Lot A2, April 30 Street, Hai Chau District,
Danang City, Vietnam

Date: _____

Subject : **Invoice for** _____

Payment should be made to:

Name : _____
Account No. : _____
Name of Bank : _____
Sort Code : _____

USD Currency Portion	Expenditure this Period	Expenditure to Date
1. Geological Survey		
Total	_____	_____

_____ (Signature)
Name
Title

Section 5. Terms of Reference

1. Background

The Government of the Socialist Republic of Vietnam (GOVN) represented by Vietnam Expressway Corporation, through Project Management Unit No. 85 (PMU85) is planning to implement Expressway Development (Da Nang - Quang Ngai) Project (hereafter called the Project). Vietnamese MOT is the line agency who makes investment decision for the Project. VEC is the project owner and PMU85 is the project management consultant at project preparation and implementation phases until the works is handed over and put into operation. PMU85 is also the implementing agency who actively works with relevant authorities to solve all the issues related to the Project. The purpose of the Expressway is to improve the inter-regional transport networks to support the socio-economic development in the Central region and in the whole country and promote traffic safety.

In preparation for the Project, the GOVN commissioned a Feasibility Study (FS) in 2003 which was subsequently revised and completed in March 2008 by JETRO Consultants. In order to meet the requirements of the guidelines and loan procedure of the World Bank and other international financial donors, the FS was updated by Nippon Koei Co., Ltd., being completed in May 2009. This updated FS is being reviewed and further refined by CPCS Transcom Limited.

The Project consists of the following three components;

(1) Component A: Civil Works
Construction of four-lane dual carriageway road (with capacity for eventual widening to six lanes) and 131 km in total length.

(2) Component B: ITS (Intelligent Transport System) Works
Provision of traffic management and toll collection facilities

(3) Component C: Expressway Operations and Maintenance

Planning an institution to operate and maintain the expressway and identifying facilities and equipment that it will need.

It is currently expected that the project will be implemented with financial support from the World Bank and the Japan International Cooperation Agency (JICA). Funds from these agencies would be used to finance separate sections of the Project. The current Terms of Reference pertain to the entire Project.

2. Objectives of the Consulting Services

The objectives of the consulting services are:

- To undertake the efficient and proper preparation of the detailed engineering design;
- To prepare an implementation program that can ensure delivery of the project in an efficient and timely manner infrastructure in accordance with the implementation program; and
- To promote technology transfer by employing suitably qualified Vietnamese professionals for the detailed design and implementation planning for the Project and by providing appropriate training for staff of the related agencies who will be at various times responsible for the Project.

3. Scope of Services

3.1 General

In executing the services, the Consultant shall follow the current relevant Guidelines and regulation/procedures of GOVN and the Bank based on the FIDIC Conditions of Contracts. The Consultant shall assist PMU85/MOT in all aspects of the work including the review of previous studies, detailed design and tender assistance required for implementation of the Project. The scope of the consulting services broadly consists of, but not limited to, the following works:

1. Review of previous studies.
2. Detailed engineering design including cost estimation and preparation of tender documents and other supporting documentation.
3. Assistance with calling and assessing tenders for works and for contract negotiations.

Special attention is drawn to the requirement that the Consultant conduct independent bid evaluations and give the Client advice on issues related to contract negotiations for the Client's reference.

The Consultant shall perform the tasks listed below:

3.2 Review of Previous Studies and Establishing the Detailed Design Framework

The Consultant shall:

(1) Review Previous Studies

The Consultant shall review the previous studies to acquaint themselves with the evolution of the Project and its current features, and to identify matters that may materially affect the work of the current contract. Key issues will be identified for discussion and agreement with PMU85/MOT. The review shall cover, among others, the following subjects:

a. Review of horizontal and vertical alignment and proposed structures.

b. Review site-specific social and environmental impacts identified in the Environmental Impact Assessment (EIA) prepared by PMU85 and the mitigation measures proposed in the associated Environmental Management Plan (EMP).

c. Review construction phasing and management of traffic during construction.

d. Review toll operation and control facilities, operation and maintenance facilities and services, service areas, parking areas, etc.

(2) Establish Detailed Engineering Design Framework

The Consultant shall:

a. Establish design criteria and design standards to be applied for the Project.

b. Recommend and agree with PMU85/MOT the format and content for the Bills of Quantities, cost estimates and prequalification and bidding documents.

c. Recommend and agree with PMU85/MOT the time schedule for preparation of the detailed design, the Bills of Quantities, cost estimates, prequalification documents and bidding documents to allow the tendering

of works and construction for each contract package to commence immediately after the completion of necessary design and documentation work and the gaining of necessary approvals.

3.3 Detailed Engineering Design and Procurement Planning

Tasks to be undertaking by the Consultant to prepare the detailed engineering design and the planning of procurement will include:

1. Identify project packaging.
2. Conduct surveys and investigations.
3. Prepare detailed design for roads, bridges and other structures.
4. Design of intelligent transport systems and toll facilities.
5. Establish an operation and maintenance system for the project.
6. Prepare an Environmental Impact Assessment, Environmental Management Plan, Ethnic Minority Development Plan (if needed) and Resettlement Action Plan.
7. Recommend construction methods and prepare a construction schedule.
8. Prepare a cost estimate for the Project.
9. Prepare pre-qualification, tender and contract documents.
10. Prepare an implementation program.

In undertaking the detailed engineering design, the Consultant shall:

a. Use the reference documents of previous studies approved by GOVN and the World Bank as the basis for detailed design.

b. Use engineering standards approved by GOVN. Where current standards are not available or are unsuitable, the Consultants shall make recommendations for appropriate standards and gain approval from PMU85/MOT for their use.

c. Undertake the work in a phased manner so that pre-qualification of contractors can occur for packages for which detailed design and documentation is completed while detailed design and documentation continues for other packages.

3.3.1 Packaging

The Consultant shall identify a recommended packaging for the project and get agreement with the Client before commencing detailed design. Packaging shall satisfy the following conditions:

a. Individual packages should be confined to a single province;

b. Individual package shall be financed by only a single financier;

c. The value of a package should generally be from about 70 million to 100 million USD, i.e. neither too big nor too small.

d. During D.D preparation, the Consultant shall study, initiate the solutions and design a contract package with reasonable scopes of works beforehand so that its construction can be commenced in 2010.

3.3.2 Surveys and Investigations

(1) Data collection

- Investigate and collect the following data for cost estimate and general cost estimate: Production costs related to local transportation activities; depreciation regulations related

to traffic vehicles; haulage tables for transportation services; charges for travel, bridges and roads, and insurance; costs for traffic accidents; inflation and exchange rate in the previous years; local unit price for calculation of general cost estimate; consult unit prices of projects under implementation in the region; investigate sources of materials and energies for construction; cooperate with local governments to identify disposal areas for soil and waste materials (including liquid waste)

- Survey for construction material transportation

- Investigate and collect planning data related to the project and work with relevant authorities: Collect planning maps of highways, railways, waterways and maritime; plan of industrial and urban zones along the route; plan of systems of hydraulic works , irrigation, canals, dykes, and pumping stations, etc; plan of underground works and system of underground and overhead lines; Plan of water supply and drainage system; plan of electricity supply and lighting; plan of communication system and other relevant plans along the route, etc (the plans must be granted with official approval of relevant authorities)

- Collect project documents and design document of the relevant projects

- Work and agree in writing with relevant authorities of Da nang city, Quang Nam and Quang Ngai provinces, 5th military zone under Ministry of Defense, EVN, VNPT, PMU of industrial zones and other relevant managing agencies about the following contents: Alignments; alternative design of interchange; scale and location of toll plazas, control center, service stations; elevation of detailed plans of urban zones and industrial zones; location, span or width, and elevation of culvert and frontage road; navigational clearance, railway clearance; documents related to hydraulic works, irrigation, water sources and sewage system for urban zones, clearance of large canals and dykes; areas within military structures, military barracks; and the other relevant documents, etc.

(2) Surveys

Implement detailed surveys served for engineering designs of all work items under the project including: surveys of topography, hydrology, geology and testing, material sources, traffic issues, electricity, land acquisition and resettlement, surveys of relevant underground and overhead structures and staking land acquisition,etc ..,and additional survey quantities (if any) during the design. The surveys must comply with current Vietnamese specifications and standards, and supply sufficient data for documentation of detail engineering designs. Before implementation of surveys, the Consultant must carry out thorough studies on existing documents and data in the previous stages (FS, JETRO). Based on the findings from the studies, the Consultant makes and submit detailed plans for VEC's approval to implement. Scope of the work are mainly, but not limited, as follows:

(i) Topographic survey

- Class IV primary control points (national coordinate system VN2000): Installed with GPS technology, mark specification is in accordance with standard 22 TCN 263-2000. Each mark's distance is about 3-4 km along the expressway route, and at least 4 marks/ point at points of intersection and large bridges such as Ky Lam, Tam Ky.... and at least 2 marks/ point for the other interchanges and bridges. The marks along the route and at the large bridges and interchanges should be arranged reasonably to avoid overlapping.

- Class IV leveling network: Installed with highly accurate geometric leveling equipment. Marks of IV class leveling network share same positions with those of IV class primary control points. Its errors are varied within standard 22 TCN 263-2000.

