

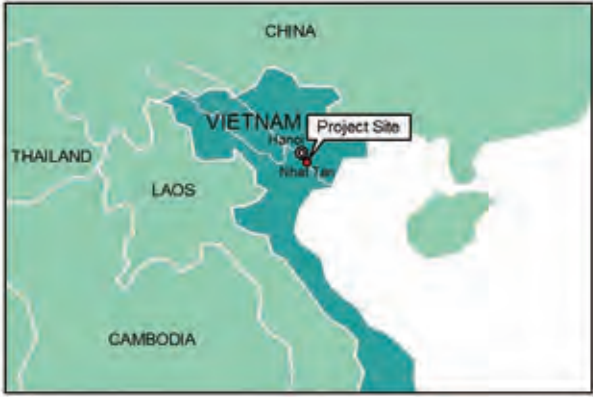
**“Nhat Tan Bridge (Vietnam-Japan Friendship Bridge) Construction Project”**

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Katahira & Engineers International

Field Survey: AUGUST 2010

**1. Outline of the Project**



Location of the Project



General view of construction of the pier P14

**1-1 Objective of the Project**

The objective of this project is to enhance transportation capacity for absorbing increasing traffic demand by constructing a bridge over Red River and its approach roads, thereby contributing to the economic development of Hanoi district.

**1-2 Outline of the Project**

Outline of the Project is shown in Table 1-1

Table 1-1 Outline of the Project (1/2)

| Items                       | Contents   |
|-----------------------------|--|
| Loan Number/ Loan Amount    | L/A No. VNX III-2 (STEP)<br>/13,698 million Yen  |
| Loan Agreement signing date | 31 March 2006  |
| Executing Agency etc.       | Project Owner: Ministry of Transport<br><br>Employer: Project Management Unit 85 (PMU 85)<br><br>Authority for Operation and Maintenance:<br><br>To be decided |

Table 1-1 Outline of the Project (2/2)

| Item                  | Contract       | Description   | Contractor  |
|-----------------------|----------------|---|---|
| Construction Contract | Package 1 (P1) | Main Bridge and North Approach bridge   | IHI Corporation (Leading firm)/ Sumitomo Mitsui Construction Co., Ltd. (member)JV (P1 JV) |
|                       | Package 2 (P2) | South Approach including approach bridge                                      | Not yet awarded   |
|                       | Package 3 (P3) | North Approach  | Tokyu Construction (P3 Contractor)  |
| Consultancy Contract  |                | Chodai/ Nippon Engineering Consultant JV in association with TEDI (Chodai JV) |   |

Note) Bridge Department of IHI, Matsuo Bridge Co., Ltd. and Kurimoto, Ltd. were merged into IHI Infrastructure Systems Co., Ltd. in November 2009. However in this Report, IHI which was named in the Contract Documents is used.

## 2. Review of the Mid-Term Review

### 2-1 Performance

#### 2-1-1 Measures for mitigating Construction Risks

Performance Index conformed to Accident Categories (refer to Table-3 in General section) is given in Table-2-1. There are 6 minor accidents.

Table 2-1 Performance Index by Accident Categories

| Package | Category      |   |             | Remarks  |
|---------|---------------|---|-------------|--|
|         | Serious←<br>A | B | →Minor<br>C |  |
| Total   | 0             | 0 | 6           |  |
| 1       | 0             | 0 | 1           | Near-miss  |
| 3       | 0             | 0 | 5           | Property damages 3 Nos. ,<br>Accidents without DAFW 2 Nos. |

Near-miss of Package 1 is that a pin of pre-installed shackle for setting a leader to a diesel hammer (pile driving machine) was dropped by vibrations generated. After this near-miss, anti-drop function was added to all pins.

Property damages in Package 3 includes turning over of re-bar cage for in-situ pile by an operation mistake of a crane operator, falling by 1.5m of concrete pile by using un-appropriate lifting gear.

#### 2-1-2 Measures for mitigating Labour Risks

Table-2-2 shows “Accident Frequency Rate”<sup>i</sup>(AFR) and “Accident Severity Rate”<sup>ii</sup>(ASR) of this project. Because both AFR and ASR are 0.00 and 0.00, it is excellent if compared to those of Civil Works in Japan, rates of which are 0.94 and 0.21 respectively. It shows that daily safety activities were well managed by the Contractors.

Table 2-2 Comparison of AFR and ASR

|                      | AFR<br>(DAFWC*: Nos.)                                     | ASR<br>(DAFW**: Days) |
|----------------------|---|-----------------------|
| Project Total        | 0.00 (0)  | 0.00 (0)              |
| Total man-hours      | 1,577,007 man-hours                                       |                       |
| Package 1            | 0.00 (0)  | 0.00 (0)              |
| Total man-hours      | 708,970 man-hours<br>Leading firm 182,750 +member 526,220 |                       |
| Package 3            | 0.00 (0)  | 0.00 (0)              |
| Total man-hours      | 868,037 man-hours   |                       |
| Civil works in Japan | 0.94  | 0.21                  |

(As of the end of July 2010 except P1 JV leading firm, the figure of which is as of August 2010)

\* DAFWC (days away from work case: Nos.)

\*\*DAFW (days away from work: man-days)

The figures in this review are calculated from the basic data, DAFW of which are 4 days or more, as shown below.

The number of accident: 0

Total working days lost: 0 day (No fatal accident)

\*Figures for Japan were obtained from the domestic works contract, carried out in Fiscal Year 2008, the contract price of which was more than 1,000 million yen.

(Source: Home page of Japan Advanced Information Center of Safety and Health, Occupational Accidents Statistics)

## 2-2 Process

The review results for the Consultant and the Contractors for P1 leading firm, P1 JV member and P3 with respect to the process for mitigating Construction Risks and Labour Risks are shown in Sub-Clause 2-2-1 to 2-2-4. The Contactor of Package 1 is a joint venture of two Japanese Construction Companies. Because leading firm and member of P1 JV mainly engaged in Super structure and Sub-structure of bridge respectively, review was carried out separately. Whole checklists for Safety Management System used in the hearing of P1 JV leading firm, P1 JV member and P3 Contractor are attached in Reference of this report. Summary is included in Sub-Clause 2-2-2 to 2-2-4.

### 2-2-1 Consultant (for Detailed Design and Construction Supervision)

The terms of reference of the Consultant covers from a review of Feasibility Study to Construction Supervision, and includes Detailed Design. The results of review are as shown in Table 2-3 and Table 2-4.

Table 2-3 Results of review of measures for mitigating Construction Risks by the Consultant

| <b>Contents and Results of Review</b>                             |   |
|---|---|
| <b>Safety Measures for the Permanent Works</b>                    | <p>The following checking consultants carried out independent design checks of the detailed design made by the Consultant</p> <p>Structural design of cable stay bridge: Schlaich Bergermann Und Partner (Germany)</p> <p>Whole of detailed design including street lighting etc.: local expert group including University professors</p> <p>Comment reply was made by local office and design department of head office jointly. Final approval for revising the design was made by Project Manager (PM).</p>  |
| <b>Comprehensive Review of Construction Documents</b>             | <p>PM nominates a team of Foreign engineer and Local engineer for reviewer. Depending on the importance of the works, members of the team selected are minimum two and maximum 4. If necessary, the construction documents are sent to Head office for review. After checking the contents of review by the team, PM extracts the comments to be sent to the Contractor for his action. When the contents of construction documents satisfy the required standard, PM approves the construction documents. SD requires the final approval of PMU 85 and the work shall not be commenced on site without the approval of PMU 85.</p> |
| <b>Strict application of Technical Specification to the Works</b> | <p>In order to confirm the quality, quantities and safety, inspections by the staffs of the Consultant is carried by applying Technical Specification (TS) strictly after internal inspections by the Contractor.</p> <p>The following points in TS are specifically noted.</p> <ul style="list-style-type: none"> <li>■ Loading tests and Monitoring on main temporary structures to check the structural integrity as a completed structure</li> <li>■ Temperature control of placing in-situ concrete</li> </ul>   |