- Secondary control point (traverse net): measured with electronic tachometer which has accuracy and errors according to standard 22 TC 263-2000. Each mark's distance is about 150m-200 m/1 point along the expressway route, and at least 8 marks/ point for points of interchange and large bridges and at least 4 marks/ point for the other interchanges and bridges. The marks along the route and at the large bridges, interchanges should be arranged reasonably to avoid overlapping.

- Technical leveling network: Marks of technical leveling networks share same positions with those of secondary control point. It is measured with highly accurate geometric leveling equipment. Its accuracy and error is in line with standard 22 TCN 263-2000.

- Site planning: According to the alignment determined in FS, a site plan at scale of 1/1000 is made along the route, with measurement range in the expressway from center line to sides of 70 m and that in level crossing (traverse) from center line to sides of 50 m. The site plan is required to have full description of topography, ground objects, underground and surface structures, high voltage and low voltage lines, ground communication lines, railway signals, location of lakes and ponds, system of irrigation and canals, special ground objects, historical site, temples, pagodas, feretories, cemeteries, and administrative land boundary, etc as well as GPS marks, and secondary control points.

- Detailed stakeout works: According to the above site plan at scale of 1/1000, alignment design must comply with the specification and is agreed with relevant authorities (locality, military, etc). Based on system of secondary control points, official setting out in the field includes: top marking, marking in the curve, main stakeout in TS, TC, P, ST, CT; and detailed stake arrangement with max. distance of lower than 20m/ stake, and main stakes in the curve and in changed terrains and stakes of ground objects, culverts, control stakes, locations in planned industrial and urban zones (focusing on starting points and ending points) boundary of communes and districts, etc. Main stakes at top of curves, in TS, TC, P, ST, CT, Km, culverts, bridges, intersection, etc must be concreted according to standard 22 TCN 263-2000.

- Survey of longitudinal section at horizontal scale of 1/1000, and vertical scale of 1/100.

- Survey of cross-section at scale of 1/200. Surveying range is 70 m from center line to both sides of the expressway.

- Survey of culverts for drainage: Planimetric survey of the culverts with span (width) of more than 1.5m is at scale of 1/500 at the culverts, and axial measurement range of 100 m and horizontal one of 100 m for each side. The axial survey of dyke's center line, horizontal survey of dyke, and road crossing at all points of dyke's center line are at scale of 1/200. Surveying range includes range of planimetric survey of the culverts. Intersection angle is surveyed between road and culvert center lines. It is necessary to agree in writing with the relevant agencies on irrigation culverts.

- Survey of intersection points with the other works such as railways, high-voltage and low-voltage lines, communication lines including phone lines, electricity and lighting structures, post and communication cables and underground structures in the expressway routes consists of the following works: measurement of height of rail top at the intersection points with the existing routes; investigation of planned elevation of crossroad, if any; survey of elevation and locating alignment and electrical poles (by coordinate), survey of at least two adjacent poles, intersection angle between lines and perpendicular lines, distance from the center line to the poles, height of the poles, clearance between the lowest lines and natural surface; and survey of kinds of poles, electricity, cables, pipeline, electric transmission grid, managing agencies.

- Survey of interchanges: Identify crossroad intersecting with designed route (coordinate, station); identify the intersection angle, width of road base, kind of pavement, existing structure, kinds of vehicle, etc in the interchanges; stake out concrete/ iron piles at centerlines, starting points, ending points, top points, and basic points in the curve; make site plan with scale of 1/500 with measurement range within designed interchange range; survey longitudinal section of interchanges and its branches with length scale of 1/1000 and height scale of 1/100; survey cross-section of interchange at scale of 1/200 and distance from centerline to each side of 50m, and survey range is equal to site plan one.

- Survey of bridge: Make elevation plan at construction place of bridge at scale of 1/500; survey profile of bridge at scale of 1/500 at center line of the expressway; stake center line of the bridge with accuracy equivalent to that of secondary control points (it is noted to collect hydrographic and hydraulic data, and the documents agreed with local authorities on plan of rivers, dykes and hydraulic works. It is necessary to survey meteorological data such as: temperature, wind, rainfall, humidity, earthquake, and figures of flow rate, velocity and water level.

- Survey of residential underpass culverts: Make plan at scale of 1/500 with distance from center line to two sides of 200m and 100m respectively along the main route; survey longitudinal section at center line of residential underpass culverts at scale of 1/500, surveying distance from the centerline to each side of 100 m; survey cross section at distance from the centerline to each side of 30 m at scale of 1/200; survey the intersection angle between the interchange and the main route; survey kinds of intersection (district ones, commune ones, and ward ones), scale and plans (if any). Survey profile of intersection at scale of 1/500, at distance from the expressway's centerline to each side of 200m, and survey cross section of intersection at scale of 1/200 from the intersection's centerline to each side of 30m.

- Survey of canals and dykes: Identify location and boundary of canals and dykes; set plan at scale of 1/500 in boundary of canals and dykes; survey longitudinal section of canals and dykes at scale of 1/1000, and their height at scale of 1/100; survey their cross section at scale of 1/100, at distance from their centerline to each side of 20m.

- Survey of toll plazas, control centers, service station, expressway management offices, bus station, communication stations: Establish area control points equivalent to secondary control points; survey topographic plan at scale of 1/500.

- Survey and investigation of land acquisition and resettlement.

(ii) Survey of hydrographical data

- Collect meteorological and hydrographical data related to rainfall, wind, and temperature, humidity from meteorological stations, and flow rate and water level at hydrographical stations in rivers in the project area.
- Collect relevant documents and work with Ministry and provincial departments of agriculture and rural development to agree with bridge designs. In terms of the culverts over irrigation systems, it is necessary to work with relevant authorities and local governments to gain agreement on culvert location, width, and required elevation from its bottom.
- Survey water level along each 1 km distance of the expressway, forming 1 water level group (each water level includes: highest one, frequent one, average one, and lowest one in 3 consecutive years; survey causes and period of flood....For drainage culverts, survey water level groups (each water level includes: highest one, frequent one,

average one, and lowest one in 3 consecutive years). Survey year and causes of flood. Illustrate surveyed water level groups in the site plan.

- Survey situation of existing drainage works, irrigational system along and through the route, identify existing cross-section of canals and dykes, their top width, bottom width, depth, bottom elevation, functions, flow direction and longitudinal slope, and mark at their side.
- Survey fully existing situation of drainage, utility purposes and managing agencies of irrigation systems along and through the route.
- Hydrologic survey of bridge: Measure cross-section of flow; survey the water level in form of 3 groups at each location of bridge including: highest one, frequent one, average one, and lowest one in 3 consecutive years, causes and duration of flood.
- Hydraulic and hydrologic calculation: Based on survey data, carry out hydrologic calculation for the engineering design such as designed water level along the route, and hydraulic and hydrologic calculation of bridges and culverts (flow rate, velocity, and water level, general and local scour).

(iii) Engineering geological survey:

The Consultant is required to study thoroughly geological data in FS stage to arrange the holes drilled at stage of the engineering designs, avoiding to quantity overlapping. Requirements of geological drill are as follows:

- Engineering geological survey of normal foundation: Drill both normal foundation and culverts with two holes at the depth of 7 m per 1 km.
- Survey at special sections such as the ones which need deep excavation, embankment or soft ground ones: Drill one hole at the expressway centerline per 75 m; drill geological cross-sections with two holes for two sides and one hole at the centerline per 150 m and these cross-sections should be combined the locations of drilled culverts. Depth of borings must be enough to meet the requirements of detailed design. Carry out Vane shear test (VST) at drilled holes of the centerline at cross-section location. Distance of vane shear is 2 m to bottom of the holes..
- Engineering geological survey of bridge: Each abutment and bridge pier have one the drilled hole (location of abutment and bridge pier is identified after completion of the plan and profile of bridge's center line); the hole is 3-5 m deeper than pile foundation with the completing conditions equivalent to standard of 22 TCN 263-2000; one sample/ 2m is taken. SPT piercing in the holes is carried out with distance of 2m/ point. Test physico-mechanical properties of ground, especially in case of soft ground, test the additional parameters such as Cv, K, organic content, and compress 3 axles in form of UU and CU to provide sufficient data for soft ground treatment.
- Engineering geological survey of tunnel: Drill one hole at the expressway centerline per 50 m. Depth of borings must be enough to meet the requirements of detailed design. Testing 17 undisturbed soil samples/ each boring and 8 disturbed samples/each boring. Seismic measurement at 4 points at the depth of 50m and 8 points at the depth of 100m is carried out to identify strata structure.
- Engineering geological survey of residential underpass culvert: Drill two staggered holes at each location of the residential underpass culvert, one hole at right lane of the

expressway, and another at left one; Take one sample/ 2m; carry out SPT piercing in the holes with distance of 2m/ point.

- Engineering geological survey of toll plazas, control centers, service station, expressway management offices: each location has at least 4 holes with full depth to provide sufficient data for the design.
- Sampling and testing works is carried out in accordance with the standards of 22 TCN 259-2000, 22 TCN 263-2000, 22TCN262-2000 and enough data is required to collect to serve for detailed engineering design. For the embankments on the soft ground, it necessary to test the parameters such as Cv, K, organic content, and compress 3 axles in form of UU and CU to provide sufficient data for soft ground treatment. The Consultant shall collect and store samples, especially the ones at large bridges. These samples shall be handed over to the client upon the Project completion.