Table 2-4 Results of review of measures for mitigating Labour Risks of the Consultant

| <b>Contents and Results of Review</b>                     |  |
|---|--|
| <b>Joint Safety Patrol with PMU 85 and the Contractor</b> | <p>Under a policy that “Prevent an accident which can be expected to occur.”, Monthly joint safety patrol with PMU 85 and the Contractor is carried out and unsafe actions/facilities etc. are pointed out. After patrol, a meeting is convened to record corrective actions identified and status of corrective actions identified in the previous meeting is also checked.</p> |

| Contents and Results of Review                                |   |
|---|---|
| <p>Introduction of extensive requirements of Safety in TS</p> | <p>Extensive requirements are listed in Part I-Section 6 Project Safety of TS.</p> <ul style="list-style-type: none"> <li>■ Safety induction training for workers newly entered into site</li> <li>■ Guarantee of direct reporting line of Safety Officer to PM in respect of safety issue</li> </ul> <p>■ Introduction of statistic Indexes for monitoring and measurement of safety management activities</p> |

Special Note)

In respect of manpower of the Consultant, further shortage is anticipated according to Appendix 1 & 2 to the Answer to Questionnaire once Package 1 Superstructure and Package 2 works commences.

### 2-2-2 P1 JV leading firm (Superstructure)

At the time of review, fabrication of steel members for the bridge, such as steel girders and anchor box etc. was on-going in the following factories, which have ISO 9001 certifications.

- Aichi factory of JV leading firm in Japan
- Factory in Vietnam operated by IHI Infrastructure Asia, 100% shares of which is owned by JV leading firm
- Mitsui Thang Long Steel Construction operated by a joint venture of Mitsui & Co., Mitsui Engineering and Shipbuilding Co., Ltd and Thang Long Bridge Co.

Staffs of JV leading firm in the site office were engaged in preparing, submitting and revising the Construction Documents according to the comments made by the Consultant. No site works were commenced. Policies of Quality and Safety of JV leading firm are as follows.



Quality policy has following 4 items for its crystallization.

- i. Restructuring of product manufacturing mentality to “Make it with our own initiative”
- ii. Enhancement of Interface Management for various parties engaged in construction
- iii. Remove problematic factors by QC patrol
- iv. Eliminate mistake at the beginning stage (prevent mistake in advance)

Safety policy also has the following 4 items for its materialization.

- i. Establish and effectively utilize PDCA cycle
- ii. Give safety training to all new workers
- iii. Eliminate all dangerous factors by KY (risk assessment) activities
- iv. Eliminate plan mistake and human mistake (human error)

The results of review are shown in Table 2-5.