(iv) Material Source Survey

This task must be ensured to collect all data of locations of material sources which meet the requirements of the Project, are practical and feasible during construction.

- Back filling materials (borrow pits) and sand for soft ground treatment: identify exploitable soil and sand quarries; work with local governments to gain agreement in writing ad then, map out them on plan at scale of 1/50,000. Collect data related to capacity and quality of each quarry; take testing sample to identify necessary parameters of back filling materials and others for soft ground treatment.
- Survey and evaluation of general situation, capacity and transportation length of the routes for exploitation and transportation to the construction site.
- Borrow pits and quarry sites for construction of bridge and culverts, pavement: For borrow pits and quarry sites which are exploited or being exploited, collect data related to their capacity and quality, exploitability, and transporting conditions to the construction site. For new borrow pits and quarry sites, carry out procedures for survey and testing necessary characteristics of each material.

(v) Survey of other relevant structures

- Survey current situations of traffic works in the area to evaluate usage capacity and level that shall be upgraded to construct service roads for construction of the expressway.

- Survey old bridges and culverts on the cross lines: Identify location, survey profile, main cross-section, and elevation of components of existing works; review construction materials; evaluate loading capacity of the works; evaluate fault degrees, suitability and utilizing capacity.

- Survey current situations of irrigation works within study area.

- Survey underground structures, public works: optical cables, underground cables, pipeline, oil and petrol pipeline, etc.

- Survey existing power supply in the route, and request for supplying capacity and starting points. For transformer stations, request was made to identify their location, scale, capacity, specifications, and works which is supplied with power, etc. Survey additional locations of transformer stations; identify clearly locations of the station by coordinate and full description in maps including topographic, geologic and ground object data, and agreeing with the local governments in writing on these issues, etc.

- Survey cultural buildings, temples, pagodas, and relevant legal religious buildings.

(vi) Additional Traffic Surveys

- The Consultant shall review available traffic data on the existing road and conduct additional surveys as necessary to:

- Collect data needed for the detailed design of foundations, pavements, interchanges, and toll stations, etc; and

- Collect base line data that can be used for monitoring performance of the completed Project, where this data shall include the quantity and composition of traffic using the current national highway, total travel time and the variability of the travel time for, separately, cars and trucks, and the number and type of traffic accidents per annum along the current corridor. This data will be collected separately for at least the segments Danang to Tam Ky and Tam Ky to Quang Ngai.

(vii) Independent Land Valuation Survey

As part of the work on updating the Resettlement Action Plan (RAP) the consultant will engage as a sub-consultant a qualified Land Valuation Consultant (LVC). The LVC must be licensed by the Ministry of Finance to undertake land valuation in Viet Nam and be independent of all project stakeholders. As part of the updating work the LVC will undertake a survey to establish current market values for all types of land, by location and use, sufficient to confirm the budget under the updated RAP.

(viii) Environmental and Social Surveys

Undertake surveys as necessary to update the EIA and EMP.

3.3.3 Detailed Design of Road, Bridges and Other Structures

Deleted here under....

APPENDIX D: SPECIFICATIONS

Table of Contents

SPECIFICATIONS

1. General

The Technical Specifications mentioned hereunder has been designed in order that the Sub-consultant shall carry out the Engineering Geological Survey of Danang - Quang Ngai Expressway with an approximate length of 140km.

2. Objective of the Work

The objective of the Work is to obtain accurate geological information along the expressway necessary for the detailed design, and further to provide reports together with drawings and boring log required.

3. Legal Basis

- Construction Law No.16/2003/QH11 dated 11/26/2003;
- Decree No.12/2009/NĐ-CP dated 02/12/2009, issued by Government for management of construction and investment projects, and Decree No.83/2009/NĐ-CP dated 10/15/2009 for supplementation and modification some provisions of Decree No. 12/2009/NĐ-CP;
- Decree No. 209/2004/NĐ-CP dated 12/16/2004, issued by Government for management of quality construction and Decree No. 49/2008/NĐ-CP dated 04/18/2008, for supplementation and modification some provisions of Decree No. 209;
- Decree No. 112/2009/ NĐ-CP dated 11/14/2009, issued by Government for cost management of construction and investment;
- Decree No. 06/2006/TT-BXD dated 11/10/2006, issued by Ministry of Construction for guiding geo-technical surveys in service of selection of construction locations and design of works;
- Decision No. 11/2008/QD-BXD dated 07/01/2006, issued by Ministry of Construction for regulations of recognition and management of laboratory specializing in construction industry;
- TOR for the soft ground geotechnical investigation work plan of Da Nang - Quang Ngai expressway construction project;
- Consulting services contract for detailed design for Danang – Quang Ngai Expressway Development Project between Project Management Unit No. 85 and Joint Venture of Nippon Koei Co., Ltd., Nippon Engineering Consultants Co., Ltd., Chodai Co., Ltd. and Thai Engineering Consultants Co., Ltd., dated 15th day of November, 2011.

4. Location of the Work

The proposed expressway starts at the beginning point located within Danang City, passes Quang Nam Province and extends to the ending point located within Quang Ngai Province.

The location of the investigation of the tunnel section in Quang Nam province is (KM22+485 - KM23+037).

The detail location of the tunnel and the geotechnical investigation shall be referred to the Appendix F.

5. Work Policy

All the works shall be carried out in accordance with the Specifications or the instructions the Consultant may give.

6. Scope of the Work

(1) Boring Investigation

The scope of the vertical boring and horizontal boring by core drillings to be carried out at 4 points are listed in Table 6.1.

Table 6.1 Boring Investigation list

Direction	Point	Name	Nos.	Point/ Boring depth	Note
Vertical	Portal BP Side	BV-1 (D=30m)	1	No.22+500 X= 521,597.6700 Y=1,749,222.7392	Depth to the bottom of the tunnel+5m
Vertical	Between Portal	BV-2 (D=59m)	1	No.22+600 X= 521,680.1537 Y=1,749,166.1877	Depth to the bottom of the tunnel+5m
Vertical	Between Portal	BV-3 (D=36m)	1	No.22+970 X= 521,985.3184 Y=1,748,956.9641	Depth to the bottom of the tunnel+5m
Vertical	Portal EP Side	BV-4 (D=17m)	1	No.23+020 X= 522,026.5501 Y=1,748,928.6953	Depth to the bottom of the tunnel+5m
Horizontal	Portal BP Side	BH-1 (L=80m)	1	No.22+480 X= 521,581.1746 Y=1,749,234.0486	
Horizontal	Portal EP Side	BH-2 (L=80m)	1	No.23+020 X= 522,026.5501 Y=1,748,928.6953	
If foundation ground could not be confirmed on vertical investigation, Boring dept shall be extended to foundation ground + 5.0m.					

(2) Seismic Refraction Prospecting

Seismic refraction prospecting is planned only at the tunnel site as described in Table 6.2.

Table 6.2 Seismic Refraction Prospecting

Direction	Point	Name	Nos.	Point/Boring Length	Note
Horizontal	Portal BP Side	SP-1	1	L=552m	KM22+485~ KM23+037
Horizontal	Portal EP Side	SP-2	1	L=552m	

(3) Geotechnical Test

The geotechnical tests are shown as necessary in Table 6.3.

Table 6.3 The contents of the Geotechnical Tests

Item	Vertical BV-1,2	Horizontal BH-1,2
Standard Penetration test	conduct	–
Physical test for rock (Bulk density, Water content)	conduct	conduct
Unconfined compression test	conduct	conduct
Ground water level	conduct	–
Rock permeability	conduct	–

The Works covered by the Specifications includes furnishing all technical staff, labors, materials, equipment and supplies required to perform the Engineering Geological Survey for the detailed design of the project.

Quantity of the Works shall be as specified in Appendix E: Bill of Quantities (BOQ).

7. Datum for Coordinates and Elevation

The following datum shall be applied to the coordinates and elevation.

Coordinates:

National Coordinate System (VN2000)
Ellipsoid: WGS84
Projection: Transverse Mercator (Zone width: 3 degrees)
Central Meridian: 108.00.00 East
Scale Factor: K=0.9999

Elevation:

National Elevation System (Hon Dau Island, Hai Phong)

8. Unit of Measurement

Unit of measurement shall be the metric system.

9. Language

All correspondences, figures, drawings and other documents shall be made both in English and Vietnamese.

10. Technical Standards to be Referred

The geotechnical investigation will be carried out in accordance with the following technical standards

No.	Standard code	Description	Issued Year
1	22TCN 259-2000	Procedure of engineering geological exploratory drilling	2000
2	22TCN 263-2000	Procedure of Roadway Investigation	2000
3	TCVN 5960	Guiding collection, transportation, and preservation of soil sample	1995
4	TCXDVN 226	Standard Penetration Test (SPT)	1999
5	TCVN 2683	Method of wrapping, transporting and saving sample	1991
6	TCVN 4195:4202	Laboratory testing	1995
7	ASTM D 2113	Standard Practice for Rock Core Drilling and Sampling of Rock for Site Investigation	2008
8	ASTM D 5079	Standard Practices for Preserving and Transporting Rock Core Samples	2008
9	ASTM D 2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	2010
10	ASTM D 4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles	2007
11	ASTM D 2435	Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading	2011
12	ASTM D 2938	Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens	1995
13	ASTM C 127	Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate	2007
14		Standard Specification for tunneling - 2006: Mountain Tunnels (Japan Society of Civil Engineers)	2007
15		Geology and Geological Investigation Standard (NEXCO the East, Middle, West)	2007

11. Laboratory Testing Standards

Testing soil samples and water samples in the laboratory should be undertaken in accordance with Vietnamese standards and AASHTO standards. Testing shall be carried out in accordance with the following standards:

No	Properties	Standard Code
1	Specific Gravity	TCVN 4195-1995
2	Moisture Content	TCVN 4196-1995
3	Atterberg Limits (Cassagrande)	TCVN 4197-1995
4	Particle Size Analysis	TCVN 4198-1995
5	Direct Shear Test	TCVN 4199-1995
6	Compression Test	TCVN 4200-1995
7	Unit Weight	TCVN 4202-1995
8	Consolidation Test	AASHTO T216
9	Triaxial Compression (UU)	ASTM D2850
10	Triaxial Compression (CU)	AASHTO T297
11	Unconfined Compression Test	AASHTO T208
12	Unconfined compression Test for Rock	ASTM D2938
13	Chemical Water Test for Concrete	TCXD 81-1981
14	Soil - Classification for civil engineering standard	TCVN 5747-1993
15	Water test	TCVN 3994-1985

12. Work Plan

The Sub-consultant shall submit the draft Work Plan not later than the time instructed by the Consultant for the checking.

The Work Plan shall include:

(1) General
(2) Implementation Organization
(3) Scope of Works
(4) Method of Geotechnical Investigation
(5) Quantity of Works
(6) Detailed Organization Chart of Sub-consultant
(7) List of Manpower of All Survey Groups to be Assigned
(8) List of Equipment
(9) Laboratory Test
(10) Quality Control
(11) Reporting
(12) Documents to be Submitted
(13) Sample Sampling to be Submitted

(14) Work Safety
(15) Emergency communication network
(16) Work schedule
(17) Bill of Quantities (without price)

13. General Work Sequence

1) The Consultant provides the boring points and the control points, primary and secondary, to the Sub-consultant;
2) The Sub-consultant carry out vertical boring in 2 points and horizontal boring par portal and seismic prospecting par portal.
3) Samples are needed to unconfined compression test is φ48mm x 96mm and φ68mm x 136mm. (Length of sample is twice the diameter)
4) Vertical boring investigation should be carried out in each portal, with total of 2 points.
5) Horizontal boring investigation, confirm the division between the layers of 80m, the strength, cracking conditions, groundwater, inflow water and water pressure study primarily males.
6) This objective to investigate the section from the tunnel portal up to the stable ground is to ensure the safety of the excavation that is planned by ground grading, drilling, support, support method, etc.

14. Mechanical Boring

(1) Determining Borehole Position

1) Objectives

- The Consultant provides the coordinates of the boring position and the survey control points, primary and secondary, to the Sub-consultants;
- The Sub-consultant will perform positioning of the boreholes at the site with inspection of Consultant and PMU85.
- Drilling shall be started after approval of the positions by Consultant /PMU85.

2) Equipment

- Using electronic tachometer DTM-332 (Product of NIKON Japan) or equivalence.

3) Executive method

- Using intersection method, leveling by electronic tachometer base on GPS benchmarks, secondary control point of the project;
- After determining, borehole positions are marked by wood stakes with onshore boreholes and telegraph buoys with offshore boreholes;

- All boreholes must have determining and position hand-over minutes at site include sufficient contents: using marker post, determining method, determining result (coordinate, elevation).

4) Technical requirement

- Borehole positions are determined on relief map by national coordinate system;
- In case of borehole position is stuck by private house or other project that must to shift, the Sub-consultant must send report document include shifting outline location to the geology investigation director. Drilling is carried out only after approved by Consultants /PMU85.

(2) Drilling

1) Objectives

- Determining stratum and geotechnical feature in the surveying area;
- Implementing tests at the field (according to Standard Penetration Test - SPT);
- Getting the samples of soil for testing.

2) Equipment

Using drilling machine with following technical features:

- Maximum depth: 100m;
- Maximum diameter: 152mm;
- Rod diameter: 42mm;
- Weight (no diesel engine): 500kg.

3) Executive Method

- In case of drilling offshore, drilling equipment is set on the pontoon with minimum area of 36m2 (dimension 6 x 6m). This system should be made by pontoons or barges that connect with others by timber beam, steel wire. Drilling pontoon should be fixed by anchor system and cable. Moving equipment, materials, and worker daily to the pontoon by board.
- In case of drilling onshore, depending on specify terrain condition to install drilling equipment to the advantage drilling location. Equipment should be upright installed and avoid any shifting in whole drilling process.
- Used method is rotary drilling by using the sample barrel enclosed alloy drill twist, pumping and cleaning with bentonite solution. The borehole diameter of 91mm, the opened-hole diameter of 127mm;
- Drilling mission is carried out according to rotary drilling method and taking sample, circulation by betonies fluid. Open hole diameter is 127mm, terminate diameter is 91mm;

- Drilling mission will accompany with installing temporary casing when the bore hole doesn't stabilize because of soft soil stratum, quick sand phenomenon or belt of weathering and strongly fissured rock;
- The boring process is done to the required depth of sampling, then it will be stopped to perform the sampling and SPT standard follow technical requirements of Missions for Geotechnical Investigation;
- The length of drilling round changes from 1.5-2.0m and depending on the stratum, depth of sampling and depth of SPT test.
- Before carrying out SPT test or taking sample, bore hole bottom should be cleaned then determined the depth again;
- The follow-up process at the field must be recorded in the works journal including elaboration of boring log. Borehole must be named in a boring log, it should mention in the depth, completed part and thickness of the soil layer, depth of sampling, the state, the colors of the soil, SPT testing indicator; elevation, coordinates of the borehole, the supervisor's name, beginning and ending date of the borehole. Each borehole must be recorded in the acceptance certificate as regulated;
- Color photograph should be taken for boring at site, including borehole location, SPT testing, collected samples, total of drilling rod.
- After check and take over, boreholes should be filled in according to the regulations of geology exploratory drilling process 22TCN 259-2000. All boreholes must have acceptance minutes for filling of boreholes.

4) Technical requirement

- The boring carry out according to the regulations of geology exploratory drilling process 22TCN 259-2000.

5) Termination of boring

Bridge:

Depth for stop the boring shall follow the table below and the final depth of boring shall be instructed by the Consultant.

Item		Depth(m)	Remarks
Cohesion less Soil	SPT>50	8m-10m	22TCN 259-2000 & TCXDVN 366-2006
Cohesive Soil	SPT>30	8m-10m	
Rock	RQD>50%	3m-5m	
	RQD>25%	5m-7m	
	RQD<25%	8-10m	
	Limestone	5m	

	Solution Cavity	3m from cave bottom	

Deep Excavation (DE):

Depth of borings must be enough to meet the requirements of detailed design, achieve to proposed designed height. In the case of discover rock layer, should be drilled into the rock layer depth is 2.0m at least

Softground (SG):

Depth of borings must be enough to meet the requirements of detailed design. Boring shall be terminated after confirming up to more than 3m of stiff clay layer (SPT > 10) and/or dense sand layer (SPT >15).

Distance of vane shear test (VST) is 2m to bottom of holes.

Normal Embankment and excavation (NEE):

Depth of borehole: 7m/ 1borehole

6) Underground Water Survey

The determination of stable underground water level at the borehole on land must be carried out when carrying out geotechnical boring. The result is collected in the explanation of geotechnical survey works.

15. Standard Penetration Test (SPT)

1) Objectives

-Determining the soil state, soil resistance in SPT;

-Sampling for testing for the in cohesiveless soil.

2) Equipment

-Using Vietnamese/ China equipment with following technical features:

-SPT hammer weight: 63.5kg;

-Free fall height: 760mm;

-Penetration tip (bifurcated sampler) outside diameter 50.8mm;

-Cone solid penetration tip 600 diameter 50.8mm.

3) Executive Method

- Drill to the SPT estimate depth;
- Pumping clean the borehole bottom then determine the depth again;

- Take the rod fitting SPT tip down the bore hole;
- SPT sampler is driven 45cm from the bottom of borehole by the hammer 63.5kg, falling height 760mm. SPT value is total of blows of the second 15cm and the thirst 15cm. The SPT graph will be present on the boring logs;
- When penetrate in gravel or strong cracked and weathered stone, bifurcated sampler can be replaced by cone solid penetration tip 600.

4) Technical Requirement

- Standard penetration test (SPT) is executed in all borehole according to TCXD 226-1999 standard;
- Standard Penetration tests (SPT) will be conducted at all boreholes with 2.0m intervals;
- All SPT sample after taken should be put into plastic box, careful protected avoid nature moisture variation and transfer to the laboratory.