Table 2-5 Review Results of JV leading firm

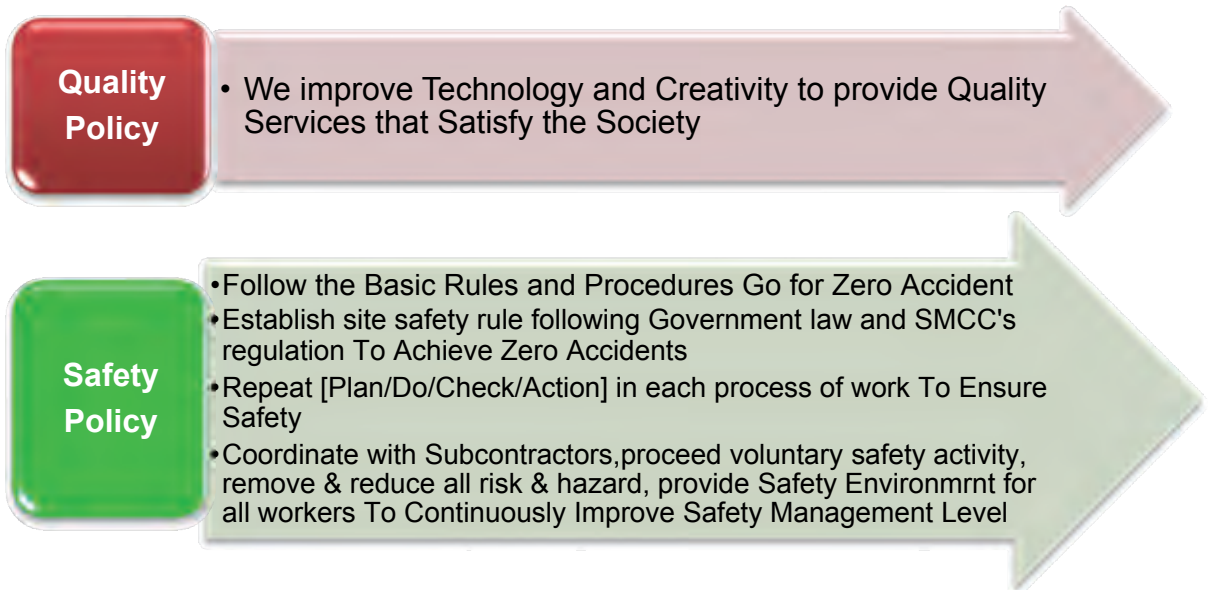
| Items                                   | Contents and Results of Review   |                                       |  |                               |
|---|--|---------------------------------------|--|-------------------------------|
| Measures to mitigate Construction Risks | <b>The Contractor's Internal Review of the Construction Documents (MS/SD etc.)</b>   |                                       |  |                               |
|   |  |                                       | Preparation by Subcontractor   | Preparation by the Contractor |
|   | Subcontractor  |                                       | Prepare  | *****                         |
|   | The Contractor   | Authorized Designer                   | Review   | Prepare                       |
|   |  |                                       | Marked on the organization chart. Designer nominated by experience and ability based on internal rules   |                               |
|   |  | Authorized Key Personnel including PM | Review   | Review                        |
|   |  |                                       | Engineers approved by PMU 85 after evaluation of experience, qualifications and ability written in CV  |                               |
|   | <p>Communication method with workers of the contents of the documents approved by the Consultant and checking measures on Site</p>   |                                       | <p>Construction Manager (CM) explains the approved documents to Japanese Supervisor (SV), Site Engineer (SE), Subcontractor's Site Manager (SM) and Forman (FM) at weekly or monthly meeting. Briefing to workers was carried out by SV or SE of the Contractor, or otherwise by SM or FM of Subcontractor.</p> <p>Checking on site was done by SE and when he identified non-conformance, he reported CM for his action. If necessary, CM issued an instruction requesting corrective actions. The Contractor provided thorough instruction that drawings without any "Approved" stamp were not able to use for construction.</p> |                               |
|   | <p>➤ <b>Internal Inspection Procedures</b></p> <p>After an internal inspection by Subcontractor, SE and QC engineer of the Contractor carries out an internal inspection. Head of department such as CM, Fabrication Manager, Material Engineer etc. check the results of the inspection. Upon an approval of manager of QC department, Request for Inspection (RFI) is submitted to the Consultant.</p> |                                       |  |                               |
|   | <p>➤ <b>Risk Management</b></p> <p>The Construction Documents for major works were reviewed by Erection Review Board (ERB) of head office with involvement of experts who has the same or similar works experiences, in which risk assessment was also carried out.</p>  |                                       |  |                               |