16. Permeability Test (Viet Nam Standard: TCN 153:2006)

This is a water pouring test in borehole to confirm the natural permeability of rock and soil for construction project.

- The borehole co-ordinate and elevation will be confirmed before testing.
- The borehole will be drilled to design elevation.
- Drilling slam will be moved out the bore hole, the drilling length must be sure exactly, set up the water pressure which is fixed through to the testing process.
- Set up the filter pile for testing section below, the casing will be also set up for upper. If the casing have been set up to the boring hole bottom, this casing will be picked up to the top of the filter, then the unnecessary casing on the ground surface will be released. The sand and gravel layer with 2-10mm diameter shall be poured to the bore hole bottom for 3-5cm thickness
- The borehole has to clear before set up other testing equipments as: water gauge, water valve, water box with the amount the water is known. The water is used for testing in one water box only, anther water box will be locked during the testing.
- The water in the water box (No2) will be poured in the bore hole with slow speed (1-1.5cm/minute) to prevent the bore hole's wall erosion and times enough for air can be released from the bore hole. Base on the water gauge, the water will be stopped when the water level increase to design level. The water pipe will be picked up from the bore hole. The water valve will be opened and the water can be flow into the bore hole. Times is started for permeability testing.

- Permeability monitoring: The water level will be monitoring at water ruler with full all details: day, hour, minute and second. The water level in the bore hole must be enough during the test. The water level on the water ruler will be written down about 10-20 minute/time depend the natural rock's permeability. The water amount which is measured consecutive in two times follow formula:

$$Q = (V1-V2)/(t2-t1)$$

V1,2: The amount water were measured at times t1,2 (cm^3)

t1,2: Time for measuring amount water (second)

- The permeability test will be stopped if amount water stability during the test, mean the consecutive six times for measurement but the water level not be changed or very small changing about 10% compare with average amount water through the test.
- The test will be finished, pick up all equipments in bore hole, the bore hole will be filled by cement.
- Calculation: The permeability rate of rock and soil will be confirmed by formula follow as:

$$Qth = 0.243Qc.\ln(2H/r) / H^2$$

In which:

Qth: The permeability rate of rock and soil (cm^3/s)

Qc: The stability flow rate (cm^3/s)

H: Water pressure height (cm)

r: Half of bore hole diameter (cm)

17. Sampling

1) Objectives

- Taking samples for determining physical and mechanical properties of soil layers;
- Taking hold sample for inspecting the stratum.

2) Equipment

- Thin wall tube sampler 91mm;
- Open-tube type 91mm;
- Opened sampler (SPT sampler).

3) Executive method

- Using thin wall tube sampler, diameter 91mm taking undisturbed sample in the soil has value of SPT <8. Sampler is pushed into the soil by static load;
- Using Open-tube type, diameter 91mm taking undisturbed sample in the in the soil has value of SPT > 8. It is often driven into ground with a slide hammer or a bob;
- Disturbed samples is collected from split barrel when SPT test or using Open-tube type to take;
- Holding Samples taking to stratum inspection following 22TCN 259:2000;
- Before taking sample must clean the borehole bottom and guarantee unaffected to the intended taking sample layer, avoid losing undisturbed property of sample;
- All undisturbed sample should be sealed to keep humidity. The end of sample should be cropped 25mm then covered by melt paraffin, micro-crystalline wax should be luted to each end to make casing/ seal off layer 25mm in thickness. The left gap between sample tube end and wax should be packed tightly by compressibility material lower than the sample and without water absorption from the sample. End of sample tube should be jacketed and adhesive tape hold;
- The labels with signal, name of borehole, date of sampling, person in charge, the depth, status, color of the soil must be sticked on the boxes.

4) Technical Requirement

- Undisturbed and disturbed carry out according to the regulations of geology exploratory drilling process 22TCN 259-2000;
- Sampling will be conducted with 2.0m/ 1sample;
- Inspecting Samples will be conducted with 1.0m/1sample;
- All samples have to be taken photograph for serving preservation and inspection.

5) Transporting Preservation Samples

- In order to avoid damage, tested sample in laboratory (both undisturbed and disturbed sample) must be keep carefully in an closed iron or solid- plastic sample box. The samples are put into wood boxes (not over 15 samples in each box);
- Each sample lot or core containing box is brought to laboratory with a full attached list that lists clearly types of sample and their only identification code;
- Method of take, package, transportation and maintenance for sample should be obeyed strictly TCVN 2683-1991 standard.

6) Photographs

- All samples shall, before the sample boxes are stacked, be photographed from the zenith in color so that details marked on the inside of the box are visible. A linear scale and color scale shall be included in the photograph and the final color positives shall be provided showing sample in clear focus at a scale of not less than 10% of the actual size of the sample. All photographs shall be taken with the samples shaded from direct sunlight and using flash if necessary.
- The samples shall be arranged to reveal the most interesting characteristics such as seams, strata and the like.
- The Sub-consultant shall submit a set of color digital data files and two color photographs to the Consultant. Each sample photograph cut along the box edge shall be connected to the one for the same hole, so as to be visible of sample condition of some hole at a glance.

18. Standard Equipment List

Standard equipment list is as shown:

No.	Description	Maker or Type
1	Drilling Machine	
2	Accessories for Drilling Machine	
2.1	Triple Drilling Tower	
2.2	Hydraulic pumping	
2.3	SPT tool for carrying out SPT and taking disturbed samples	
2.4	Undisturbed sampling	
2.5	Drilling rods of 42mm in Diameter	
2.6	Casing with Diameter of 127mm	
2.7	Coring Bit	
2.8	Bentonite Solution	
2.10	Thin wall head	
2.11	Thin-walled steel tube of 76mm in diameter for taking undisturbed samples	
2.12	Sample box	
2.13	Sample tray	
2.14	Camera	

19. Environmental Sanitation

- Environmental sanitation is carried out in all investigation time. Investigation Contractor must be guaranteed environmental sanitation at the investigation areas will be restored as the beginning;
- Drill cuttings, wastes (oil, grease), soil and rock core… shall be revoked, transported to shore

and treated according to regulations, not let out directly to surround environment;

- After check and take over, bore holes should be filled in according to the regulations of geology exploratory drilling process 22TCN 259-2000.

20. Laboratory Test

- About 50% of samples (25% of undisturbed sample and 25% of disturbed sample) are collected during boring should be tested based on following indicators:
- For undisturbed sample, 09 properties should be tested as follows: grain size (P%), moisture content (W%), specific gravity (Δ), unit weight (γ), liquid limit (WL), plastic limit (WP), compression test (compressibility coefficient a), direct shear test (cohesive power - C; internal friction angle - φ).
- For the disturbed sample, 07 properties should be tested as follows:
- For the cohesive soil following testing grain size (P%), moisture content (W%), specific gravity (Δ), liquid limit (WL), plastic limit (WP).
- For the cohesiveless soil following testing grain size (P%), moisture content (W%), specific gravity (Δ), dry and wet angle of repose, maximum void ratio (e_{max}), minimum void ratio (e_{min}).
- Except above normal tests, should be take special laboratory testing (Consolidation, Triaxial compression test, Unconfined compression test) to determine the parameters as Es, Cs, Cc, Cv, Kv, mv, Pc, qu.

21. Laboratory Test of Rock

- Laboratory tests are necessary to verify classification and determine engineering properties. The following tests shall be carried out using some SPT and RQD, all rock core samples:

(1) Purpose of the Work

- Representative rock specimens selected from the drilling core samples of cylindrical form by the Engineer shall be sent to the laboratory for the purpose of confirming the basic physical, chemical and mechanical characteristics of the rocks in geotechnical aspects.

(2) Scope of the Work

- The work shall comprise the selection of samples for the laboratory test in cooperation with the Consultant, their transportation to and testing at the laboratory, geotechnical interpretation and evaluation of the testing results.

(3) Laboratory Testing

- Items and envisaged quantities of the laboratory test shall be as listed below. The samples for the tests shall be selected by the Consultant out of core samples of the core drilling. Color

photographs shall be prepared for each sample. In addition, I follow ASTM.

- Natural Water Content ASTM D 2216
- Unit Weight Test ASTM D 4718
- Consolidation ASTM D 2435
- Specific Gravity of Rock ASTM C 127
- Absorption of Rock ASTM C 127

22. Seismic Refraction Prospecting

(1) Purpose of the Work

- The seismic refraction prospecting shall be carried out with the proposed tunnel line in order to obtain accurate geological and foundation engineering information by classifying the sub-surface ground on the basis of difference in velocity of seismic wave propagation. It will give overall picture of the subsurface foundation condition and detect depth of solid rock, locations of weak zones, faults, etc.

(2) Work Sequence

The work includes but not limited to the following items:

1) Planning a detailed working plan including layout of prospecting traverse lines, allocation of spreads and shooting points, time schedule and provision of equipment and consumables, especially explosives. Permission for transporting and handling explosives shall be taken by the Sub-consultant.

2) Mobilization and preparation in the site, including negotiation with land owners for permission of trespassing and working in cultivated land and others.

3) Field work of profile survey of the prospecting traverse line.

4) Seismic prospecting and recording work.

5) Analysis and interpretation of the record.