| Items                             | Contents and Results of Review  |
|-----------------------------------|---|
|                                   | <p>➤ <b>Loading Tests on temporary facilities</b><br/>A loding tests will be carried out using concrete blocks the weight of which are equivalent to the loads acting on temporary facilities, such as a bent truss for installing concrete slab and false works for concrete bridge cast insitu.</p> <p>➤ <b>Quality Management System</b><br/>Quality Management System of Head office of JV leading firm is applied to the site quality management. The above QMS was certified for its compliance to the requirements of ISO 9001.</p>  |
| Measures to mitigate Labour Risks | <p>➤ <b>Utilization of past experience in Vietnam, such as Binh Bridge Construction</b><br/>JV leading firm wishes to utilize his first experience in Vietnam of Binh Bridge Construction The same Japanese SV and local operators for cranes etc. will be employed. Construction of steel bridges will be carried out by labour supply subcontractor under supervision of Japanese SV and that of concrete bridges will be made under the subcontract with local experienced subcontractor(s).</p> <p>➤ <b>Safety Activities and Trainings</b><br/>Safety induction training for new workers, Safety Patrol, Safety Committee, Safety Officer, Emergency evacuation drill, subscription of river information including forecast etc., the same system applied P1 JV member will be applied.</p> <p>➤ <b>Safety Management System</b><br/>A safety management system and manual implemented by Head Office will be employed. The above SMS includes Fault Tree Analysis (FTA) system in which ,when an accident occurs on the site of JV leading firm in the world, primary report will be sent to staffs by e-mail within several hours and the results of FTA and corrective actions established and approved by Head Office will follow.</p> |

### 2-2-3 P1 JV member firm (Substructure)

Piling for piers for a main cable stay bridge No. P13, P14 and P15 by steel pipe sheet pile foundations have been completed and a full scale test of assembling re-bar for a segment of Pylon was carried out in order to check effectiveness of detailed design and corresponding method statement.

Policies for Quality and Safety are as follows. JV member firm applied his original Project Management System (PMS) for Safety Management and Quality Management on site works. Quality Management System, which is a part of PMS, of International Division of member firm was certified for its compliance to the requirements of ISO 9001.



Quality policies include the following 6 commitments to materialize them.

- i. We Deliver Quality Construction Service that meets Customer's Requirement.
- ii. We develop & Improve Construction technology to meet Society's requirements
- iii. We establish Quality Objectives and Make regular Review
- iv. We educate Staffs & Conduct Internal Audit to achieve Quality Management Target
- v. We communicate Internally and Externally to exchange views and learn from it
- vi. We Continue to Review & Improve Quality Management System

Internal Audis of PMS operated by a local office are carried out by auditor team which consists of not only auditors of Head office, but also one regional auditor appointed from regional office in Shanghai, Jakarta, Bangkok or Singapore.

Review results of JV member firm are shown in Table 2-6. Because procedures up to Internal inspection is the same as those of JV leading firm, those portions are omitted in Table 2-6.