6) Demobilization, site clearing, and reporting.

(3) Quantity and Location of the Work

- The seismic refraction prospecting shall be performed with ten (10) traverse lines and for 1,100m of the total length, in the Tunnel. The scheduled quantity of the work is as shown on attached Appendix 3. These traverse lines are indicated in Figure 3.The quantity and the locations mentioned above may be subject to revision in the course of the work depending on new finding.

(4) Equipment and Material

- All of the equipment and material to be used shall be of a type, capacity and condition suitable for the work as specified. Handling, storing and transporting explosives shall meet all relevant safety requirements and the government regulations. Sub-consultant shall submit for the Engineer's approval, equipment and material list referring the items mentioned below and an operation plan including a plan for transportation and storage of the explosives:

    1) Detector (geophone)
    2) Amplifier
    3) Oscillograph
    4) Seismic land cable, blasting cable and telephone cable with reel
    5) Seismic starter (High-voltage blaster)
    6) Tester battery, battery charger and other tools
    7) Dynamite and instantaneous electric detonator (fuse)

- Any part of the equipment shall be replaced whenever it is judged not suitable for the work by the Engineer, even if the equipment may have once been approved.

(5) Field Operation

- Geophones are set at every 10 m as one spread. Data are acquired through 24 channels as one spread at the same time. Shooting is made of 3 kinds: far offset shot, end shot, and internal shot. Far offset shots are arranged approximately 57.5m away from both ends of a spread and end shots are set at the both ends of a spread. Internal shots are carried out at 12.5m; 27.5m; 42.5m; 57.5m (Center spread); 72.5m; 87.5m and 102.5m. Shooting is used hammer or explosives. One spread includes two far offset shots, two end shots, and seven internal shots. After a shot, the spread is moved by 115 m for the next measurement 4 times then the 5th time will be 90m spread length. These procedures are plotted at Figure 3.

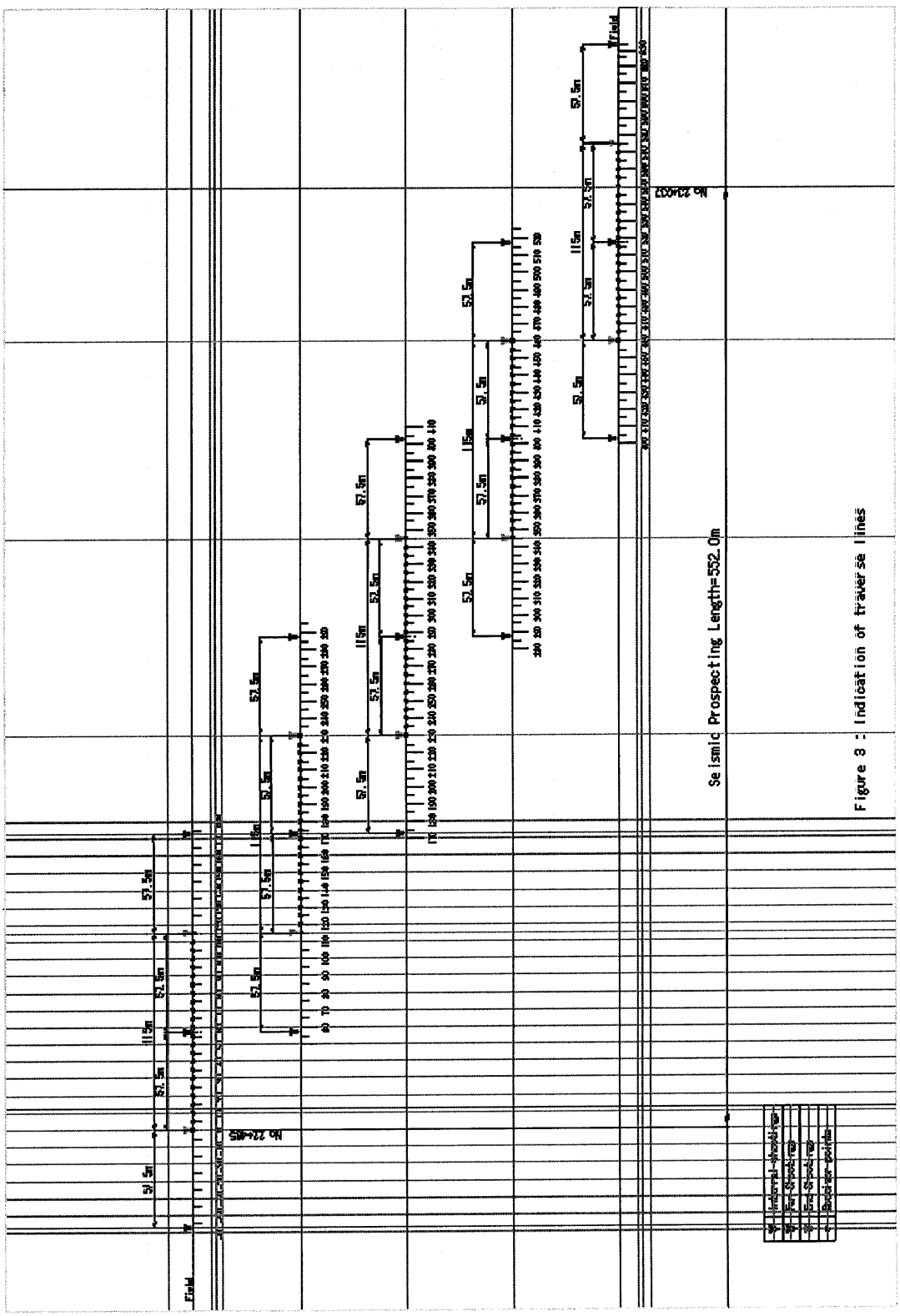


Figure 3 : Indication of traverse lines

(6) Setting of Prospecting Traverse

- A plan of arrangement of shooting (blasting) points and detector (geophone) points shall be prepared for every prospecting traverse line and submitted to the Engineer.
- Ground surface profile of every traverse line shall be surveyed, and all shooting points and detector points shall be marked with wooden stakes and pegs numbered with distance from an end of each traverse line.
- Each prospecting traverse line shall be divided into observation spreads, each of which is a unit of observation covered by a set of geophones in the same number as of channels of the oscillograph. The field prospecting work shall be made spread by spread until it covers all the length of each prospecting traverse.

(7) Profile Survey

- Ground height of every detector point shall be surveyed accurately by leveling to draw a topographic profile of every prospecting traverse line at a scale of 1/1000.

(8) Shooting

- Shooting shall be made effectively and safely with subsurface explosion in hand-dug pits or auger holes, by use of dynamite and instantaneous electric detonators. Prior to blasting, adequate warning shall be given to all persons, whether of the project or the public, staying within a distance of 50 m from the blasting point.
- The shooting for each spread shall be made at least at five (5) locations on the traverse line or its extension; i.e., two at both ends of a spread, one at the middle point of the spread and the other two for remote or offset shootings beyond the ends of the spread.

(9) Detecting

- Detectors or geophones shall be allocated at a regular interval of 10 m in each spread on the prospecting traverse line, or as directed by the Engineer.

(10) Recording

- Record of every shooting shall be reviewed at the site. When any record is not clear or questionable, the shooting and recording shall be made again. Ends of every spread shall overlap with ends of the adjoining spreads for continuity of the records over a prospecting traverse line.
- The record shall be plotted on time-distance graphs, and then interpreted into profiles of seismic wave velocity layers.
- The procedure of the interpretation shall be described in the report and any auxiliary lines utilized to interpret the time-distance curve (travel-time curve) shall be shown on the same graph. Abnormal or peculiar record, e.g., discontinuity in the time-distance curves and

reversed velocity layers, if found, shall be reported.

- Deduced seismic wave velocity layers shall be shown in profiles, using the ground surface profile prepared by the profile survey.

23. Quality Control

Quality inspection, monitoring and acceptance for geotechnical investigation consists of content are follows:

(1) Work Progress Regulation

- Sub-consultant shall submit a detailed work schedule to the Consultant.
- Sub-consultant shall confirm the boring position with the Consultant at the site, then, start the construction after getting permission of Engineer.
- Sub-consultant shall submit a daily report in accordance to Clause 20 and explain to the Consultant the progress of work every day by the end of the work.
- If base layer was not confirmed, after finishing planned boring depth, Sub-consultant shall discuss with the Consultant

(2) Measuring boring, SPT& Sampling Depth

- Inspecting boring process, depth of drilled round, depth of samples, SPT process. The staff of the Sub-consultant in the field has to record full boring process as: stratum, the depth for sample, preliminary description the soil name, state, boundary of geotechnical layer... the sampling is according to the technical requirements and preservation conformable to the regulations of preservation and holding sample, transportation, delivering and receiving sample.
- Making the acceptance minutes of the boring result and SPT when termination of borehole.

(3) Laboratory Testing Inspection

- Inspecting the testing work in the laboratory. Testing requirement sheet and sample delivery note for the laboratory should be made.
- Regulations of sample inspection should be reviewed before delivery to the laboratory.
- Content in the sample label and preserving method should be inspected. When monitoring sample test process, if it is found out unsuitability between the field documents and laboratory testing result, it is required to inform to the Consultant timely without delay for further direction.