Net for falling prevention and unit scaffold



Table 2-6 Review results of JV member firm

| Items  | Contents and Results of Review  |
|--|---|
| <p>Measures to mitigate Construction Risks</p> | <ul style="list-style-type: none"> <li>➤ <b>Risk Management</b><br/>At the time of preparation of Project Safety Plan required by PMS, not only Construction Risks and Labour Risks, but also credit risks and other risks were identified and countermeasures were discussed. Before award of contract and before commencement of works, construction review meetings were held with involvement of design and technical department of Head Office.</li> <br/> <li>➤ <b>Loading Test for temporary facilities etc.</b><br/>In addition to the measurement of bearing capacity of foundation piles for a temporary jetty, a loading test was carried out after completion of the jetty using a crawler crane planned to use on the jetty. A full scale re-bar assembling test was on-going to verify the space of re-bar in the design and check the effectiveness of method statement.</li> <br/> <li>➤ <b>Quality Management System</b><br/>QMS, which is a part of PMS, was applied to the site works. Quality/Safety manager carried out site patrol by himself more than once a month and he compiled his findings and proposed corrective actions as a Monthly Audit Report and he submitted it to International Branch via. Regional office.</li> <br/> <li>➤ <b>Emergency Preparedness</b><br/>Under the requirements of procedures for Emergency Preparedness in SMS, which is also a part of PMS, Emergency Evacuation Plan from sandbar in Red River during high flood season and emergency drill was carried out as per the same Plan.</li> </ul>   |
| <p>Measures to mitigate Labour Risks</p>       | <ul style="list-style-type: none"> <li>➤ <b>Introduction of Safety Activities and Facilities as per Japanese style</b><br/>Upon entry to the site: Safety induction training is carried out for all new workers.<br/>Daily Activities: Toolbox meeting, Daily safety meeting<br/>Weekly Activities : Weekly Safety Patrol<br/>Monthly Activities: Monthly Joint Safety Patrol with PMU85/ the Consultant. After joint patrol, Monthly Safety and Environmental Protection Meeting is to be held with the same attendants. Meeting minutes are made for follow up action.<br/>In addition to the above, Safety Promotion Meeting (Anzen Taikai) with attendance of all workers, Monthly Safety Patrol and Safety and Hygiene Committee with attendance of management of Subcontractors are carried out.<br/>Temporary unit scaffolds, staircases etc. were introduced as safety facilities and Safety officer team consists of two Japanese Safety officers and local safety officers. In case safety standard of Vietnam is not clear, then Japanese safety standard is applied.</li> <br/> <li>➤ <b>Risk Assessment for Labour Risks</b><br/>Items to be reminded for safety were added to Work procedures. Preparation was made for explaining the contents of Risk Assessment by its Vietnamese translation.</li> <li>➤ <b>Sharing accident information (Lateral spread or Horizontal development)</b><br/>By a procedure of Safety Management System(SMS), when a labour accident which has 4 DAFW or more, an accident which has considerable affect to the Employer and/or public , a primary report should be made to International Branch within 24hours. After further report to the Head Office, an Accident/Incident Report- Preliminary will be distributed to all regional office. Accident Report with corrective actions to be taken will follow shortly.</li> </ul> |

**2-2-4 P3 Contractor (North Approach Roads)**

Due to the delay of handover of work site, drainage works, foundation for piers for viaducts, surcharge embankment for soft ground improvement etc. were under construction in the limited area. Diversion of high voltage (110 kV and 35kV) lines into underground was being carried out by other contractors.

Safety policy and Quality objectives of P3 Contractor are as shown below.



Progress of Customer’s Satisfaction of Quality policy includes 5 commitments.

- i. Understand the Customer’s requirements clearly
- ii. Deliver and complete the work on time
- iii. Keep high quality performance by implementing Quality Management System
- iv. Perform the customer’s work request promptly
- v. Keep the work safe by implementing Safety Plan

The review results of P3 Contractor are shown in Table 2-7.

Table 2-7 Review results of P3 Contractor

| Items                                   | Contents and Results of Review   |   |
|---|--|---|
| Measures to mitigate Construction Risks | <b>The Contractor’s Internal Review of the Construction Documents (MS/SD etc.)</b> |   |
|   | Approved Subcontractor   | Prepare a draft based on a discussion with an engineer in charge, of the Contractor. (45days before commencement)   |
|   | The Contractor   | Primary Review: engineer in charge<br>Secondary Review: CM or equivalent engineer(s)<br>Final Review and Internal approval: PM<br>Internal approval of PM is to be made within two weeks after receipt of Construction Documents. |

| Items   | Contents and Results of Review   |
|---|--|
|   | <p>Communication method with workers of the contents of the documents approved by the Consultant and checking measures on Site</p> <p>Before commencement of works, Safety Officer (Vietnamese) and engineer in charge arranges a meeting for explaining the contents of documents with the following personnel. Records of meetings are kept.</p> <ul style="list-style-type: none"> <li>■ Site agent of the Subcontractor</li> <li>■ Site agent or foreman of Subsidiary company (Sub-Subcontractor) who is responsible for actual site works</li> <li>■ Workers, operator of cranes etc. , electrician etc. who works on site</li> </ul> <p>Engineers in charge of the Contractor and of the Subcontractor check the compliance with MS on site.</p> <p>➤ <b>Internal Inspection Procedures</b></p> <p>Before internal inspection, an inspector prepares an inspection sheet based on the drawings for construction included in approved MS. If no problems are identified, he submits RFI to the Consultant. Qualifications for an inspector of the Contractor are university graduates who majored in Road, Bridge and Civil or equivalent. Vietnamese engineers who had experience of working for Japanese contractors as an inspector were employed.</p> <p>Internal inspections for materials are carried out by QA/QC staffs.</p> <p>➤ <b>Risk Management including third-party (Public) risks</b></p> <p>Following risks were identified in the risk management and countermeasures were established.</p> <ul style="list-style-type: none"> <li>■ Existence of high voltage power line of 110kV and 35kV</li> <li>■ Accidents by construction vehicle, such as a traffic accident and an accident against residential people (third-party accident)</li> <li>■ Falling down accident and/or accident caused by cranes, bulldozers etc.</li> </ul> <p>➤ <b>Quality Management System</b></p> <p>QMS of Head Office which has ISO 9001 certification was applied to site works. Internal Audit by Head Office was carried out annually, which is scheduled in September 2010.</p> |
| <p>Measures to mitigate</p> <p>Labour Risks</p> | <p>➤ <b>Risk Assessment for Labour Risk</b></p> <p>Refer to Risk Management including third-party (Public) risks.</p> <p>➤ <b>Safety Activities</b></p> <p>Upon entry to the site: Safety induction training is carried out for all new workers.</p> <p>Daily: Toolbox meeting, Safety Walk, Daily safety meeting</p> <p>Weekly: Weekly Safety Patrol on every Friday</p> <p>Monthly Activities: Monthly Joint Safety Patrol with PMU85/ the Consultant. After joint patrol, Monthly Safety and Environmental Protection Meeting is to be held with the same attendants. Meeting minutes are made for follow up action.</p> <p>In addition to the above, on the first working day of the month, Safety Patrol with attendance of management of Subcontractors are carried out and Safety Promotion Meeting (Anzen Taikai) with attendance of all workers are carried out. Workers who showed good safety practice were commended.</p> <p>➤ <b>Emergency Training</b></p> <p>Employment of First Aiders, liaison with emergency hospitals, preparation of emergency contact lists etc. were made as per Emergency plan and education of such plan to all</p>  |

| Items | Contents and Results of Review  |
|-------|---|
|       | <p>workers was made. However no emergency drill was carried out.</p> <p>➤ <b>Safety Contributions</b><br/> The predetermined sum is deducted from the payment due to the Subcontractor whose workers made many unsafe acts, in other words, the Subcontractor makes safety contribution, and such sum is provided for resource of safety award etc.</p> |

### 3. Mid-Term Review Results, Lesson Learnd and Recommendation

#### 3-1 Mid-Term Review Results

##### 3-1-1 Performance

As of the end of August 2010, work progress rates of Package 1 and Package 3 were 14.2% and 12.8% respectively. There were neither Category A accident nor Category B accident. Only 6 Nos. of Category C accidents were recorded.

Beacuse no accident of worker which has 4 days away from works (DAFW) or more, Accident Frequency Rate and ASR for the Project become 0.00. it is excellent to keep AFR as 0.00 where total working hours exceeded 1.5 million hours.

##### 3-1-2 Process

##### 3-1-2-1 Measures mitigating Construction Risks

###### (1) Design of Permanent Works

Sclaich Bergerman Und Partner ofGermany, employed by PMU 85 as a checking consultant, independently checked the structural design of main cable stay bridge and whole of detailed design including street lighting etc. were checked by the local expert group including University professors. The Consultant arabnge his head office design department to carry out the review of the Construction Documents which are considered to be important.

###### (2) Risk Management

The Consultant specified in the Technical Specification that the Consultant reserves the right to request loading tests of main temporary facilities to check the structural integrity as a completed structure. P1 JV carried out a loading tests of temporary jetty and further loding tests will be carried out for a bent truss for installing concrete slab and false works for concrete bridge cast insitu.

By the records, it is confirmed that P1 JV leading firm carried out risk management in Erection Review Board for important Project specified in QMS and with invlvement of experts and managers of head office. In rsk management of P3 Contractor main focuses were on the works adjacent to the high voltage power lines and third party (public) accident.