(4) Working Photographs

- Working photographs shall be taken at all boring position and submitted as including final

report.

Photographs scene are shown below as necessary.

1) Before the investigation
2) During and after established equipment
3) During drilling
4) Measurement of remaining length of the rods
5) Measurement of the pulled out rods
6) During back filling of borehole
7) After back filling of borehole

- Working photographs shall be taken the situation of sample condition tests in laboratory and be submitted as including final report.
- The Sub-consultant shall submit a set of color digital data files and two color photographs to the Consultant.

(5) Documents of Acceptance:

- Documents of acceptance and record include:
- Boring record;
- Boring Log;
- Acceptance certificate of defining borehole location;
- Acceptance certificate of field survey (conforming to the Circular No. TT 06/2006/TT-BXD dated Nov 10 2006)
- Testing requirement sheet
- Sample delivery note at the laboratory
- Acceptance certificate of survey results (based on the Decision No. NĐ 209/2004/NĐ-CP dated Dec 12 2004) and the Decree No. 49/2008/NĐ-CP dated Apr 18 2008 on adjustment and supplementation of some articles in the Decree No. 209/2004/NĐ-CP.

24. Reporting

(1) Daily Report

- Daily report of drilling shall be prepared every day and be submitted to the Consultant by the end of the work. The daily report shall contain the following information:
  - Borehole number and date
  - Work progress of the day

- Model name of the drilling machine utilized
- Diameter of the drill bit and the casing
- Water table in the borehole
- Depth and rate of water loss or spring, if any, and back pressure of spring water
- Standard penetration test data
- Name of personnel in charge of the drilling and the tests

- The forms for the daily report shall be proposed by the Sub-consultant for the Consultant's approval.

(2) Weekly Report

- Weekly report should be done and submitted to Consultant at the last working day of week by hard copy and data file. Report content include following sufficient information:
- Quantity of investigation work had been done in week and plan of work for the next week;
- Site investigation result had been done in week include: drilling investigation results (boring logs, samples), SPT test results;
- Laboratory testing results of soil/water samples.

(3) Final Report (Investigation Report)

Final report (Geotechnical Investigation Report) should be carried out according to Vietnamese standard and ASTM/AASHTO. The content in the geotechnical survey report should mention the following contents:

1. Introduction
1.1. Soil investigation purpose
1.2. Legal bases
1.3. Standards and regulations
1.4. Methodology and quantities of survey works
2. Geotechnical engineering conditions
2.1 Topography and geomorphology of project area
2.2 Geotechnical feature of project area
2.3 Stratum characteristics
2.4 Hydro geotechnical condition

3. Conclusions and recommendations

(4) Final Report (Drawings)

1) General

Followings shall be provided in the drawings as separate volume.

- Plan of borehole locations;
- Boring logs;
- Geotechnical profile;
- Summary of soil properties of layers;
- Summary of soil properties of samples;
- Detailed testing data sheets;
- Photograph: borehole location, SPT test, samples and total rod.

2) Location Plan

The drawing of location plan shall be created or compiled by means of Auto CAD. (1/1,000, A1) The location plan shall be shown the boring point and each coordinates of borehole.

3) Boring Log

The drawing of boring log shall be created or compiled by means of Auto CAD. (1/100, A4)

4) Geological Profile

The drawing of geological profile shall be created or compiled by means of Auto CAD. (1/1,000; 1/100, A1)

5) Hardcopy Formant

- Hard copy drawings to be delivered shall be produced on standard size sheets of A1 (596mm x 841mm). All the drawings shall be produced using the drawing frame approved by the Consultant. Each drawing will be labeled with the date of generation, unique drawing number, version number and scheme section.
- Sub-consultant shall submit Proof Copies before finalizing drawings. Proof Copies of drawings shall consist of two (2) hard copies. The Consultant will return one (1) copy of each sheet with any corrections to be made annotated on the copies.

6) Data Format

Soft data drawings shall be produced in AutoCAD format.

- In order to keep the model to a reasonable size, the Sub-consultant may split the information into manageable parts with the approval of the Consultant.
- The names, colors, and contents of layers created in CAD files shall be further instructed.
- Investigation results shall include calculation results, observation sheets, photographs, etc. The forms and data sheets used in the Investigation results shall be approved by the Consultant prior to the preparation.
- Investigation report shall describe the investigation method adopted, equipment used, work schedule, difficulties encountered and its solutions, etc. The forms and data sheets used in the Investigation report shall be approved by the Consultant prior to the preparation.

7) Other

- The approved final drawings shall be retained by the Sub-consultant for a period of one (1) year from the issue of the corresponding survey report, during which time they shall be made available to the Consultant on request and copies supplied to the Consultant when instructed.

(5) Final Report (Appendices)

1) Borings Logs

- Logs of all borings along with a location plan shall be included in the appendix of the report. Also pictures of all borings data. The logs shall be based on the field logs and laboratory test data.

2) Test Data

- The results of all laboratory tests on various samples shall be tabulated and included in the appendix of the report. The tabulation shall identify each sample as to boring number, depth, and sample number, and shall include all results obtained under section geotechnical laboratory tests. Separate tabulations shall be included for classification test results, strength test results, and other special test results.

3) Geotechnical Analysis

- The work described herein shall include review and correlation of various test results as to geotechnical engineering considerations. Sketches, assumptions, calculations, etc., (where applicable) of all final engineering analyses shall be included in the appendix of the report. The source of the analysis, the input and output data (properly labeled) all shall be provided if computerized analysis methods are utilized. Methods of analysis shall be as approved in the proposed work plan. Set the geological feature fixed number to use for a design.

25. Sample Sampling to be Submitted

- Sampling shall be carried out in accordance with Clause 16.
- The Sub-consultant shall submit all samples, collected from the boreholes,
- The samples shall be safely packed in a box without any damage.

26. Supervision of the Work

The Consultant has the right to supervise all of the works and to approve the plan of operation, work methods and progress of the Work. The Consultant also has the right to accept and reject the results of the Work.

27. Other Requirements

The Sub-consultant shall arrange at his own expenses so that he may have free access to the land required for performing the Works, whether it may be under the ownership of the Government or the third parties. The Sub-contractor shall indemnify any damages to the land and associated properties.

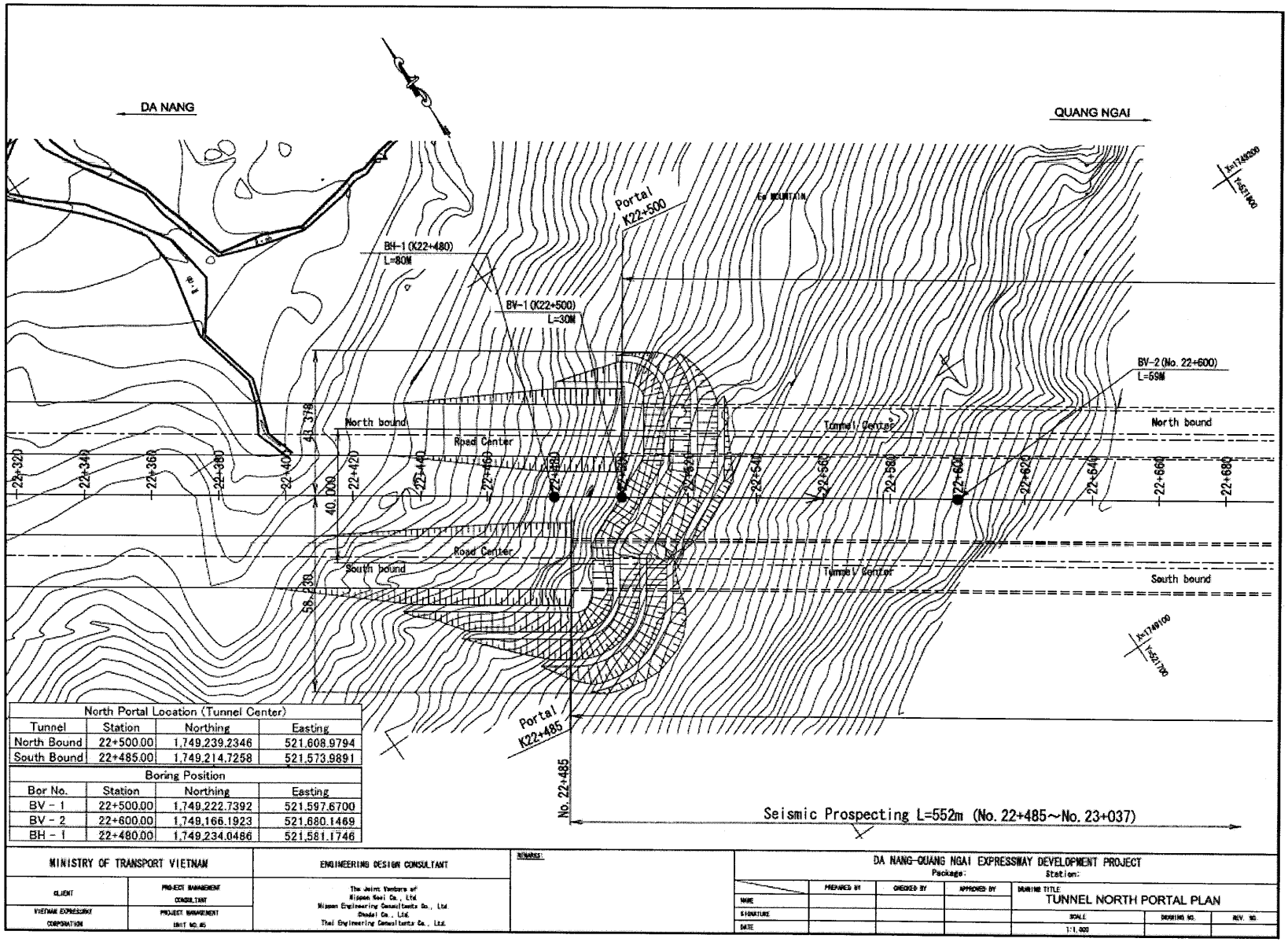
28. Time Schedule of the Work

The Works shall be commenced immediately after signing of the Contract or the issuance of the Notice to Proceed by the Consultant. All the Work shall be completed not later than 31 October 2012.