### **(3) Emergency Response Manual**

P1 JV, who worked around sandbar in Red River, an Evacuation Plan during high flood season was made and training was carried out. P3 Contractor has prepared an emergency manual for injury of workers.

### **(4) Degree of achievement for requirements in Quality Management System**

P1 JV and P3 Contractor applied QMS of their head office or International division of head office which has ISO9001 certification. There are detailed provisions in respect of Quality Management in Vietnam domestic laws and regulations, such as Decree No. 209/2004 on Quality Management of Construction works. That fact encourages the Contractor to apply his ISO 9001 certified QMS to the site works.

## **3-1-2-2 Measures mitigating Labour Risks**

### **(1) Degree of achievement for requirements in Safety Management System (OHSAS)**

Because P1 JV member applied SMS, which is a part of his own Project Management System (PMS) ,to the site works, all requirements were fulfilled. Although P1 JV leading firm or P3 Contractor was not applied a safety management system, requirement of SMS were regarded to be substantially fulfilled judging from the checking results using a check list.

### **(2) Measures for mitigating Labour Risks**

In addition to Monthly joint safety patrol with PMU 85/ the Consultant/ the Contractor, the following safety management activities which becomes normal exercise of the construction sites in Japan, were carried out.

- Safety induction training for workers newly entered into the site
- Daily toolbox meeting before start of works
- Daily Safety meeting for reporting, coordination, discussion of safety issues etc.
- Weekly and Monthly Safety patrol
- Monthly Safety Promotion meeting with attendance of all workers on site (“Anzen Taikai” in Japanese)

Method statements were prepared reflecting the results of risk management and/or assessment.

It is noted that P1 JV member assigned Safety Officers and applied safety standard in Japan to the safety facilities, such as net for preventing workers falling down inside of steel pipe pile, a diameter of which is 1.2m, and unit type temporary scaffold.

## **3-2 Recommendation**

### **3-2-1 Recommendation for Executing Agency**

It is recommended to let the personnel assigned to Safety management to attend at the Monthly joint safety patrol with the Consultant and the Contractor and state opinions of PMU 85 as the Employer.

It is also recommended to accelerate the diversion works, carried out by other contractor, of the high voltage lines, which are located in relatively low position and located at the middle of work site, to implement the works below such power lines. Longer the high voltage lines exist in the existing position, the higher probability of the occurrence of accident becomes.

### **3-2-2 Recommendation for Contractor**

#### **3-2-2-1 Recommendation for P3 Contractor**

The works adjacent to the above high voltage lines should be carried out after all workers are kept informed and understood of the risks identified in risk assessment and corresponding countermeasures.

#### **3-2-2-2 Recommendation for P1 JV/P3 Contractor**

It is recommended for P3 Contractor to carry out safety drill for an emergency. It is also recommended to repeat safety drills on regular basis against anticipated risk events.

Note)

MOT TCQM suggested reviewer to include the following items into recommendation for the Contractor, who engaged in the projects funded by ODA Yen loan.

1) In addition to safety talks with newly employed workers, enough safety training to the workers should be carried out.

2) It is recommended for the Contractor to select Subcontractor who employs vocationally trained or educated workers, such as graduates of vocational training school etc.

However the above 2 items are not included in recommendation, because 1) our review results showed that the Contractors carried out necessary safety training to the workers employed on site. 2) employment of trained or educated workers was not able to check within timeframe of mid-term review.

### **3-3 Lesson Learned**

Although it is very physical and primitive method, lesson has learned that a method to check the function of the completed temporary facilities by carry out physical loading test has been applied and effective where there are unknown factors in ground conditions. From the point of reliability, this method is considered to be the best. However this method has inherent problems in costs and time. It is aspired for the Japanese consultants and/or Japanese contractors to research and develop an alternative method in substitution for physical loading tests, by analyzing accumulated data of physical loading tests, and effective utilization of those.