The Sub-consultant shall submit the detailed plan and schedule to the Consultant for weekly progress monitoring purpose.

Bill of Quantities (BOQ)

No.	Item	Unit	Unit Price (USD)	Quantity	Amount (USD)	Remark
A	**Expressway**					
8	**Tunnel**				**78,844.00**	
	Drilling work				**67,184.00**	
81a	Mechanical boring (vertical)	m	226.11	142	32,108.00	
81a-1	Measuring Permeability of Rock Mass (VNTCN 153:2006)	nos.		4		(Drilling cost + Supervisor cost + Indirect cost + Overhead) / 302m
81b	Mechanical boring (horizontal)	m	217.66	160	34,826.00	
82	Standard penetration test (SPT)	nos.	50.00	5	250.00	
83	Sampling	nos.			-	All core sampling
	Laboratory test				**2,100.00**	
84	Disturbed sample test	nos.	25.00	28	700.00	
85	Unconfined compression test	nos.	50.00	28	1,400.00	
	Land seismic survey				**9,560.00**	
86	Seismic measurement	point	159.33	60	9,560.00	
B	**Linking Road**	l.s.			-	
C	**Mobilization and Temporary Camp Yard**	l.s.	4,000.00	1	**4,000.00**	$2400 (Drilling work) + $400 (In-site test) + $1200 (Land seismic)
D	**Floating Equipment (for Off**	l.s.			-	
E	**Reporting**	l.s.	1,748.10	1	**1,748.10**	
Total					**84,592.10**	
Discount					**84,500.00**	
VAT 10%					**8,450.00**	
Grand Total					**92,950.00**	



North Portal Location (Tunnel Center)			
Tunnel	Station	Northing	Easting
North Bound	22+500.00	1,749,239.2346	521,608.9794
South Bound	22+485.00	1,749,214.7258	521,573.9891

Boring Position			
Bor No.	Station	Northing	Easting
BV - 1	22+500.00	1,749,222.7392	521,597.6700
BV - 2	22+600.00	1,749,166.1923	521,680.1469
BH - 1	22+480.00	1,749,234.0486	521,561.1746

MINISTRY OF TRANSPORT VIETNAM

CLIENT: VIETNAM EXPRESSWAY CORPORATION

PROJECT MANAGEMENT CONSULTANT: PROJECT MANAGEMENT UNIT NO.45

ENGINEERING DESIGN CONSULTANT: The Joint Venture of Nippon Koei Co., Ltd. Nippon Engineering Consultants Co., Ltd. Chodai Co., Ltd. Thai Engineering Consultants Co., Ltd.

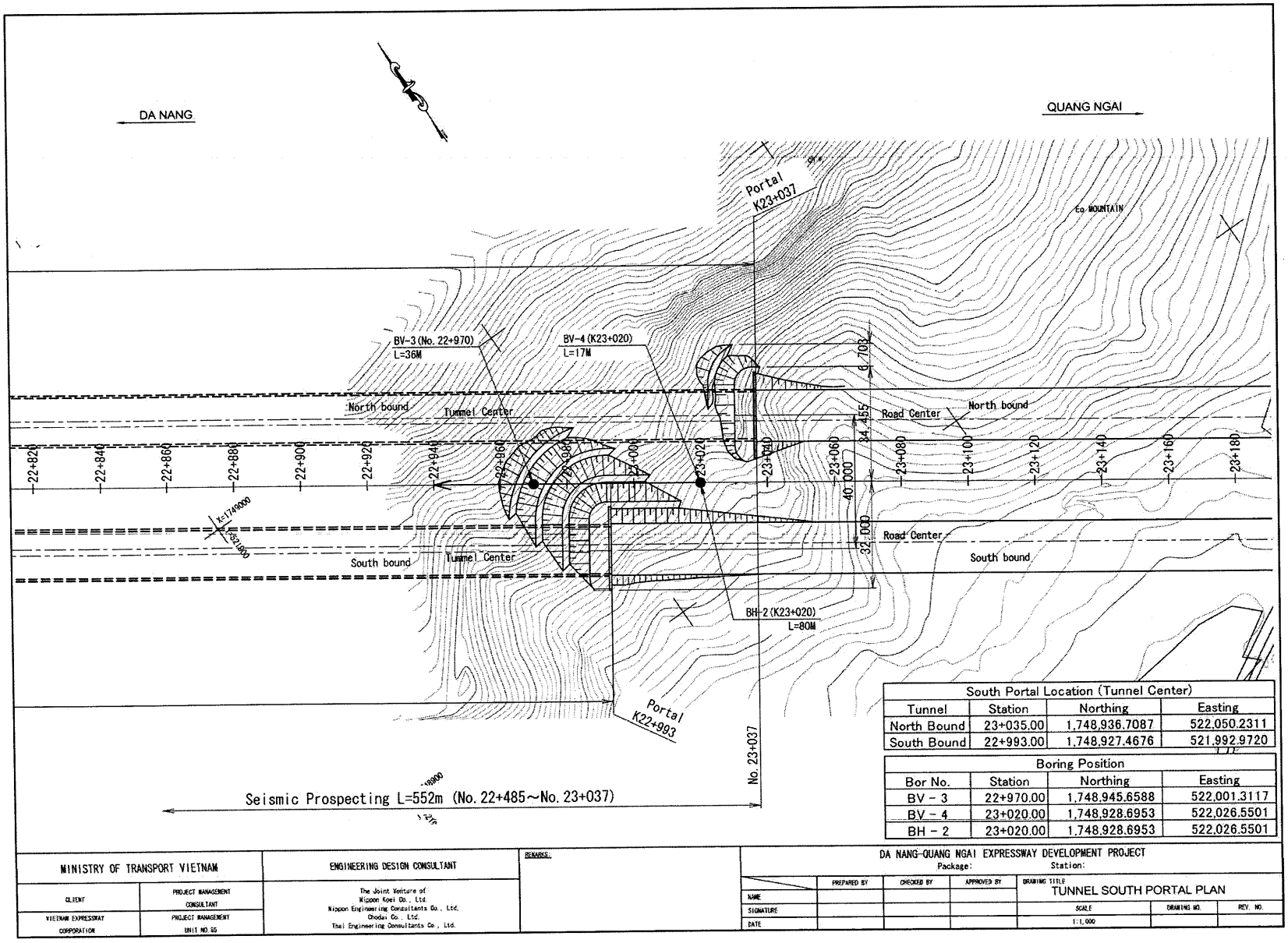
REMARKS:

DA NANG-QUANG NGAI EXPRESSWAY DEVELOPMENT PROJECT
Package:
Station:

	PREPARED BY	CHECKED BY	APPROVED BY
NAME			
SIGNATURE			
DATE			

DRAWING TITLE: TUNNEL NORTH PORTAL PLAN

SCALE: 1:1,000 | DRAWING NO. | REV. NO.



South Portal Location (Tunnel Center)			
Tunnel	Station	Northing	Easting
North Bound	23+035.00	1,748,936.7087	522,050.2311
South Bound	22+993.00	1,748,927.4676	521,992.9720

Boring Position			
Bor No.	Station	Northing	Easting
BV – 3	22+970.00	1,748,945.6588	522,001.3117
BV – 4	23+020.00	1,748,928.6953	522,026.5501
BH – 2	23+020.00	1,748,928.6953	522,026.5501

MINISTRY OF TRANSPORT VIETNAM		ENGINEERING DESIGN CONSULTANT	REMARKS:	DA NANG-QUANG NGAI EXPRESSWAY DEVELOPMENT PROJECT Package: Station:				
CLIENT	PROJECT MANAGEMENT CONSULTANT	The Joint Venture of Nippon Koei Co., Ltd. Nippon Engineering Consultants Co., Ltd. Chodai Co., Ltd. Thai Engineering Consultants Co., Ltd.			PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE: TUNNEL SOUTH PORTAL PLAN
VIETNAM EXPRESSWAY CORPORATION	PROJECT MANAGEMENT UNIT NO.85			NAME				
				SIGNATURE				SCALE: 1:1,000 / DRAWING NO. / REV. NO.
				DATE				